Upper Sacramento, McCloud, and Lower Pit

Integrated Regional Water Management Plan

November 25, 2013

Upper Sacramento, McCloud, and Lower Pit
Regional Water Management Group

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Member entities and primary representatives of the Regional Water Management Group (RWMG):

California Trout: Meadow Fitton
City of Dunsmuir: Brenda Bains
City of Mt. Shasta: Geoff Harkness
McCloud Community Services District: Wayne Grigsby
McCloud Watershed Council: Angelina Cook
Medicine Lake Citizens for Quality Environment: Janie Painter
Modoc Nation: Jeff (Greywolf) Kelley
Mt. Shasta Bioregional Ecology Center: Michelle Berditschevsky
Pacific Forest Trust: Megan Wargo
Pit River Tribe: Vernon Ward
The River Exchange: Phil Detrich
Siskiyou Land Trust: Kathleen Hitt
Trout Unlimited: Robert Blankenship
Western Shasta Resource Conservation District: Leslie Bryan
Winnemem Wintu Tribe: Mark Miyoshi

Members of the RWMG Coordinating Council:

Statutory Authorities:
City of Dunsmuir: Brenda Bains
City of Mt. Shasta: Geoff Harkness

Tribal Authorities:
Winnemem Wintu Tribe: Mark Miyoshi
Pit River Tribe: Vernon Ward

Resource Management Interests:
Siskiyou Land Trust: Kathleen Hitt
Mt. Shasta Bioregional Ecology Center: Jennifer Witherspoon

Other Regional Stakeholders Contributing to Plan Development:

Black Fox Timber Management
Campbell Timberland Management
Castle Lake Environmental Research and Education Program
Central Valley Regional Water Quality Control Board
California Department of Fish and Wildlife
Hancock Natural Resource Group
Hearst Forest
McCloud Local First Network
Roseburg Forest Products
Sacramento River Watershed Program
Shasta Indian Nation
Shasta Nation
Shasta Valley Resource Conservation District
Shasta-Trinity National Forest
Sierra Pacific Industries
Siskiyou County

IRWMP Process Design & Facilitation Team:

Forsgren Associates
This Integrated Regional Water Management Plan was prepared by Forsgren Associates, Inc. The plan was prepared for the stakeholders in accordance with the California Department of Water Resources' November 2012 IRWM Planning Guidelines and per the instructions and preferences of the stakeholder group.

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www.riverexchange.org

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List of Acronyms

AB 32 - Assembly Bill 32 (California's landmark greenhouse gas emissions law)
AB 3030 – Assembly Bill 3030 (requiring groundwater management plans for all mapped basins in California)
ACHP – Advisory Council on Historic Preservation
ACS – American Census Survey
ADD – average daily demand
ADWF – average dry weather flow
AF – acre-foot/feet
AIRFA – American Indian Religious Freedom Act
APHIS – Animal Plan Health Inspection Service (part of the USDA)
BCSD – bias-corrected special downscale(d)
BIA – Bureau of Indian Affairs
BLM – Bureau of Land Management
BMP – best management practice
Bureau – US Bureau of Reclamation
C – centigrade
CC – Coordinating Council (component of USR governance structure)
CCC – California Conservation Corps
CDFG – California Department of Fish and Game (now Fish and Wildlife)
CDFW - California Department of Fish and Wildlife (formerly Fish and Game)
CDP – census-designated place
CAB – community advisory board
CALFED – California Bay-Delta planning and management process
CAL FIRE – California Department of Forestry and Fire Protection
CalTrans – California Department of Transportation
CalTrout - California Trout (organization)
CARB – California Air Resources Board
CAS – climate adaptation strategy
CASGEM – California Statewide Groundwater Elevation Monitoring
CAT – climate action team
CDBG – Community Development Block Grant
CDEC – California Data Exchange Center
CDEN – California Environmental Data Exchange Network
CDFA – California Department of Food and Agriculture
CDPH – California Department of Public Health
CEIC – California Environmental Information Catalogue
CERES – California Environmental Resources Evaluation System
CEQA – California Environmental Quality Act
cfs – cubic feet/second
CIMIS – California Irrigation Management Information System
CLEREP – Castle Lake Environmental Research and Education Program
CMIP3 – Coupled Model Intercomparison Project Phase 3
CNDDB – California Natural Diversity Database
CNPS – California Native Plant Society

CNRA – California Natural Resource Agency
CRMP – coordinated resource management plan
CSA – community service areas
CSD – community services district
CVP – Central Valley Project
CVPILLA – Central Valley Project Indian Lands Acquisition Act
CVRWQCB – Central Valley Regional Water Quality Control Board
CV-SALTS – Central Valley Salinity Alternatives for Long-Term Sustainability
CWA – Clean Water Act
CWHR – California Wildlife Habitat Relationships
CWP – California Water Plan
DAC – disadvantaged community (80% of state MHI)
DCBM – dichloroboromethane
DMA – Disaster Mitigation Act
DMS – data management system
DQO – data quality objective(s)
DWR - California Department of Water Resources
E. coli – *escheria coliform* (fecal coliform bacteria)
EIR – environmental impact report
EIS – environmental impact statement
EPA – Environmental Protection Agency (may be US or California)
ESA – Endangered Species Act
F - Fahrenheit
FEMA – Federal Emergency Management Agency
FERC – Federal Energy Regulatory Commission
FIR – formal issue resolution (a component of the USR decision-making process)
FRS – Fall River Springs
FSC – Fire Safe Council
GAMA – Groundwater Ambient Monitoring and Assessment program
GCM – general circulation model
GHG – greenhouse gas(ses)
GIS – geographic information system
GPM – gallons per minute
GWMP – groundwater management plan
HE – household equivalent
HPMP – Historic Properties Management Program
HUC – hydrologic unit code
I&I – infiltration and inflow
IPCC – Intergovernmental Panel on Climate Change
IRWM – Integrated Regional Water Management
IRWMP – USR Integrated Regional Water Management Plan
IWRIS – Integrated Water Resources Information System
JPA – joint powers authority/agreement
KGRA – known geothermal resource area
kV - kilovolt
kW - kilowatt

LAFCO – Local Area Formation Commission
LID – low-impact development
LRMP – Land and Resource Management Plan
LSR – late successional reserve
MAF – million acre-feet
MCL – maximum contaminant level
MG – million gallons
MGD – million gallons/day
MHI – median household income
M&I – municipal and industrial
MLCFEQ – Medicine Lake Citizens for Environmental Quality
MLH – Medicine Lake Highlands
MOU – Memorandum of Understanding
MSBEC – Mount Shasta Bioregional Ecology Center
msl – mean sea level
MW – megawatts
MWC – McCloud Watershed Council
NAHC – Native American Heritage Commission
NCWA – Northern California Water Association
NEPA – National Environmental Policy Act
NFMA – National Forest Management Act
NGO – non-governmental organization
NMFS – National Marine Fisheries Service
NOAA – National Oceanic and Atmospheric Administration
NOI – notice of intent
NPDES – National Pollutant Discharge Elimination System
NPS – non-point source
NRA – National Recreation Area
NRCS – Natural Resource Conservation Agency
NRHP – National Registry of Historic Places
NSV IRWMP – Northern Sacramento Valley Integrated Regional Water Management Plan
NTU – nephelometric turbidity units
NWFP – Northwest Forest Plan
OEHHA – Office of Environmental Health Hazard Assessment
O&M – operations and maintenance
PFT – Pacific Forest Trust
PG&E – Pacific Gas and Electric
pH – power of hydrogen (relative acid/basic nature of a solution)
PIER – Public Interest Energy Research Program (part of the California Energy Commission)
Plan – USR Integrated Regional Water Management Plan
ppm – parts per million
PPP – public-private partnership(s)
PRC – California Public Resources Code
PRT – Pit River Tribe

PSA – public service announcement
PUC – Public Utilities Commission
PWWF – peak wet weather flow
QA/QC – quality assessment and quality control
RAC – Resource Advisory Council
RAP – Regional Acceptance Process
RCD – Resource Conservation District
RCM – regional climate model
REX – River Exchange (Dunsmuir-based organization)
RMS – resource management strategies
RTCA – Redband Trout Conservation Agreement
RV (park) – recreational vehicle (park)
RWMG – Regional Water Management Group
RWQCB –Regional Water Quality Control Board
SB 221 – Senate Bill 221 (California Law governing development and water availability)
SDWA – Safe Drinking Water Act
SIA – special interest areas
SLWRI – Shasta Lake Water Resources Investigation
SNMP – Salt and Nutrient Management Plan
spp. – species (various or undetermined)
SRES – Special Report on Emissions Scenarios
STNF – Shasta-Trinity National Forest
SVRCD – Shasta Valley RCD
SWAMP – Surface Water Ambient Monitoring Program
SWCMP – Sacramento Watershed Coordinated Monitoring Program
SWIM – Sacramento River Watershed Information Module
TAC – technical advisory committee
TCP – traditional cultural property
TMDL – total maximum daily load
TP – timber production
TPZ – timber production zone
TU – Trout Unlimited
US – United States
USACE – United States Army Corps of Engineers
USBR – United States Bureau of Reclamation
USDA – United States Department of Agriculture
USFS – United States Forest Service
USGS – United Stated Geologic Service
USR - Upper Sacramento, McCloud and Lower Pit River IRWM Region
UWMP – Urban Water Management Plan
WUI – wildland-urban interface
WA – watershed analysis
WDL – Water Data Library
WRCP – World Climate Research Program
WSRCD – Western Shasta Resource Conservation District

WWT – Winnemem Wintu Tribe
WWTP – wastewater treatment plant

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1. Introduction

Stakeholders in the Upper Sacramento, McCloud, and Lower Pit Region (USR) have worked together since 2009 to implement Integrated Regional Water Management (IRWM) planning. This effort has been enhanced by the regional cooperation and collaboration that took place for decades between stakeholders covering such topics as resource planning and management, endangered and special status species, issue and watershed management prioritization for national forests, the management and future of groundwater resources, and many other topics. This IRWM plan incorporates relational and resource synergies from those efforts for identifying and developing opportunities for further consideration of regional water management issues.

1.1 Purpose and Vision

This planning effort and adopted USR IRWM plan (IRWMP, or Plan) is not a final destination, but rather is the continuation of past discussions and the beginning of a process that participants expect to follow for years. Stakeholders have voiced the need for continued dialogue as water resource projects are proposed and implemented while further developing communication pathways to address regulatory issues, speak with a unified voice when needed about resource issues of federal and state importance, and make use of each others' strengths to accomplish objectives identified in this IRWMP. As part of this commitment, participants have identified an important expectation of all regional water management group (RWMG) members as the IRWMP is implemented: Members need to participate in at least one work group and/or committee; and, Member entities need to contribute some in-kind effort toward the ongoing implementation, tracking, and development effort of the plan as it will be a living document and management process.

1.2 Regional and Statewide Priorities

In addition to addressing regional issues, there are multiple priorities identified in the DWR Guidelines that address issues of concern on a statewide basis. These issues have differing relevance and importance within the USR, as described below.

Drought Preparedness: While much of the literature described in the climate change section (Chapter 9) indicates that community water sources in the USR are largely insulated from drought due to substantial utilization of spring water sources, extreme droughts – in supply or duration – could adversely affect those springs. Several of the projects submitted by jurisdictions in the USR are targeted at increasing water system reliability and flexibility, thereby incorporating drought contingency and climate change adaptation into regional water systems.

Use and Reuse Water More Efficiently: Water use efficiency measures are built into some of the infrastructure projects identified in Chapter 10. In addition, the added resource management strategy of education (see strategy "aa" in section 8.1.5) will help stakeholders focus on the benefits of region-wide education and outreach regarding water use efficiency, reuse opportunities, and drought preparedness.

Climate Change Response Actions: There are extensive opportunities for climate change response in the USR. This ranges from the concerted effort to use local labor, thereby minimizing travel emissions; to implementing small and micro-hydropower projects to take advantage of the region's topography in producing green infrastructure; to collaborative prioritization efforts with the USFS to implement more comprehensive, system-wide habitat management strategies for endangered and special status species, green infrastructure, and recreational and local economic purposes. This topic is further described in Chapter 9, Climate Change.

<u>Expand Environmental Stewardship</u>: USR stakeholders are aware of and support the idea of the use of natural systems as buffers for climate change and "green" infrastructure. Many stakeholders in the USR have a unique relationship with natural resources in that the clean – and even pristine – state of much of the region's resources supports excellent tourist attractions and helps to generate needed economic development dollars in the region. Many of the projects proposed for implementation address the topic of environmental stewardship (see tables 10.4 and 10.5 in Chapter 10, Project Implementation, for how the environmental stewardship objective and resource management strategy are met by the suite of projects – 70% and 63%, respectively). Resource stewardship is important to all USR stakeholders, as described in section 3.4.4 of the Region Description.

<u>Practice Integrated Flood Management</u>: The identification of some of the region's natural resources and habitats as "green" infrastructure is a frequent theme in considering resource management strategies in the region. Stakeholders are interested in the many uses of resources on a multitude of levels. As a source water region, stakeholders have also identified the downstream benefits of effective headwaters management, whether it includes meadow restoration for flood attenuation or examination of system capacity in order to better prepare local communities for flood flows and retain more storm water back in the system in times of need. More information on flooding is available in the Region Description and Climate Change sections of this document (Chapters 3 and 9). In addition, stakeholders identified an Objective 9 to address the specific flooding issues experienced by localities over the last few decades (section 7.4.9 of Chapter 7, Objectives).

<u>Protect Surface Water and Groundwater Quality</u>: Water quality – in both surface and groundwater systems – is of great importance to USR stakeholders. This is the water supply source for the region, and it is currently of very high quality with very limited need for treatment for contamination or aesthetic considerations. The protection of regional water quality through investigation of resource status and use (identified in several implementation projects described in Chapter 10) seeks to add greater understanding to the region through research activity. Most stakeholders believe that, through better understanding of water resources, those resources can be more securely protected and managed in an uncertain future.

<u>Improve Tribal Water and Natural Resources</u>: Indigenous groups (i.e., nations, tribes) have been integral to the development of this IRWMP. Water supply issues vary throughout the USR for these aboriginal groups. Some experience extreme difficulty getting clean water of adequate quantity, and some resources are threatened by nearby development and unknown groundwater conditions. Without exception, tribes view their aboriginal ties to these resources as strong and immutable. They are an integral and essential part of resource planning in the USR and should continue to be key participants in the process.

<u>Ensure Equitable Distribution of Benefits</u>: The USR is almost completely made up of disadvantaged communities as identified by the 2010 US census. Thus, the participation of these communities is essential to the continuing planning process. Special considerations for outreach, meetings, and the provision of expertise and materials was made during the planning process in ways that would have been very different if the region was made up of large, well-funded urban areas. The benefit of this expanded outreach can be seen in the integrated nature of the project development process, as well as the inclusion of projects addressing regional needs outside of convention, such as tourism and the preservation of habitat for endangered species. More conventional projects such as water, wastewater, and energy infrastructure for small disadvantaged communities are also included in Chapter 10, which will help the region comply with state policies that identify the need for clean, safe, and affordable water for all people.

1.3 IRWMP Organization

The elements of this IRWMP were guided both by the DWR Guidelines (November 2012) as well as the priorities and preferences of participating stakeholders and the RWMG. They are described in order below.

Chapter 2: USR Planning Framework, Stakeholder Involvement, and Integration

This chapter describes the history of watershed planning in the USR and how that planning was integrated into this IRWMP. It describes the process of stakeholder outreach and inclusion, and introduces the decision-making process identified by stakeholders for preparation of the IRWMP. As part of the document development, stakeholders identified how local, state, and federal priorities fit into the USR itself, as well as the IRWMP document.

Chapter 3: USR Region Description

The USR region description describes in general terms the natural resources, stakeholders, communities, and native habitats throughout the USR. It draws on many local, state, and federal documents to complete this description, and serves to inform related planning objectives (Chapter 7) directly.

Chapter 4: Relation to Local Water Use Planning

Because of the nature of the USR as a headwaters region, the relationship of the water management plans of local jurisdictions and water purveyors to regional resource issues is quite different from other parts of California. This chapter describes how local jurisdictions and water authorities consider and plan for water use within the USR.

Chapter 5: Relation to Local Land Use Planning

Land use planning is an important component of water resource planning. Except for limited specific areas, the USR hasn't experienced extensive amounts of growth or development in the past. Furthermore, due to various development constraints, extensive growth isn't expected in the near future. However, land use planning can also be affected by the planning conducted for natural resources, including resources on public lands. This chapter identifies the various forms of land use planning occurring in the USR and how it relates to water resources in the region.

Chapter 6: Issues and Interests

The process by which issues, interests, and challenges were identified represents a significant amount of work and negotiation on the part of participating stakeholders, and is represented in this chapter. The issues are identified as headers in the chapter and the interests are those nuances of issues identified by various stakeholders as being of concern and/or note. The identified challenges stem largely from topics on which there has been significant disagreement or from processes that are outside the scope of IRWM planning. Related concerns are identified and described, and possible opportunities for continued discourse and engagement are noted.

Chapter 7: Objectives

The objectives of the plan are described in this chapter, along with two overarching goals that were identified to guide implementation and tracking. The objectives are accompanied by measurable components that can also serve as performance metrics (see also Chapter 12).

Chapter 8: Resource Management Strategies

The resource management strategies (RMS) identified in Chapter 8 represent those identified in the 2009 California Water Plan, the 2012 IRWM Guidelines, and the priorities identified by stakeholders through the issues identification process. These RMS will help guide the activities and suite of options discussed by stakeholders as the IRWMP is implemented.

Chapter 9: Climate Change

The USR, as a forested source water area, is expected to experience unique effects in the future as a result of climate change. Potential effects are identified in this chapter along with analysis of climate change projections for the region. Effects and vulnerabilities are identified, and the vulnerabilities are prioritized using a matrix of urgency, risk, and cost.

Chapter 10: Project Review Process and Implementation

Initial projects identified by the RWMG to implement this IRWMP are identified and described in this chapter along with the process by which projects were solicited, submitted, developed, reviewed, prioritized, and publicized. General and projected outcomes of project implementation are described as well as the process by which stakeholders expect to revise the project implementation list in the future.

Chapter 11: Impacts and Benefits

Discussing and identifying IRWM planning impacts and benefits on various stakeholder groups throughout the USR was an important component of the planning process and is represented in this chapter. There was some disagreement between stakeholders – individuals and entities – throughout the planning processnd much of this discussion is represented here. In addition, the benefits and impacts of regional planning are identified for the region as a whole as well as for interregional relationships and a process by which adaptive management may be implemented is described.

Chapter 12: Plan Performance and Monitoring

The performance and monitoring chapter describes how progress and success of IRWM implementation will be tracked. This chapter also describes the process by which this evaluation will occur and the responsibility for implementation.

Chapter 13: Data Management

Data collection and management is an important consideration for a region that has undertaken and completed significant planning efforts. This chapter describes specific data gaps and information needs of the region, as well as how data is to be managed. This includes reporting to state databases and the proposed in-region data management system.

Chapter 14: Technical Analysis

Technical analysis is the process by which stakeholders assessed the relative reasonability of technical data and information as well as how the analyses feeding the development of the IRWMP (some of it identified as cost-share in the planning grant budget) was developed and used. This section also identifies important data gaps for the USR and includes a table representing the key reference documents used in development of this IRWMP.

Chapter 15: Financing IRWM Implementation and RWMG Operations

Planning for IRWMP implementation requires consideration of financial needs and the operations of the RWMG. This chapter outlines stakeholder preferences, identifies options, and will serve as the guiding document for RWMG identification and recruitment of implementation funding.

Chapter 16: Governance and Next Steps

This chapter provides information on many of the general topics identified in Chapter 2. The RWMG, which will be the group responsible for IRWMP development, is described in Chapter 16, as well as how the formation of that group occurred. The governance structure for the RWMG going forward is identified and described. Communication, coordination, and collaboration efforts are described as both a historical reference and as a plan for ongoing implementation and operations.

The appendices for the plan are provided as directly relevant materials to IRWM planning and implementation. Stakeholder data, background, and information are provided as requested and submitted by stakeholder entities in the data management system (described in Chapter 13).

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2. USR Planning Framework, Stakeholder Involvement, and Integration

The purpose of this section is to give an overview of the IRWM process, including the history of developing the USR IRWM, an overview of the stakeholder process and involvement, and a review of the various levels of integration achieved through this process.

2.1 Regional Framework for Integrated Planning in USR Watersheds

Per DWR Guidelines and the California Water Code, an IRMWP is to be a comprehensive planning document to encourage regional strategies for management of water resources. Through 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 via this grassroots effort, accommodating a diversity of regional needs.

2.2 Stakeholder Involvement

In-region stakeholders have been the driving force of this IRWM planning effort, from identifying the opportunity of IRWM through pushing for a representative governance structure and inclusive plan. Below is described some of the region's history with IRWM and other collaborative efforts, as well as how stakeholder input and effort has been integrated into the planning process.

2.2.1 USR Planning Process — Overview

In March 2009, the River Exchange (REX) and California Trout (CalTrout) sent out a joint letter as part of the project's stakeholder solicitation process and in support of the Regional Acceptance Process (RAP). The letter announced that these two organizations were working together to promote regional water management planning for the Upper Sacramento and McCloud watersheds, and that they were inviting organizations to participate in what was proposed as a long-term effort to better understand the water resources in those watersheds, and to design a collaborative approach to managing those resources that recognizes the many competing needs for water use and stewardship in the region.

In developing the RAP documents, the organizations were in contact with representatives of the now-approved Upper Pit Region, the Northern Sacramento Valley Region, and the North Coast Region to ensure that the USR covered substantial portions of excluded areas and possessed congruent regional boundaries. REX and CalTrout submitted the RAP on behalf of the Upper Sac region in April 2009, and held the first meeting of the RWMG in February 2010 to announce acceptance as a region. In August 2010, the second meeting of the RWMG was held to determine the applicant for the planning grant. REX, with extensive organizational experience in implementing and administering state grant awards, was chosen by the RWMG to be the applicant for the region.

In developing the planning grant proposal coordination occurred with RWMG members, DWR and CVRWQCB staff, adjacent regions (North Coast, North Sac Valley, and Upper Pit) as well as with the Cosumnes, American, Bear, and Yuba and Inyo-Mono regions.

In early 2012, the River Exchange signed a 2-year grant agreement with the California Department of Water Resources (DWR) to manage the process of developing an Integrated Regional Water Management (IRWM) Plan for the Upper Sacramento, McCloud, and Lower Pit River Region. The planning process is designed to develop a water management plan that is meaningful for the region and developed by the stakeholders, rather than a top down, one-size-fits-all approach, to accommodate the diverse needs of different interests.

Much of the groundwork for the IRWM planning effort in the region had already been initiated through the work of other collaborative processes. Examples of such collaborative processes in the McCloud watershed are the McCloud CRMP, the Redband Trout Conservation Agreement and the FERC relicensing process, all of which serve as building blocks to facilitate integrated regional water management. In the Upper Sacramento watershed, REX, in partnership with a diverse group of stakeholders, recently completed a Watershed Assessment and Management Strategy, funded under the DWR CALFED Bay-Delta Program. In the McCloud and Lower Pit watersheds, diverse stakeholders have been involved in FERC relicensing process with PG&E facilities.

As the planning process got underway in 2012, the project team began with meetings held every-other-month. This schedule encouraged for continuity of discussion, while allowing time for the project team to respond to requests and develop meeting materials. In mid-2013, after most of the chapter work had been discussed within the stakeholder meetings, much of the details were worked out by working groups dedicated to particular subjects. For example, the project development work group developed the approach to prioritization as a recommendation to the RWMG for approval. These work groups allowed for continued and open participation, but on a more targeted topic; this helped to refine the details necessary to complete a comprehensive USR IRWMP.

2.2.2 Stakeholder Composition

Chapter 16, Governance, gives an in-depth look at the composition of the stakeholder body. It is important to note that stakeholder identification and outreach has been happening since the RAP process began in 2009. Interested stakeholders who are new to the IRWM effort are constantly integrated into the planning process in whatever capacity in which they're interested and willing to participate.

Of the stakeholder types listed in the California Water Code, the USR has representatives from:

1. Retail water purveyors, including local agencies;
2. Wastewater agencies;
3. Flood control agencies;
4. Municipal and county governments and special districts;
5. Electrical corporations;
6. Native American tribes that have lands within the region;
7. Environmental stewardship organizations (including watershed groups, land conservancies, and environmental groups);
8. Industry organizations (including agriculture);
9. State, federal, and regional agencies with specific responsibilities and knowledge within the region; and
10. Disadvantaged community representatives.

A full list of participants may be found in Chapter 16, Governance.

2.2.3 Process to Identify Stakeholders

The River Exchange, as the grant recipient from DWR, publically noticed the IRWM development process in March 2011 as a news release to a number of regional news outlets. It announced the grant award and contract as well as a description of the planning process and intent to prepare an IRWMP. The news release included contact information for the River Exchange should any readers be interested in participation. This announcement was preceded by at least two years of outreach to and research by a variety of organizations within the region, including those types listed above and in Chapter 16, Governance.

As described above, stakeholder identification was complimented by the numerous collaborative activities that have occurred in the region, including the Upper Sacramento Watershed Assessment, the Redband Trout Conservation Agreement, and various FERC relicensing processes. Through these efforts, many stakeholders knew each other, or were at least aware of organizational interests. This aided REX in their initial outreach. The 2009 group was asked to further identify potential interested organizations for participation, and this was requested again in 2012 with the beginning of the planning grant. While the process was structured to ensure that all stakeholders were able to submit their comments and viewpoints, at no point in the development of the RAP or the IRWMP was participation closed to any individual or organization.

2.2.4 Disadvantaged Community Outreach

Most of the region can be qualified as "disadvantaged," using DWR's criteria of 80% of statewide median household income as recorded in the last census. The major communities in the USR have all participated actively in the planning process, including Dunsmuir, the City of Mt. Shasta, and McCloud. These communities all qualify as disadvantaged.

Outreach to these entities began with the RAP process, as described in section 2.2.1. They were identified through the history the River Exchange has in the region, and were described as disadvantaged through the tool the DWR has made available on its IRWM website. Continual contact with these entities by the River Exchange and through collaborative outreach with other groups ensured that these communities were well integrated into the process early on, and consistently incorporated and included throughout. This outreach included individual phone calls, informative e-mails, process updates through other organizations, and one-to-one discussions in the project development phase to ensure that these communities had every opportunity to identify and describe their projects, thereby preparing them for future implementation opportunities.

Stakeholders were aware during the RAP process and continue to consider that these disadvantaged communities have critical water supply, delivery, and wastewater treatment issues that must be addressed. All stakeholders in this IRWM development process have made it clear that a major project implementation priority for the region – if not the major priority – is to provide support for the infrastructure challenges faced by these communities. This support from all parties has been key in the continuity of these communities' participation, and will likely provide a foundation on which future USR RWMG activities can be based.

2.2.5 Aboriginal Community Outreach

As described in the Region Description (Chapter 3), there are four tribes represented in the USR: the Modoc Nation, the Shasta Tribe (represented by the Shasta Nation and the Shasta Indian Nation), the Pit River Tribes, and the Winnemem Wintu. These tribes began to be identified in the RAP process (though the Shasta Nation band of the Shasta Tribe was invited at the beginning of the planning process, in early 2012).

Similar to the disadvantaged communities, these nations have been involved in the planning process; dissimilarly, however, the involvement varies widely from group to group. Participation in the planning process has run from the limited participation of the Shasta Indian Nation, which attended a few planning meetings and did not submit any projects, to the Winnemem Wintu, a nation that has been quite active due to their partnership status on several projects and which submitted many comments on nearly all chapter drafts. While the Pit River Tribe is the only federally recognized tribe in the USR, its representatives have been involved tangentially, attending most of the larger planning meetings but not submitting any projects. The Pit River Tribe has commented that their participation has been limited in part because of their inclusion in several IRWM regions, thus putting additional pressure on their staff resources.

Outreach completed during the planning process has included a special effort to encourage input and comments from these aboriginal nations. This has ranged from one-to-one discussions regarding process and timeline to accepting late chapter comments for consideration. Each group was asked on at least one occasion about project development, including the offer of technical assistance. In addition, the budget identified in the planning grant application for completing an assessment of regional tribes' ethnographies and attitudes towards water and natural resources was actually doubled partway through the planning process to accommodate the number of tribes and the importance of their contribution to the planning process. For at least one nation, this ethnography work will be their primary contribution to the document; for others, it represents a compliment to the effort they've put into contributing to – and, in some cases, developing – Plan content.

2.2.6 Technology and Information Access

A website was developed early in the planning process to make information available to all stakeholders and interested parties, available at www.uppersacirwm.org. The website adds to process transparency, but also ensures that all participants get access to the same information at the same time. The website also has a password-protected area to allow internal information – mostly related to project development – to be kept confidential to the process and participating stakeholders until it is ready to be made public. The password component allows for a "gestation time" for projects and other discussions, so that participating stakeholders can work together to get comfortable with the suite of projects before they are made public. This allows the group to develop greater cohesion through an element of safety and confidentiality in their collaboration efforts.

In addition to the website, REX keeps an e-mail and contact list updated with new stakeholders, representatives, and their contact information. It is anticipated that this contact information will be passed along to any future organization that is able to take on the outreach activities for the RWMG.

The IRWM development project team encouraged an open process with information going both ways. Much of the role of the stakeholders in the plan development process was to provide current and accurate information regarding regional conditions, policies, values, and priorities. In return, the project team provided source information, bibliographic references, and arranged forums for discussion in the case that further discussion was needed on any topic. The most relevant and used references were added to the website data management system for universal reference (see Chapter 13, Data Management, for more information).

2.2.7 Decision Making Process

This topic is covered in more depth in Chapter 16, Governance, however, on a basic level, the USR stakeholders went through two formats of decision making in developing the IRWMP.

The first approach to decision-making was identified in 2012 before the formal RWMG was established. This was done through an interim governance structure to facilitate decision-making without having the immediate requirement for a formal agreement. Through a majority decision made via a noticed vote of interest groups present, stakeholders agreed to have a direct democracy through the "general assembly" of all interested and participating stakeholders. To have a say in any decision, the organization must have had a representative participating in at least two out of the previous three meetings. The first attempt at a decision was for consensus. If one could not be reached, the parties not in agreement met to work out their differences. At the next meeting that same issue was brought back, first for consensus and then, if consensus could not be reached, a vote requiring 75% approval. If the issue did not pass the second round of consensus and did not achieve a 75% approval, it was identified as a “dead” issue.

In addition to this, and in order to facilitate the process of document development, stakeholders agreed that any chapter that received no comments at all during review could be considered approved by the stakeholders for use as foundational material in further chapter development. This agreement was reached with the caveat that all stakeholders would be able to review the document again before plan adoption.

The second decision-making development came with the writing and signing of an MOU in mid-2013 to formalize the governance structure. This document altered, somewhat, the decision-making process, but retained the representative democracy of the stakeholder group – now the regional water management group, or RWMG – made up of signatories to the MOU. More about this topic may be found in Chapter 16, Governance.

2.2.8 Involving Stakeholders

As shown in table 16.1 (Chapter 16, Governance), the suite of entities participating in the development of the USR IRWMP is diverse and includes varied interests throughout the region. During the initial outreach phase of the development of the USR IRWMP, all organizations and agencies in the region were alerted of the opportunity to participate and, subsequently, sign on to the MOU. This outreach was achieved through personal contact by the grantee (REX) as well as through encouraging those contacted to invite others they thought might be interested. Outreach also included public announcements. The outreach phase extended from the RAP through much of the planning process, allowing extensive time for contact, communication, and ongoing opportunities for participation in the planning process.

The diverse nature of the USR stakeholder group is an essential component to implementing the objectives through the use of the resource management strategies (RMS) (see Chapters 7 and 8). As described in the Governance section (Chapter 16), the work group identified to draft the initial objectives included aboriginal groups, environmental advocacy organizations, timber companies, water purveyors, and federal and local public agencies. The individuals representing these points of view made use of the RMS to identify concrete, measurable outcomes for the objectives, which were then turned into performance measures. The decision made by this group, and affirmed by the stakeholder group, was that the measures used to identify successful implementation of the objectives (and, therefore, the Plan), would be cumulative between the diverse entities active in the region and in the development of the IRWMP. For example, while the USFS may address up to 3,000 acres annually for fuels control, the other entities implementing this work – including the resource conservation districts and fire safe councils – also implement fuels control projects and their work is included in the established goal for a total of 5,000 acres. In addition, the diverse stakeholder participation present in the development and ongoing governance of the USR RWMG established a governance structure that will encourage a balance as far as input and implementation of these objectives and the use of these resource management strategies. More about this is available in Chapter 16, Governance.

In the Coastal Smart Growth reference[1] provided as part of the DWR Guidelines (November 2012), the website lists the following as the goal of involvement: “to fairly identify and respond to all legitimate interests by providing clear and convenient opportunities for substantive involvement at

[1] http://coastalsmartgrowth.noaa.gov/elements/encourage.html

critical stages in the development process." On regular occasions, all stakeholders received a list of chapters for review, along with the due date for edits and comments, and whether the chapter was out for the first or second review round. In most cases, submitting comments on review documents represented the best and most important way for stakeholders to take part in the plan development process, and this was completed through a very fair, open, and representative process.

Not present at the planning process was Shasta County. Early in the RAP development, Shasta County had a reticence to participating in the USR process, perhaps due to the fact that the county has a physical presence in three IRWM regions. In any case, they were kept informed through the e-mail list, and also periodic meetings and documents for review. Information relevant to county service areas and other topics of interest represents accurate and current information because of these contacts. It is possible that the county may be interested in future participation.

Also not present in the planning process were PG&E and the Bureau of Reclamation. Both of these entities have substantial fiscal and policy interest in the USR, and were unwilling to participate after several invitations. As with Shasta County, it's possible that these entities may be interested in future participation; they will be kept informed via remaining on the process e-mail list.

2.2.9 Technical Assistance to Project Proponents

The process by which project proponents could receive technical assistance was straightforward and open. It began with the initial presentation by the project team at a stakeholder meeting regarding project development and application for inclusion in the IRWMP. The suggested process included that 1) the project proponent make a request to REX for help, 2) REX would then either help the sponsor themselves or ask another member of the project team to assist the project sponsor, 3) that contact was made as assigned, and all questions worked out between the project sponsor and their individual technical assistant. For clarity and consistency, the same technical assistant followed each project through the development process. In addition, the project team advised that ongoing assistance was a possibility, even after the completion of the IRWMP. This will be worked out through REX.

2.3 Integration

There are four types of integration discussed here: integration of local, state, and Federal perspectives and priorities; stakeholder integration; resource integration; and project integration. While many of the processes and structures facilitating this integration are in other sections of the document, and the outcomes of this integration are evident throughout the document, it is important to note that the USR RWMG continues to coordinate and integrate specific efforts with the goal of better functioning as a unified whole.

2.3.1 Integration of Local, State, and Federal Priorities

As noted in the Region Description (Chapter 3), there are significant planning efforts going on throughout the USR, led by a variety of institutions. Some of these institutions are active participants in the USR planning process, and some of them are not. In all cases, the jurisdictional responsibility of these groups is respected in that the USR IRWMP does not challenge, negate, or oppose any of these authorities, nor does the governance structure or authority of the USR MOU document affect these authorities. The relation of the USR IRWMP function to these documents and processes is meant to be a positive and complimentary one. Stakeholders would like to see the USR IRWMP integrate these other efforts, and encourage the further integration of planning efforts together. The goal of the planning document is to be a hub for information as well as an inspiration for further collaboration, developing synergies that result in implementation approaches that would never be possible without the IRWM structure. Further integration efforts on a local, state, and federal governmental level will pursue this ideal, and are memorialized in section 3.04 of the MOU:

"Although the IRWMP refers to many legally binding statutory and regulatory provisions—such as general plans, zoning ordinances, water quality plans, and various permits, licenses, and approvals—its purpose in doing so is to ensure that the IRWMP is consistent and compatible with those existing legal obligations. Rather than adding to or modifying the present legal and regulatory environment, the IRWMP is intended to streamline and improve the stakeholders' ability to operate and succeed within that environment."

2.3.2 Stakeholder/Institutional Integration

One of the most tangible, yet unquantifiable, benefits of IRWM planning is the practice of regular meetings of water-related interest groups to discuss activities, opportunities, and issues. Many of the organizations sitting at the table have historically been (or may currently be) at odds over water issues. While it is not expected, nor intended, that the RWMG will solve all water-related conflicts in the region, there are definite advantages to increased communication and cooperation. The process has helped to educate stakeholders about each other's activities, priorities, and challenges. During the RWMG's discussions regarding their collective future and the future of the group, many participants expressed the desire that the IRWM planning process should continue with the objective of increased education and coordination regarding common issues. Stakeholders see this continued communication as a way to overcome conflict and, possibly, achieve common objectives on issues that affect all participants.

In addition to the goals and outcomes of USR stakeholder integration, the governance structure was identified and further refined so that all stakeholders were on equal footing with regard to input and expectations. Financial support is not expected from any participant and, though in-kind effort is expected with regard to participation, it is hoped that organizations will be able to equitably share the coordination and meeting facilitation efforts.

2.3.3 Resource Integration

Integrating resources can include financial and/or staff resources, how data is shared, coordinating technical expertise and capacity, or looking at resources in a more integrated and "ecosystemic" way. USR stakeholders have encouraged organizational integration through placing a priority on projects with multiple partners (see Objective 2 – Cooperation and Trust). In addition, the integration of organizational resources is memorialized in the MOU through the identification of a "roving" responsibility for fiscal agent and secretary. IRWM implementation can be seen to be integrating the ecosystemic component of resource integration; more information is available on this topic in Chapter 10, Project Review Process and Implementation.

2.3.4 Project Implementation and Integration

Chapter 10, Project Review Process and Implementation, gives more detail on this topic, however, in general project sponsors have responded positively to requests and opportunities for integration. As project development began after the identification of regional issues and challenges, objectives, and resource management strategies, participants were able to respond to these topics and collaborate with other stakeholders to identify true regional gaps in management and/or knowledge in designing their project responses. Project sponsors had many facilitated opportunities to discuss integration and coordination through project development workshops. In addition, proximity made further collaboration – outside the facilitated process – easy. One of the key tasks for future RWMG activities and implementation includes further coordination in issue identification and project development; stakeholders see this as an important service provided by the IRWM process, and one that is not duplicated in other arenas.

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3. Region Description

3.1 Introduction

This section of the Upper Sacramento/McCloud/Lower Pit Region (USR) IRWM plan constitutes the region description for that plan. The description provides an introduction to water-related resources, infrastructure, management programs, and many issues concerning water resources in this IRWM region. This is done with the intent of helping to establish the context of issues and community needs, many of which will be addressed in various ways by projects to be proposed by local agencies and concerned property owners and organizations. This region description is not intended to be a comprehensive assessment of those resources and issues. It is acknowledged that many specialized studies have been and will need to be prepared to provide a more complete evaluation of many of the topics introduced in this section.

Drafting of this region description has relied upon a variety of informative documents including watershed assessments and analyses that have been prepared for specific areas within this region. In fact, this region description would do well to incorporate by reference many of the studies that have been prepared. With that point in mind, it is appropriate to begin this region description with recognition and acknowledgement of some of the key assessments that have been prepared for this region.

Following is a list of watershed analyses or basically equivalent “ecosystem analyses” that have been prepared by the Shasta-Trinity National Forest covering areas that are located completely or partially within the USR. Nearly all of these analyses are available on the website maintained by the Shasta-Trinity National Forest (http://www.fs.usda.gov/main/stnf/landmanagement/planning). A more complete explanation of the watershed analysis process will be included in this region description:

1. Mount Shasta Watershed Analysis
2. Lower McCloud Watershed Analysis
3. Squaw Valley Creek Watershed Analysis
4. Edson Watershed Analysis
5. Pit Arm Shasta Lake Watershed Analysis
6. Porcupine Watershed Analysis
7. Headwaters Sacramento River Ecosystem Analysis
8. Shasta Lake West Watershed Analysis
9. Squaw Creek Watershed Analysis
10. McCloud Arm Watershed Analysis
11. Bartle Watershed Analysis
12. Shotgun-Slate Watershed Analysis
13. Iron Canyon Watershed Analysis
14. McCloud Flats Ecosystem Analysis
15. Upper Sacramento River (Castle/Soda Creek area – not on website)

The Modoc National Forest also prepared a watershed analysis for the ‘Medicine Lake Highlands’ in 1999 (available as of 11/2013 at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5380154.pdf).

In addition to the watershed analyses that have been prepared by the Forest Service, there are a couple of watershed assessments that have been prepared by other non-federal sources. As noted throughout this section of the IRWM plan, this Region Description draws heavily upon information in the *Upper*

Sacramento River Watershed Assessment and Management Strategy. The watershed study area was the watershed of the Upper Sacramento River from the headwaters of the river to Shasta Lake Reservoir. The watersheds of the McCloud and Pit Rivers, which flow into the Sacramento River at the reservoir and are part of the larger Sacramento River Watershed, were not included in the Upper Sacramento River watershed boundary for the purposes of that assessment. However, much of the regional information from that assessment can be applied to describe the character of many resources in the greater region.

That assessment was funded by the State of California through a Proposition 50 grant, via the CALFED Watershed Program. The River Exchange in partnership with California Trout, the U.S. Forest Service, Shasta Valley Resource Conservation District, Western Shasta Resource Conservation District, and the U.S. Fish and Wildlife Service obtained the grant funds. The Department of Water Resources was the state agency responsible for administering the grant funds, and the River Exchange was responsible for managing the project.

Another watershed analysis, the *Lake Siskiyou Watershed Assessment* (2004), was prepared under the direction of the Siskiyou County Planning Department. The area considered as the Lake Siskiyou watershed is generally the watershed of the Upper Sacramento River above Box Canyon Dam in southern Siskiyou County. The area is bounded by Mt. Shasta to the north, Mt. Eddy on the west, Lake Siskiyou on the south/southeast, and the City of Mt. Shasta to the northeast.

The Mount Shasta Springs 2009 Summary Report, published in 2010 by California Trout, reported findings of a study on general water quality and geochemical parameters, recharge area, age, and vulnerability of springs that originate on and below the slopes of Mount Shasta. The study was conducted and evaluated by a collaboration of California Trout, AquaTerra Consulting, the UC Davis Center for Watershed Sciences, and other project partners. The spring waters study was conducted from 2007-2009, and the report was published in 2010. A related vulnerability rating report concerning the springs was published in 2011 as an addendum to the study.

3.2 Regional and Internal Boundaries

3.2.1 Regional Boundaries and General Description

The Upper Sacramento-McCloud-Pit River IRWM Region, referred to in this document as USR, includes the entire watersheds of the Upper Sacramento River and the McCloud River from the headwaters of these watersheds to where the rivers flow into Shasta Lake Reservoir (see figure 3.1). This planning region also includes the watershed area that flows directly into the Lower Pit River, which is the portion of the Pit River below Lake Britton to the surface of the reservoir; but does not include the watershed above and draining into Lake Britton. The USR also includes the area commonly known as the Medicine Lake Highlands. Surface waters of the Medicine Lake Highlands flow into the USR via the Lower Pit River, and the groundwater resources represent a significant recharge area via springs into Fall River, which is a tributary to the Upper Pit River and, ultimately, to the Lower Pit. The region was identified by the three main watersheds due to their unity as tributaries to Shasta Lake Reservoir, as well as the common challenges and opportunities faced throughout these three watersheds. The Medicine Lake Highlands were identified as an important source water area and spiritual and cultural region for both the USR and the Upper Pit IRWMP. It was included in the USR boundaries because of the surface water flow contributions to the McCloud River (ground water flows contribute to Fall River, which is a tributary to the Upper Pit River).

Below Shasta Dam and Keswick Dam, the waters that originated from the USR subsequently contribute in part to the greater Sacramento River.

The USR is located within southern Siskiyou County and northern Shasta County.

3.2.2 Physical Boundaries and Significant Water Resource Features

As noted above, the USR consists of the watersheds of the Upper Sacramento River and the McCloud River, includes the Lower Pit River area, and includes the area known as the Medicine Lake Highlands. Each of these watersheds and subareas, including their physical boundaries and significant water resource features, are described in more detail below.

The Upper Sacramento River Watershed

The watershed for the Upper Sacramento River itself (as a distinct watershed within the USR) is approximately 600 square miles in size. It has a northern boundary that is dominated by Mount Shasta (the highest mountain in California at 14,179 feet), Black Butte, and Mount Eddy, and a southern boundary that terminates at the waters of Shasta Lake Reservoir. On the west the watershed is bounded by the Sacramento/Trinity River watershed divide, which includes the Eddy and Trinity Mountains. To the east, it is separated from the McCloud River watershed by physical features including Everitt Hill, Snowman’s Hill, Girard Ridge, Tombstone Mountain, High Mountain, Hanland Peak and O’Brien Mountain.

Many small natural alpine lakes are scattered along the crest of the Upper Sacramento and Trinity River watershed divide, including Castle Lake, Grey Rock Lake, Cliff Lake, Toad Lake, and others.

The most significant reservoir in this watershed is Lake Siskiyou, which lies behind Box Canyon Dam. This reservoir, with a surface area of approximately 430 acres, represents the only impoundment on the Upper Sacramento River between the headwaters and Shasta Lake Reservoir.

The annual monthly mean flow of the Upper Sacramento River at its Delta above Shasta Lake reservoir is 1,198 cfs.

The McCloud River Watershed

The McCloud River watershed covers approximately 800 square miles. The headwaters of the McCloud River include Colby Meadows, from which the river flows approximately 50 miles southwesterly to Shasta Lake Reservoir. However, the McCloud River is also fed by springs along its run, such as McCloud Big Springs with an average discharge of 600 cubic feet per second. The McCloud Basin drains the eastern and northeastern ridges of Mount Shasta, and in the north is bounded by Military Pass (just south of Whaleback Mountain), Ash Creek Butte, Dry Creek Peak, Rainbow Mountain, and Stephens Butte. This watershed is bounded on the west by the ridges that divide it from the Upper Sacramento River watershed, as described above. The eastern boundary includes Buck Mountain, Dead Horse Summit, Bartle Gap, Mushroom Rock, Grizzly Peak, Dutchman Peak, Shoinhorse Mountain, McKenzie Mountain, North Fork Mountain, Signal Butte, Curl Ridge, Salt Creek Mountain, Minnesota Mountain, Town Mountain and Horse Mountain. To the south the McCloud River and the watershed terminate at Shasta Lake Reservoir.

The McCloud reservoir, formed by the impoundment of water behind McCloud Dam, has a surface area of approximately 520 acres, and is the most significant surface water body in the McCloud watershed.

The McCloud River is often described as consisting of the Upper McCloud River above McCloud Dam and the Lower McCloud River below the dam to Shasta Lake Reservoir. As part of the PG&E McCloud-Pit Hydropower Project (under license from the Federal Energy Regulatory Commission, or FERC), the McCloud River is partially diverted at the McCloud Dam into the Pit River via the

McCloud-Iron Canyon diversion tunnel. As much as 90% of water flowing in the Upper McCloud River has been diverted to the Lower Pit River watershed in this manner. Tributaries below the dam, such as Squaw Valley Creek, supply more than three times as much runoff to the Lower McCloud River than is supplied by the Upper McCloud River watershed.

The annual monthly mean flow of the McCloud River above McCloud Reservoir is 919 cfs. The monthly mean of water diverted in the McCloud tunnel to Iron Canyon Reservoir and ultimately to the Pit River is 833 cfs. The McCloud River, as it enters Shasta Lake reservoir (after the diversion, but also after additional tributaries), has an annual monthly mean of 791 cfs.

The Lower Pit River Watershed

To describe the watershed of the Lower Pit River, it must again be noted that the watershed of the Pit River above and including Lake Britton (regarded as the Upper Pit River) is not included in the Upper Sacramento IRWM region. That is, Lake Britton is not included in the Lower Pit River area, nor are the streams and watersheds that flow into Lake Britton or into the Pit River above the lake. To the west and north, the McCloud River watershed described above borders this area. Major boundary features to the east include the dam at Lake Britton, Hatchet Mountain and Hatchet Mountain Pass. It is noted that the Lower Pit River area also includes the watershed of Squaw Creek that flows directly into Shasta Lake Reservoir between the outlet of the Pit River and the McCloud River arm of the lake.

From Lake Britton, the Lower Pit River flows approximately 40 miles to the confluence with Shasta Lake Reservoir. The estimated size of the watershed is 700 square miles. As noted in the description of the McCloud River watershed, a considerable amount of water is diverted from the McCloud River to the Pit River via the McCloud-Iron Canyon diversion tunnel. The most significant surface water body in the Lower Pit River watershed is the Iron Canyon Reservoir, approximately 500 acres in size, which receives water from the McCloud River via the diversion tunnel. It can also be noted that the series of PG&E diversion dams on the Lower Pit River form several reservoirs along the river. These features are described in Section 5, Water-Related Infrastructure.

The Squaw Creek watershed between the McCloud River and the Pit River flows into the Pit River arm of Shasta Lake Reservoir and can be considered part of the Lower Pit River watershed.

The annual monthly mean of the Pit River as it enters the Upper Sac Region at Lake Britton is 2,944 cfs. The Lower Pit River before entering Shasta Lake reservoir, which includes the diversion received from the McCloud River, has an annual monthly mean of 4,847 cfs. As described above, the Lower Pit River includes several diversions of various reaches as part of PG&E's hydroelectric network. These diversions are returned back into the river after being channeled through powerhouses.

Medicine Lake Highlands

The Medicine Lake Highlands, which is the northeastern-most area of the Upper Sacramento IRWM region, comprise the upper portion of the Medicine Lake Volcano (Donnelly-Nolan, 2008)[2], a broad shield volcano that covers about 850 square miles and is the largest volcano by volume (approximately 600 cubic km) in the Cascade Range. The volcano stretches some 30 miles east to west and 50 miles north and south. The Medicine Lake Highlands consist of the Medicine Lake Caldera and its surrounding rim of mountains that include Mt. Hoffman, Glass Mountain, Lyons

[2] This researcher has done the mapping for the USGS and identifies the Medicine Lake Highlands as the area above the 6680-foot elevation of Medicine Lake. However, in other instances the USGS refers to the entire volcano as the Medicine Lake Highlands. It is useful to make this distinction for hydrological purposes, since the higher elevations receive most of the precipitation and snowpack.

Peak, and Medicine Mountain. The Highlands receive the voluminous snowpack whose waters are a major source of the Fall River Springs, the largest spring system in California. While not recognized as a typical watershed due to the lack of streams, much of the area of the Medicine Lake Highlands is a significant recharge area, via subsurface flows, to springs outside the region including the springs that feed the Fall River. Fall River is a tributary to the Upper Pit River. The area of the Medicine Lake Highlands that is in the USR includes the caldera in which Medicine Lake itself is located, and the south and southwesterly slopes of the highlands to where it abuts the McCloud River watershed. Significant boundary features include Stevens Butte, Pumice Stone Mountain, Glass Mountain, Round Mountain, and Hambone Butte.

Medicine Lake, from which this area derives its name, lies in a caldera near the top of the highlands at an elevation of approximately 6,680 feet. Medicine Lake has a surface area of approximately 430 acres at full pool. Very small lakes in the vicinity include Little Medicine Lake, Bullseye Lake, and Blanche Lake.

3.2.3 Jurisdictional Boundaries

This section identifies the notable jurisdictional boundaries and over-lapping areas in the region (see Figure 3.1, on the next page). Also included in this subsection is a succinct general history of the land management and ownership experiences of the Native American Tribes in the USR. This provides both and important backdrop from which to understand current land management patterns and structure as well as information to better appreciate the perspective from which these tribes contribute.

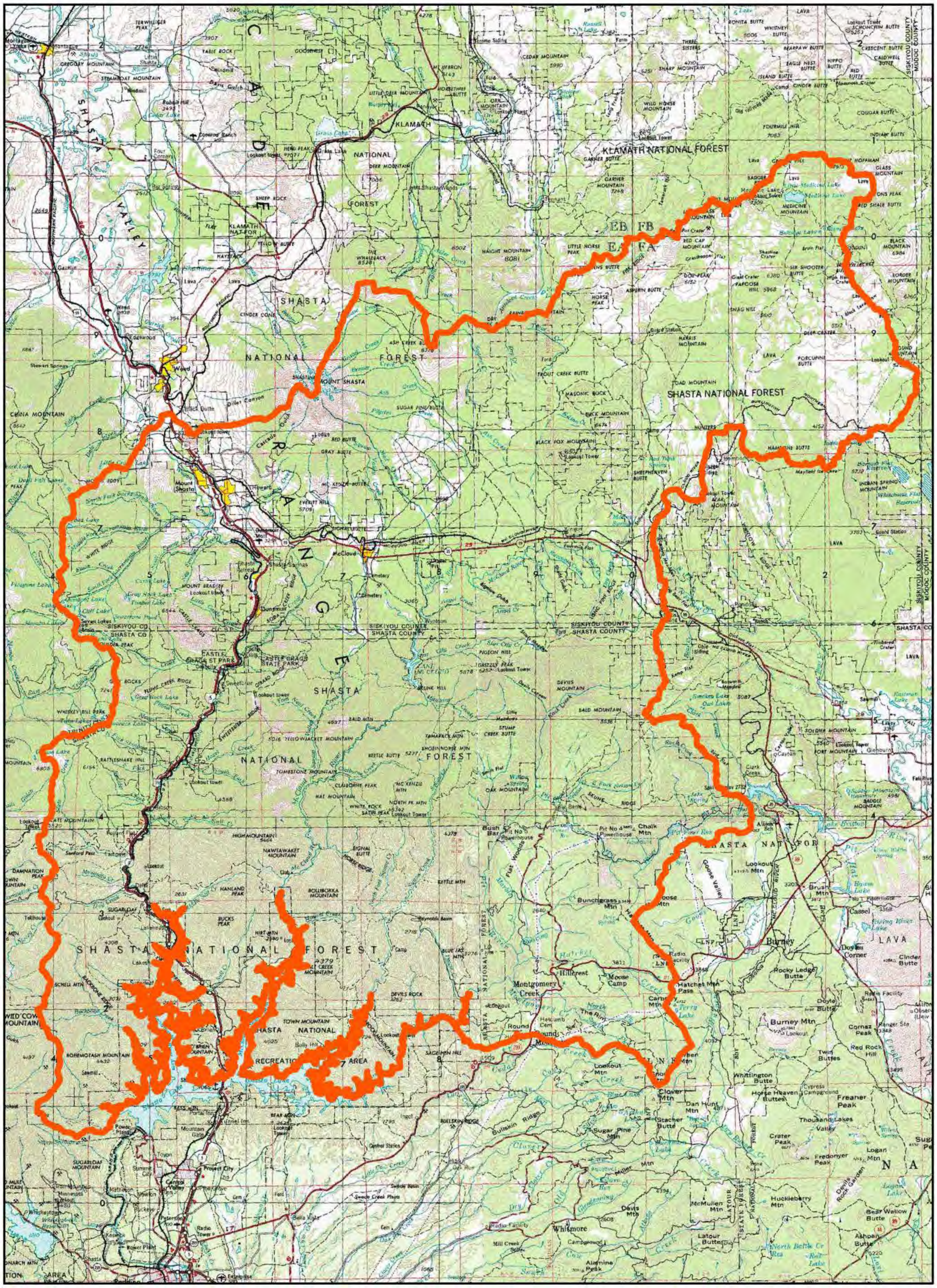

Figure 3.1: Upper Sacramento, McCloud, and Lower Pit Rivers Integrated Regional Water Management Planning Area

3.2.3.1 Aboriginal Experience with Land Ownership and Management

There are four tribes active in the USR IRWM process: the Pit River Tribe, the Winnemum Wintu, the Modoc Nation, and two bands of the Shasta Tribe. The Pit River Tribe is a federally recognized tribe that maintains three rancherias in the region: Big Bend, Montgomery Creek, and Roaring Creek. The Pit River Tribe is comprised of 11 autonomous bands, which are: Atwamsini; Atsugewi; Astarawi; Aporige; Ajumawi; Hewisedawi; Illmawi; Itsatawi; Kosealekte; Hammawi; and Madesi. While not federally recognized, there are three other tribes maintaining historic sovereignty in this region, including the Winnemum Wintu, the Modoc Nation, and the Shasta Tribe, which is represented by two groups: the Shasta Nation and the Shasta Indian Nation.

Pre-history and European Contact:

Native American Tribes are sovereign nations, as they were pre-contact and will be in perpetuity. Historically and to this day within their traditional aboriginal boundaries, they protected, tended, utilized, revered, and named the land and resources. Natural systems continue to be respectfully cared for by many of these tribes, with the recognition of mutual interdependence between people and the environment, and between the physical and the spiritual world.

Americans of European decent entered into the USR in the 1800s and brought with them a social system based on the economic and legal imperative of land ownership.

The opposing worldviews demonstrated by the indigenous people and the European Americans manifested themselves in what historians, anthropologists, and aboriginal peoples of California describe as genocide. Hydrologic modification and commoditization of natural resources greatly impacted California Native Americans historically, and these issues continue to impact the people to this day.

Indigenous Experiences with Land Ownership and Title[3]:

The history of legal land ownership and title in California begins with the occupation and removal of indigenous peoples from their aboriginal lands. The following laws, legal precedents, and bureaucratic culture that were established after taking control of the land favored the state and the federal governments and European Americans in general. These legal and bureaucratic constructs became the template for natural resource management, which is largely followed to this day.

Initially claimed by Spain, California soon passed into the ownership of Mexico and then the United States in the early and mid-1800s, respectively. With the Treaty of Guadalupe Hidalgo on May 30, 1848, the United States government assumed control of all of present day California along with much of the western U.S. The Treaty also called for the United States to recognize existing land titles and accept all people living in the ceded territory as citizens. William Carey Jones was appointed Confidential Agent of the United States government and was to examine the land titles, and determine what rights the native peoples held during the Spanish and Mexican regimes (Robinson 1948 and Starr 2005). Jones' report was clear and direct: it confirmed that the aboriginal peoples did indeed have secure title and right to their lands under the Treaty.

Though the Treaty of Guadalupe Hidalgo had promised continuous ownership of existing land grants, it conflicted with the view held by newly arriving settlers that California should be open to Americans (Robinson 1948). In 1851 Congress passed the first legislation implementing the property protection provisions of the Treaty: "An Act to Ascertain and Settle the Private Land Claims in the State of California," which passed on March 3, 1851, Statute 631. The Act required that existing land titles had to be registered and affirmed by the Land Commission within a five-year period. If a claim was

[3] Much of this section is taken from McTavish, 2010; references are included so that the reader may find more information.

not filed with the Land Commission, the land was considered abandoned. Land from abandoned and rejected claims went back into the public domain to be surveyed and made open to settlement (Robinson 1948 and Sanchez 2003). Very few claims were presented on behalf of the Tribes. Many Spanish and Mexican land grants were not presented either. These public lands were to be later offered to public and private entities as mining claims, homestead claims, grants to the railroads, PG&E, and other utilities, and the National Forest system.

In 1851, President Fillmore appointed three commissioners to conduct treaties with Native American Tribes in California. Between March 19, 1851 and January 7, 1852 at various central meeting places throughout California, they met with 402 tribal heads — representing 139 tribes or bands of aboriginal people, and entered into eighteen treaties (Ellison 1974, Heizer 1972, and Robinson 1948). As described in these treaties, the designated reservations would have added up to 7,488,000 square acres of land, or 7.5 percent of the total area of the state.

The 18 treaties were sent to the United States Senate on June 1, 1852. Most Californians were opposed to having the government sign treaties with the native people. United States citizens in California believed the reservations included valuable land that should be reserved for mining and farming instead of for the tribes. Despite President Fillmore's recommendation that the treaties be confirmed, Congress ordered them sealed in a secret file, where they remained for 53 years. The injunction of secrecy was not removed until January 18th, 1905 (Goodrich 1925, Heizer 1972, Hoveman 2002, and Sanchez 2003).

Eventually some temporary reservations were set up, some of which were later given permanent status by executive order (Ellison 1974, Theodoratus Cultural Research 1981).

Of the Native American Tribes in the USR, only the Pit River Tribe is federally recognized and has federally-designated land. The other three tribes are not recognized by the United States government and continue to wait for the federal treaties, as well as many following agreements and contracts, to be ratified.

3.2.3.2 Internal Jurisdictional Boundaries

The USR is located within southern Siskiyou County and northern Shasta County. Two incorporated cities in Siskiyou County are located less than seven miles apart within the region. The City of Dunsmuir is located along the banks of the Upper Sacramento River, and the City of Mt. Shasta is located just to the north. Both cities are located along Interstate 5 and the Union Pacific Railroad. The McCloud Community Services District (CSD) serves the unincorporated community of McCloud in Siskiyou County, located off of State Highway 89.

Siskiyou County maintains a countywide Flood Control and Water Conservation District. Siskiyou County also owns and manages water resource and flood management facilities in the region, including Box Canyon Dam and Lake Siskiyou on the Upper Sacramento River.

The Shasta County Water Agency was established in 1957 to develop water resources for the beneficial use of the people of Shasta County. The Water Agency's governing body is the Shasta County Board of Supervisors. Shasta County also maintains three county service areas (CSAs) in the region, including: Sugarloaf (CSA No. 2); Castella (CSA No. 3); and Crag View (CSA No. 23). All three of these CSAs are located in the Upper Sacramento River watershed portion of the region.

Approximately half of the land in the region consists of federal land managed by the U.S. Forest Service. This land is mostly within the Shasta-Trinity National Forest with a small area in the northeast corner of the region near Medicine Lake that is managed by the Modoc National Forest. Land managed by the Forest Service includes the Castle Crags Wilderness (10,500 acres) and a large part of the Mt. Shasta Wilderness (30,200 acres, not all of which are in the planning region). In the vicinity of Shasta Lake Reservoir, much of the federal land is managed as the Shasta Unit of the Whiskeytown-Shasta-Trinity National Recreation Area. The Bureau of Land Management also has some management areas within this IRWM region.

State lands within this region include Castle Crags State Park, which is 4,350 acres in size, and several tracts of land acquired by the California Department of Fish and Wildlife along the Upper Sacramento River in the aftermath of the Cantara Loop spill in 1991.

The majority of the remaining land in the region is privately owned, including land owned or otherwise managed by private corporations including Roseburg Resources Company, Sierra Pacific Industries, Hancock Timber Resource Group, Campbell Group, Union Pacific Railroad, the Hearst Corporation, Pacific PG&E, and Westlands Water District (which owns land but does not provide water services within the region). Several non-corporate entities own and manage large tracts of land in the region, including The Nature Conservancy.

The entire Upper Sacramento IRWM region is located within the jurisdiction of the Central Valley Regional Water Quality Control Board, which is Region 5 of the State Water Resources Control Board. The Central Valley RWQCB office is located in Redding, California.

3.2.4 Neighboring IRWM Regions

Adjacent to the north and west of the USR is the North Coast IRWM Region, which includes the watersheds of the Klamath and Trinity Rivers, among others. Adjacent to the east of the USR is the Upper Pit IRWM Region. The Upper Pit River watershed is divided from the Lower Pit River at the Lake Britton dam. The Upper Sacramento River flows into Shasta Lake Reservoir, which flows via Shasta Dam to Keswick Reservoir. At that point the river is within the Northern Sacramento Valley IRWM Region, the adjacent IRWM region to the south of the USR. There are no overlapping boundaries for the USR.

Staff working with the USR Regional Water Management Group (RWMG) has consulted with representatives from the three adjoining regions on common issues and coordination is good. No joint inter-regional projects have been proposed as of this writing, though similar issues have been identified, such as the need for investment in source water areas.

The interregional ties of stakeholders in the USR are strengthened by the organizations and entities whose property, ancestral lands, and/or area of interest extends into other regions. For example, the Pit River Tribe is split into three different IRWM planning regions, California Trout is active throughout much of the headwaters in California, and participating counties usually are split between at least two, if not more, IRWM regions.

3.3 Communities and Land Use

3.3.1. Communities

Communities in this region range in size and character from: the two incorporated cities, Dunsmuir and Mt. Shasta; small unincorporated towns such as McCloud and Lakehead; communities that are very small and "village-like" having some combination of homes, post office, a store or two, and/or an elementary school (e.g. Castella, Montgomery Creek, Big Bend); and sparsely populated rural residential areas which, although extremely small in size or dispersed in development, have specific place names. In addition to these communities, there are many privately owned residential parcels located in isolated parts of the region. These also include independently owned Native American allotments.

The region historically contained many small communities and towns built in support of mines, lumber mills, transportation hubs, and recreational locales. These communities often contained little more than a few cabins for housing located near the main economic focus of the area, be it a sawmill, railroad yard, stage stop, or mine.

Following is a list of the more distinct communities in the IRWMP region. Additional information, such as population, is provided for some of these communities in the Demographic section of this Region Description.

Shasta County	Siskiyou County
Big Bend Castella Crag View Delta Gibson Lakehead Montgomery Creek O'brien Pollard Flat Sugarloaf (Shasta Lake Subdivision) Vollmers	Bartle Dunsmuir, City of (incorporated) McCloud Mt. Shasta, City of (incorporated)

Three Rancherias are managed by the Pit River Tribe in this IRWM region, all in Shasta County. These consist of the Big Bend Rancheria, the Montgomery Creek Rancheria, and the Roaring Creek Rancheria.

It is also noted that there is a small community of cabins and homes, mainly for summer use, at the south end of Medicine Lake. In addition, the Mount Shasta Forest Community is located west of Pilgrim Creek Road, an access point to Medicine Lake; a number of homes there are inhabited year-round.

3.3.2 Land Use

3.3.2.1 Transportation

Before discussing particular community and resource-based land uses in the region, it is first appropriate to acknowledge transportation facilities in the region as both a type of land use and as influential factors concerning other land uses.

Truck and Auto Travel

Interstate 5, which was developed with mostly four traffic lanes as an upgrade to the old two-lane Highway 99, is the primary interstate highway running north-south through California. In addition to its function as a major transportation corridor, Interstate 5 provides opportunities for people living and/or doing business in the region to commute to or otherwise access or ship products to urban areas outside the region, such as the Redding metropolitan area to the south and the Ashland/Medford area to the north. Two state highways, State Routes 89 and 299, pass through portions of the region and connect to Interstate 5. There are also a number of county roads as well as forest service roads that provide access to areas within the region, including some of the more remote locations.

Railway Travel

The Union Pacific Railroad is also a significant transportation feature, particularly along the Upper Sacramento River. The railroad generally runs parallel to both Interstate 5 and the river, and both the railroad and the highway cross the river at various locations within the region. The founding and development of the City of Dunsmuir was largely due to the community's relation with the railroad industry, the servicing of trains traveling through the Upper Sacramento River canyon, and as a resort area promoted, in part, by the Southern Pacific Railroad.

The McCloud Railway has also operated a short line railroad that was developed years ago by the McCloud River Railroad between the Union Pacific tracks (formerly Southern Pacific) in the City of Mt. Shasta to McCloud and eastward to Burney, where it connected to the Burlington Northern Railway lines. A dinner excursion train was operated on the McCloud-Mt. Shasta portion of this line for several years. It was proposed that portions of the line east of McCloud were abandoned. However, a coalition of nonprofit organizations including Shasta Land Trust, McCloud Local First Network, Save Burney Falls, and the Volcanic Legacy Community Partnership is leading efforts to establish an 80-mile-long public recreation trail on the alignment under rail banking provisions of the National Trails System Act. The trail project has been named the Great Shasta Rail Trail.

Cultural and Environmental Effects of Transportation Corridors and Travel

While these transportation options offer USR inhabitants excellent economic, social, and recreational opportunities, they have also degraded the environment and have had an inarguable effect on indigenous — and even modern — cultures and land use. The actions were devastating to indigenous cultures (McTavish 2010).

The land grants made to the railroad determined ownership of much of the land in California's upper watersheds, setting the template for land use today. In the United States as a whole, 9.5% of the public domain was patented to railroads (Robinson 1948). In California alone, between 1850 and 1880 over 16 million acres were patented to different railroad companies, and by 1880, railroads possessed 16% of the land in California (Sanchez 2003; Short 2001; and White 1983).

The Railroad Act of July 25, 1866, authorized construction of a railroad and telegraph line through the Sacramento and Shasta valleys to Portland. With a 400-foot-wide right-of-way, plus patents for 20 alternate sections per mile, the railroad was granted up to 12,800-acres-per-mile of completed line. The United States extinguished the Native American Tribes' titles that conflicted with railroad titles, plunging many families and whole tribes into poverty, with no opportunity for self-sufficiency. The government did not extinguish homestead or mineral claims (Robinson 1948).

The arrival of the railroad affected sites of indigenous cultural value, destroying transportation corridors, sacred sites, and historic villages. For example, an 1876 map shows Dog Creek as a major salmon gathering site for the Wintu; building the railroad destroyed this site (Hoveman 2002). Building the railroad fouled the water so badly that, in 1883, salmon egg production was reduced to the point that the run was almost non-existent for several years.

With the intensity of use of the Interstate 5 and railroad transportation corridor, especially along the Upper Sacramento River, the waters of the region are susceptible to contamination from accidents involving the transport of hazardous materials. For example, on July 14, 1991, just upstream from the city of Dunsmuir, a train derailed along a section of track known as the Cantara Loop. A chemical tank car containing the herbicide metam sodium fell into the Sacramento River and released 19,000 gallons of the chemical into the river. As the metam sodium mixed with the water, highly toxic compounds were created. Aquatic life in the Sacramento River between the Cantara Loop and Shasta Lake Reservoir was destroyed. As a result of a lawsuit filed against Southern Pacific, the Cantara Trustee Council (CTC) was established to address the effects of the spill on the upper Sacramento River. Fortunately, the health of the river was restored in the following years.

3.3.2.2 Community Land Uses

In recognizing the communities within the region, we can also describe in this context the major land uses that are components of established communities. This includes residential, commercial, industrial, and other land uses that exist in relation to larger communities. The cities of Dunsmuir and Mt. Shasta and the towns of McCloud and Lakehead are the primary population and service centers within the region. Within and adjacent to these communities are not only the most intense residential development and land use in the region, but also the principle commercial areas. Cities, being incorporated communities, have specific boundaries (i.e. city limits) with related service areas for municipal infrastructure. In the case of McCloud, which is not an incorporated city, the McCloud Community Service District (CSD) still has specific district and service area boundaries that function much like city limits.

In some cases, as in areas around the City of Mt. Shasta, residential and other community development has evolved near and sometimes adjacent to the city limits and district service areas. For example, west of the City of Mt. Shasta is the Mount Shasta Golf Course and Resort, as well as substantial residential development. Other areas east of and around the city on unincorporated land also have substantial amounts of development. With special agreements, municipal services may be extended outside the city limits to provide water or wastewater services to neighboring development. In the case of Mt. Shasta, the wastewater treatment plant is designated as a regional facility in that it was intended to serve development both within the city and in specific nearby areas outside the city limits.

Aside from areas that are provided with some form of community services, land use in areas outside cities and service districts in the region is mostly served by individual septic tanks and wells, and is served by county services or by special districts (e.g. county sheriff, fire protection district). As discussed in this Region Description under water-related infrastructure, there are several special districts, county service areas (CSAs), and private utility companies that provide water or waste water service to specific communities. Again, using the area west of the City of Mt. Shasta as an example, the Lake Siskiyou Mutual Water Company provides water service to an area, mostly residential in land use, which is connected to the regional wastewater treatment plant operated by the city. A mutual water company also supports community land uses in Lakehead and Shasta County maintains three CSAs with water service for small, primarily residential communities including Castella, Crag View, and the Sugarloaf area near Lakehead.

Industrial and manufacturing uses may occur within or outside communities. For example, the water bottling plant that was developed originally by Dannon near the City of Mt. Shasta is actually located outside the city limits, although the plant has had agreements for limited services (e.g. wastewater) from the city. Also, the old mill site in McCloud has never been annexed into the district boundaries of the community services district.

As noted above, there are several small communities that are primarily residential in character, although they may also have one or two commercial uses such as small stores or gas stations, and/or community facilities such as a post office, school or firehouse. With different degrees of development and mixture of land use, communities such as Bartle, Big Bend, Montgomery Creek and Pollard Flat can be included in this category. There are also three Rancherias in the Big Bend/Montgomery Creek area that provide residential land use under the management of the Pit River Tribe, which has offices outside the region in Burney.

Residential land use, sometimes with home occupations, is also dispersed in much of the region in areas that may or may have particular place names. For example, homes in varying densities may be found in such areas as along Squaw Valley Road south of McCloud, along Gibson Road and Gilman Road from Interstate 5, and in other various locations in both Shasta and Siskiyou counties.

3.3.2.3 Forestry Land Uses

On the basis of land area, forest management and timber production by private companies or on National Forest lands is a predominant land use. Major timber companies with land holdings and/or resource management roles in the area include Sierra Pacific Industries, Hearst Forest, Roseburg Resources Company, Campbell Timberland Management, and Hancock National Resources Group.

As the mining industry grew in the mid 1800s, large amounts of lumber were required to build and maintain infrastructure for mining operations. Milled lumber was used for housing, water flumes, support structures, and other constructs, and fuel wood was necessary to keep steam-powered equipment running. This spurred the development of the timber industry in the 19th century, which has remained an integral part of regional land use. By the 1890s, mines and communities of various sizes dotted the region, primarily in its southern and northern ends. It was around this time that a number of lumber mills began operating in the watershed near the present day communities of Castella and Lamoine. This coincides with the advent of railway access between Redding and the Mount Shasta area via the Sacramento River canyon in 1887. The presence of the railroad allowed for easier transport of logs and wood products out of the area, thereby encouraging some lumber companies to expand their timber harvest operations further into the watershed. By 1896, the railroad had opened up large areas in the region to timber harvest. By the late 1870s, logging had become a major industry in the region. The timber industry has continued in varying degrees to be a significant land use and economic catalyst in the region. McCloud Flats, east of the town of McCloud, is an example of a particularly valuable timber production area in this region.

As an aside, the community of McCloud itself is noted as having originated as a lumber company town in 1897 with the formation of the McCloud River Lumber Company, which was supported by the development of the related McCloud River Railroad Company. The lumber company owned, developed, and maintained the town as company property. In 1963, U.S. Plywood Company (which soon thereafter merged with Champion International Corporation) purchased the mill, railroad and the town and began the process of dividing off and selling homes and other property. The McCloud Community Services District was formed to manage the utilities that were once operated by the McCloud River Lumber Company. In 1980, P&M Cedar Products, Inc. (which later became California Cedar Products) bought and reopened portions of the mill. This mill closed in 2002, bringing an end to industrial land use on that site in McCloud. The City of Mt. Shasta also once had large mills adjacent to the city.

Although the Shasta and the Trinity National Forests had been established as forest reserves in 1905, the Shasta-Trinity National Forest, as a unit, was not established until 1954. The years following World War II mark a turning point in the federal government’s management of forestlands in northwestern California. Increased demand for lumber and dwindling timber supplies on private lands made logging on federal lands more economically attractive. Technological advances such as lighter weight chainsaws and yarding systems and construction of an extensive network of forest roads made logging possible in areas that were once considered unprofitable or inaccessible.

The importance of, and continuing support for, the timber industry is acknowledged in the general plans of both Shasta County and Siskiyou County. The Shasta County Timberlands Element (Section 6.2) in the County's General Plan is a combination of planning requirements from the mandated land use, conservation, and open space general plan elements. The Timberlands Element notes:

> Land dedicated to commercial forest management provides not only building materials, energy for industrial processes, firewood, County revenue for roads and schools, and employment opportunities, but also wildlife habitat, recreational opportunities, aesthetic enjoyment, and watershed. Maintaining timber operations and preservation of valuable timberlands are important to the economic base and the natural resource values of Shasta County. The Timberlands Element, therefore, relates present and future uses of timberlands to the natural resource, economic, and community development plans for Shasta County. (Shasta County 2004)

Shasta County's General Plan recognizes timberland as one of the county's most valuable resources. The General Plan notes that, of the County's total area, 50.7% is dedicated to commercial forest uses. In 2002, 613,495 acres of non-federally-owned timberlands were designated in timber production zones (TPZs) pursuant to section 6.2.02 of California's Forest Taxation Reform Act of 1976. These lands represented nearly half of all County timberlands and approximately 87% of privately owned timberlands.

Much of the private timberland in the region is within a form of timber production zone pursuant to county zoning. In Shasta County, the Timber Production (TP) district is defined in the Chapter 17.08 of the Shasta County Zoning Code. The purpose of the TP zoning district is to preserve lands devoted to and used for growing and harvesting timber and to provide for uses compatible with the growing and harvesting of timber. The TP district is equivalent to the timberland production zone (TPZ) referred to in the California Timberland Productivity Act of 1982. Land within a TP district is subject to all conditions and restrictions applicable to a TPZ under the act.

In Siskiyou County, the general plan as well as on-going policy developed by the Board of Supervisors supports timber production as an important and significant land use and economic engine. A substantial amount of private timberland in the region is zoned TPZ to encourage the production of timber. The TPZ district focuses the uses of timberland to the production of timber products with compatible uses consistent with the requirements of the Forest Taxation Reform Act of 1976. The TPZ district is directed to those areas dedicated to the growing, conserving and production of timber in areas of sufficient size to be economically feasible. The TPZ district is designated to protect such areas from intrusion by incompatible uses.

Even with the economic and cultural importance of the timber industry in the USR, many communities, private landowners, non-profit organizations, and California Indian Tribes continue to express their concerns regarding commercial timber industry practices and their impact on cultural and environmental resources, wildlife habitat, water quality, species biodiversity, and old growth habitat and dependent species. The practice of clear-cutting is particular problematic for many individuals and organizations who see it as having a negative impact on watershed and cultural resources. This will be an ongoing challenge for the USR and participating stakeholders: to balance the environmental, aesthetic, and cultural needs of regional stakeholders and resources while maintaining this cornerstone economic industry within the region.

3.3.2.4 Recreation

Recreation is another important land use category in this region. Recreational activities encompass a variety of winter and summer sports, including mountaineering, skiing, hiking, camping, fishing, hunting, boating, golf, pleasure driving and other outdoor activities.

The area has a rich history of recreation and related tourism. The rivers, lakes, and mountainous terrain create venues and opportunities for outdoor recreation, featuring such activities as camping, hiking, fishing, hunting, and boating. The beauty of the area, mineral springs, and recreational opportunities in this area have been promoted by both private and public organizations since the late 19th century. In addition to the many publicly owned recreation facilities, there are many privately owned facilities including boat ramps, boat rentals, RV parks, and campgrounds.

In the 1880s, the developing railroad was extended north into what is now the Upper Sacramento IRWM region and this link soon created and supported a tourism industry by making the area more accessible to people from cities and faraway places. More and more residents from the San Francisco Bay Area and Sacramento would take the train to enjoy the sights and recreation opportunities of the Sacramento River canyon and surrounding region. To accommodate these travelers, innkeepers constructed larger and more elaborate resorts to replace the smaller, more rudimentary facilities. The Southern Pacific Railroad played an important role in promoting the resorts and the beauty of the area. The company published brochures and offered excursion rates throughout the area.

Water sports became increasingly popular in this area with the creation of Shasta Lake Reservoir, which continues to be one of the most visited recreation destinations in the area. (The Lake Shasta National Recreation Area is described below.) Today people enjoy boating, house-boating, and waterskiing, in addition to fishing and camping at the reservoir. In 1968, Lake Siskiyou reservoir was created by the construction of Box Canyon Dam. This reservoir is unique in that the primary purpose for which it was created was for recreation and fisheries enhancement, although flood protection and hydroelectric production are also important functions. Like Shasta, Lake Siskiyou continues to be a popular recreation destination. Boat launches, campsites, RV parks, hiking trails, and a golf course were all constructed in the immediate vicinity of Lake Siskiyou. Lake McCloud reservoir is another popular recreation resource for boating and fishing.

In addition to general fishing opportunities, the three rivers and some of the major creeks in the region are renowned as fly-fishing waters. The Upper Sacramento River has nearly 40 miles available for fishing and is noted for its Shasta Rainbow Trout. The Lower Pit River below Lake Britton runs for approximately 30 miles with boulder pocket water and pools, divided into three separate reaches by dams and powerhouses. The McCloud River is famous with anglers for its special resources. The Nature Conservancy operates a reserve with over two miles of trails accessing the Lower McCloud, but limits the number of anglers per day. The McCloud River opens to fishing on the last Saturday in April and remains open through November 15. The Lower McCloud is controlled by dam releases from McCloud Reservoir, which generally maintains consistent flows throughout the season.

Private land use along the McCloud River includes private clubs such as the McCloud River Club. This club was established as a private fishing club in 1904 and owns land along approximately seven miles of the river.

Interest in preserving the natural beauty and areas where outdoor recreation could be enjoyed has been an important objective in the region. In 1928, voters in California approved bond money to begin buying lands for the creation of state parks. The newly established State Parks Commission completed a statewide survey for potential state park lands, and Castle Crags was considered for acquisition. The Castle Crags Wilderness Association, created in 1930, raised money needed to purchase Castle Crags and assist the state in establishing the park. In 1933, the State Park Commission authorized the purchase of 925 acres to establish Castle Crags Wilderness State Park. The California State Parks agency manages Castle Crags State Park, which includes 4,350 acres of land. This land is protected from development and is managed for resource preservation and non-motorized outdoor recreation. The park features 76 campsites, 28 miles of hiking trails, as well as fishing and swimming areas.

Related to recreation and tourism is the unique geological attraction known as the Lake Shasta Caverns, which features a network of limestone caverns and calcite formations. The caverns are located on the east side of the McCloud arm of Shasta Lake Reservoir and are only accessible by boat and, for most visitors, by a bus ride up the steep access road. A small related office and commercial visitor center has been developed near the Holiday Harbor Marina on the west side of the lake crossing.

A concern that has been expressed by some owners of private forested land in the region is that recreationalists may not appreciate, and end up disregarding, the fact that much of the forest is not public land. Similarly, tribes in the region have stated a variety of challenges associated with aboriginal lands now managed by the federal government in the public interest; these lands often host a number of sites of great cultural and/or spiritual value, and these values are seldom shared and often not respected by those visitors not sharing those values. It is assumed by many people in the public that, since much of the forested land in this area is within a National Forest, all forested lands are available for public recreation use of all types. Such disregard and, at some times, outright trespass has resulted in misuse of and damage to private property and important cultural sites.

3.3.2.5 Mining

While mining played an important role in the development of the area and will be discussed in more detail below, it currently has a minimal presence as an active land use in the region. The history of mining will be briefly described below, in part because of the relation of historic mining to on-going water quality issues. The Upper Sacramento River Watershed Assessment, from which much of the following information was extracted, provides a good overview of the evolution of mining in the area.

Historically, mineral exploration and subsequent mining operations were conducted throughout the Upper Sacramento River watershed and the USR. Mining activities began upon the arrival of the Euro-American settlers during the California Gold Rush (circa 1850) and were typically small- to medium-scale operations. Gold mining activities in the watershed were sporadic and ended shortly after they began. Despite the small scale and short time period, the mining activity dislocated and destroyed indigenous people and tribes, as well as negatively affected the habitat and environment in watersheds where mining occurred. The environmental effects from these activities are persistent in terms of water quality and river geomorphology, and have negatively affected the capacity of USR watersheds to provide cool, clean water of amounts historically provided.

In general, the easily accessible gold was taken quickly from riverbeds and exposed bedrock. The gold that remained was more difficult and more costly to access and produce. The more ecologically destructive methods of mining — namely hydraulic mining — were stopped by a court case in 1884[4]. It is worth noting that a significant portion of the gold extracted from the watershed was later mined primarily from 1880 through 1920 as a byproduct of copper processing operations.

[4] Farmers sued a hydraulic mining operation in the landmark case of Edwards Woodruff v. North Bloomfield Mining and Gravel Company made its way to the United States District Court in San Francisco where Judge Lorenzo Sawyer decided in favor of the farmers in 1884, declaring that hydraulic mining was “a public and private nuisance” and enjoining its operation in areas tributary to navigable streams and rivers.

Mining activity went through boom and bust periods as the focus shifted to other minerals, including copper, chromite, zinc, silver, limestone, and asbestos, which were mined extensively during the turn of the century era (circa 1890 – 1920). The bulk of the mining activity in the watershed subsided by 1920. Activity picked up during the Great Depression and again during World War II, but the mining era that defined the area was over. In the late 1890s to 1920s, copper and chromite replaced gold as the primary minerals produced in the area. The copper extraction and processing occurred in and around the area that is now the Sacramento arm of Shasta Lake Reservoir. Most of the chromite mining took place on the west side of the Sacramento River between Pollard Flat and Castella.

Copper was discovered in the area in the 1850s, and was mined at Copper City (which is now under the reservoir) in 1862. At that time, the copper was found in small quantities by miners who were exploring underground for gold and silver. Where previously there had been several attempts to mine for gold and silver, a copper industry quickly developed. Instead of shipping the ore out of town for processing, the mining companies built and operated large copper smelting plants in the mountains. The copper ore also contained valuable deposits of gold and silver. Even though the amount of gold and silver was not large compared to the amount of copper, the profit from these metals was significant.

The first copper smelter in this area was built south of the IRWMP region in Keswick. The area in and adjacent to the region became home to numerous large smelters. The Iron Mountain District, which covered areas in and around the Sacramento arm of Shasta Lake Reservoir, eventually became the most important copper district in Shasta County. Copper production in the area was effectively ended by a court order in 1919 mandating the closure of smelting plants, which were producing toxic fumes detrimental to livestock and crops. Extensive damage to the watershed occurred as a direct result of these toxic fumes. The smelter fumes killed much of the vegetation around what is now Shasta Lake Reservoir, and the loss of vegetation caused large scale erosion and gullying, particularly in the western tributaries to Shasta Lake.

Another example of copper mining and smelting in the region was the Bully Hill Mine. The Bully Hill Copper Mining & Smelter Company built a huge smelter on the banks of Squaw Creek in 1901. In addition to processing ore from the Bully Hill Mine, copper ore from the Afterthought Mine at Ingot was transported by way of an 8.5-mile-long aerial tramway to the Bully Hill smelter. The mine and smelter closed in 1910 because of a decreasing copper supply and litigation over the poisonous fumes released from the chimney of the smelter.

Local mining of chromite was limited. The decline of the copper and chromite industries in California occurred shortly after World War I, but these minerals were mined sporadically during the Great Depression and World War II. Another mineral sometimes mined in conjunction with chromite was olivine. The Lucky Strike Mine near Castella produced both minerals.

Asbestos was another mineral that was discovered in large quantities throughout the watershed. Several asbestos claims were developed during the early 1900s near Castella and Mears Creek. The Trinity Asbestos Mining Company was responsible for planning the road between Castella and Carville, which is located to the east in the Trinity River watershed.

Although not a mineral, sand and gravel have been extracted from local rivers and their tributaries for many uses throughout the years. For example, the river rock from Sims was mined by the state for several years and was used to build Highway 99. The river rock from this source was sufficient to meet strict engineering properties required for freeway construction.

Existing mining activity in the watershed is limited to few permitted commercial operations and small-scale recreational gold mining. For example, the Spring Hill Mine, owned by Sousa Ready Mix, is located in the City of Mt. Shasta. This aggregate operation is located on private land in the Spring Hill area adjacent to Interstate 5. Stone and cinder are excavated and used for aggregate and concrete production. Another example is an underground gold mine that is permitted to operate on the Shasta-Trinity National Forest near Pollard Flat, adjacent to the Sacramento River. This tunnel claim is worked intermittently.

Despite the spotty nature of the mineral resources remaining in the watershed, mining claims cover the majority of the Sacramento River and its tributaries, including several claims above Lake Siskiyou. In recent years, speculators claimed much of the river and sold the claims to hobby miners via the Internet. These claims were intermittently worked with suction dredges in the summer months until a court order required CDFG to suspend all suction dredge-mining permits in 2009. The moratorium on instream dredge mining is in effect until CDFG completes environmental review of the permitting program and updates applicable regulations accordingly.

The historic Balakala, Keystone, and Mammoth Complex mines of the West Shasta Copper-Zinc Mining District and the Bully Hill Mine of the East Shasta Copper-Zinc Mining District are undergoing active remediation.

3.3.2.6 Agriculture

Agriculture and ranching occupy much of the valley and foothill areas of Siskiyou and Shasta counties; however, these activities are limited in this IRWMP region because of the steep mountainous terrain. Agricultural and grazing activities have been limited and scattered.

Various ranch and farming operations sprang up to support early mining activity. As gold mining diminished, many prospectors turned to small-scale ranching and timber operations. Nineteenth century land grants drew more settlers to the area. Between 1899 and 1920, several families and individuals homesteaded the valley that later was turned into the Iron Canyon reservoir.

For example, a ranch operation was recorded near Pollard Flat. Historic records note how the Baker Ranch, located west of Pollard Flat, used a ditch originally constructed for hydraulic mining to serve as irrigation for cattle. Cattle grazing was also prevalent at this time on the grasslands west of the present day City of Mt. Shasta. The conversion of mining ditches to agricultural ditches was a common transition in these areas. By the early 1900s, the area around Mount Shasta hosted many small farms and orchards. Apple, cherry, plum, and pear trees were planted throughout the Mount Shasta area as early as 1887. Historic records note that the young orchards and vegetable patches would thrive without much rain. This was because the area had plentiful water, including several wet and dry meadows. As a result, there was moisture enough in some areas to grow fruits and vegetables without irrigation. Areas with wet meadows were partially drained to irrigate dry meadow gardens and orchards. Produce, orchards, and animals were also raised south and west of the city and in the Dunsmuir area, as well as in the vicinity of McCloud.

While agricultural and ranching practices of the early settlers contributed to the current conditions of local watersheds, much of the land that was used for such purposes was later abandoned or developed for other purposes. Agricultural and ranching practices along the old Highway 99 soon gave way to forestlands or housing developments once Interstate 5 was constructed. Farms and ranches around Castella, Dunsmuir, and Mt. Shasta began to disappear in conjunction with the construction of Highway 99 and later Interstate 5. In the modern era, vehicular traffic grew, refrigeration and packaged foods became more prevalent, and most small family farms and garden plots that once served the area gave way to residential and other forms of development.

3.3.2.7 Power Development

The topography of the area lent itself to the development of hydroelectric power facilities beginning in the last decade of the nineteenth century. The first recorded use of hydroelectric power in Shasta County occurred at the Gladstone Mine in 1894. The Northern California Power Company, which had originally been established as the Keswick Electric Company to supply power to the Keswick Smelter, took over electrical operations of the Gladstone Mine sometime around 1900. PG&E purchased the water rights of the Mount Shasta Power Company in 1917 and in 1919 purchased the Northern California Power Company. The construction of the Pit River hydroelectric facilities spanned from 1921 to 1966 and has been said by PG&E to be the single largest construction project in PG&E's history. More discussion of PG&E's hydroelectric system involving the McCloud River and the Lower Pit River is included in Section 3.5, Water Supply and Demand.

The Hatchet Ridge Wind Project, developed by Renewable Energy Systems on private land owned by Sierra Pacific Industries and the Fruit Growers Supply Company, has been developed along the southeastern boundaries of this region approximately six miles east of Burney. The total project consists of 44 wind energy turbines on 77 acres with a total generating capacity of approximately 100 megawatts. While this project was and continues to be controversial among some stakeholder groups, it does represent part of the region's potential for renewable energy production[5].

The power production generated in the USR is largely hydropower. Thus, these activities contribute greatly towards California's AB 32 goals for renewable power generation. However, these developments came with an environmental price in terms of blocking anadromous fish passage, disrupting a natural sediment regime, and decimating indigenous populations and cultures through land acquisition and the destruction of food sources. While stakeholders remain interested in pursuing renewable power sources, the qualifications today of a power project likely will look much different than they did in the mid-1900s. These projects, when discussed, often include land already affected by development or infrastructure, or even power production in current water transmission lines. The planning of these projects will usually include all affected stakeholders rather than only those benefiting from the production of power.

Information on in-region interest in geothermal energy development can be found in this document in Section 7.4 Geothermal Waters.

3.3.2.8 Federal Land Management

Recognizing that a large portion of land in this IRWMP region is federal land managed by US Forest Services, the following section provides an overview of related land use and resource planning and management for federal lands. Most of this discussion is focused on lands managed by the Shasta-Trinity National Forest, but it is noted that the Modoc National Forest manages a small portion of the region in the vicinity of Medicine Lake.

The National Forest Management Act (NFMA) of 1976 was formulated to balance interests in providing a steady supply of harvestable timber with interests focused on other public uses, including recreation, and a stronger emphasis on conservation. Under the NFMA, the USFS must develop Land and Resource Management Plans, or LRMPs in cooperation with state, local, and federal agencies,

[5] Project concerns include: energy transport out of the region and lack of benefit to local communities; impact of this project on the viewshed; impact to migrating bird species (such as endangered Bald Eagles); the position of the installation along the Pacific Flyway, and; the potential negative impacts of low frequency emmittance on human health.

tribal governments, and the public to guide the management of forests within its jurisdiction. The plans divide each forest into management areas and outline how the forest will be managed over a 10- to 15-year period. NFMA prohibits harvesting under LRMPs where harvesting may cause extensive or irreparable harm to resources, biological diversity, or watersheds. The act also restricts the use of clear cutting (frequently referred to as "green-tree retention" in USFS terminology), and limits the volume of trees that can be removed to the number that can be harvested annually on a sustained-yield basis. LRMPs must also be consistent with the Multiple-Use Sustained-Yield Act and be compliant with the National Environmental Policy Act. The Shasta-Trinity National Forest completed its LRMP, or Forest Plan, in 1995.

Another fundamental federal land management document, the Northwest Forest Plan (NWFP), adopted in 1994, consists of a series of federal policies and guidelines governing land use on federal lands in the Pacific Northwest region of the United States. It covers areas ranging from northern California to western Washington and includes national forest lands in this IRWM region. The NWFP was originally drafted with the intent of protecting critical habitat for the northern spotted owl and the marbled murrelet, but the plan came to include much broader habitat protection goals.

The NWFP takes an ecosystem approach to forest management, while adhering to the requirements of applicable laws and regulations. The dual intent of management on affected federal lands is: (1) to maintain a sustainable supply of timber and other forest products that will help maintain the stability of local and regional economies on a predictable and long-term basis to meet the need for forest habitat and forest products; and (2) to maintain a healthy forest ecosystem with habitat that will support populations of native species (particularly those associated with late-successional and old-growth forests), including protection for riparian areas and waters.

The Shasta-Trinity National Forest Land and Resource Management Plan (Forest Plan) was prepared to guide the management of the Shasta and Trinity National Forests. The primary goals of that plan are to integrate a mix of management activities that allow use and protection of forest resources, meet the needs of guiding legislation, and address local, regional, and national issues. The Forest Plan provides four general levels of direction: (1) general Forest-wide management direction; (2) Land allocations and Standards and Guidelines from the Record of Decision (which adopted the plan); (3) direction specific to each management prescription (or type of land allocation); and (4) specific (or supplemental) direction for each management area within the Forests. The following table provides a generalized description of basic land use designations pursuant to the Land and Resource Management Plan.

Table 3.1: National Forest Land Use Designations

Land Use Designation	Description of Land Use
Matrix	Mixed use. Most timber harvest would occur on these lands. Standards and guidelines are in place to ensure appropriate conservation of ecosystems as well as provide habitat for rare and lesser-known species.
Late-Successional Reserves	Established to protect and enhance conditions of late-successional and old growth forest ecosystems and to ensure the support of related species, including the northern spotted owl.
Administratively Withdrawn Areas	Recreation and visual areas, backcountry, and other areas where management emphasis precludes scheduled timber harvesting.
Riparian Reserves	Provide an area along streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis.
Congressionally Withdrawn	Wilderness areas where management emphasis is on enhancing the

Table 3.1: National Forest Land Use Designations	
Land Use Designation	**Description of Land Use**
	natural conditions for wildlife habitat and non-motorized recreation. Timber harvest is precluded.

The implementation process for the Forest Plan provides the framework for translating management direction into actual projects or activities that will be consistent with the environmental and administrative objectives of the plan. A responsibility of the Forest Supervisor is to ensure that, subject to valid existing rights, all outstanding and future permits, contracts, cooperative agreements, and other instruments for occupancy and use of affected lands will conform to the plan. The implementation strategy of the plan establishes the framework for translating management direction into goals, objectives, and standards for on-the-ground projects. The Forest Plan is implemented on each of the various Ranger Districts in the forest. Projects will continue to be planned and evaluated through an interdisciplinary process. District and STNF staff conduct environmental analyses for projects and document them in appropriate environmental documents that are tiered to the Forest Plan.

The Whiskeytown-Shasta Trinity National Recreation Area (NRA) was established in conjunction with the development of Shasta Lake Reservoir. The U.S. Forest Service manages the NRA. Land use designations are consistent with the Forest Plan for the Shasta Unit. Riparian Reserves, the largest land use designation in the NRA, are located in areas along rivers, streams, lakes, and wetlands, including the area inundated by Shasta Lake Reservoir. Approximately 25% of the land in the NRA is designated Matrix and Adaptive Management; these areas generally emphasize recreation and visual quality. Late Successional Reserves (LSR) and Administratively Withdrawn Areas each account for 20% of the land use designations in the NRA. LSRs are characterized by large blocks of land reserved for northern spotted owl and other species that are dependent on late successional old-growth forest. Lands with this designation are scattered throughout the NRA; these lands have a natural appearance, with much of the land area covered with late successional forest vegetation. The Shasta Unit of the NRA is not managed for timber harvest.

Recreational use in the NRA is extensive and is estimated to exceed two million visitor days annually. Water-oriented activities, such as boating, fishing, waterskiing, and house-boating, are the main attractions. Currently operating marinas include Antlers, Sugarloaf, Shasta, Lakeview, Holiday Harbor, Packers Bay, Bridge Bay, Silverthorn, Jones Valley, and Digger Bay. Other recreational land uses include hiking, camping, picnicking, and off-highway vehicle activities.

It is noted that the Bureau of Land Management (BLM) manages a small portion of the region near Shasta Lake Reservoir west of Backbone Ridge. These lands, located in the far southwest corner of the region, consist of several sections (i.e. 640-acre tracts) located in a patchwork of private, National Forest, and BLM ownership. This area is managed in accordance with the Interlakes Special Recreation Management Area. Land in this area is managed for multiple uses including motorized recreation, timber harvest, wildlife habitat, scenic viewshed, and mineral development.

Each of these federal agencies has a mandate to work in cooperation for the interest of the local indigenous tribes, however, when recreational development was first pursued, local indigenous tribes were not part of the planning or implementation process and there were no laws at this time for the protection of historic and prehistoric sites. Many of the developed recreation locations today — campgrounds, boat launches, hiking opportunities, and more — are located on sacred sites to one or more of the tribes indigenous to the region. These tribes still have difficulty accessing these sites for traditional uses and, because of the status of several of the tribes as federal unrecognized, the federal entities responsible for land management in and around these areas cannot provide the access and protection to the tribes in holding their traditional religious observances.

Federal Agencies and the Indian Trust Responsibility
Federal agencies have a unique and particular responsibility to federally recognized tribes when it comes to federally managed land and other natural resources. "There is a government-to-government relationship between the United States and each Indian tribe; the United States has a legal trust responsibility to each tribal government that includes the protection of the sovereignty of each tribal government (25 U.S.C. Sec. 3601)". This charge includes a responsibility to make decision based on tribes' best interests, encouraging self-government and economic opportunity. This responsibility has been interpreted as a fiduciary duty, or relationship, which imposes the highest degree of responsibility the law recognizes, similar to the relationship between a guardian and a ward. Agency officials must advocate for the tribe, act in good faith towards the tribe, and seek to make tribal resources under the agency's control productive and profitable. This includes a requirement to consult with affected tribes with regard to the development and/or best uses of resources.

3.4 Demographic, Economic, Social and Cultural Characteristics

3.4.1 Demographic and Economic Characteristics
The population of the USR is estimated at approximately 12,000. Native American Tribes active in the USR maintain that the area formerly sustained a much larger population without significant inputs of energy or materials from outside the region.

Many communities have actually lost population over the last several decades due to economic factors such as loss of employment opportunities and other demographic trends. Following are population numbers for various communities within the region, in order of size, recognizing that part of the population of the region is dispersed and not affixed to any particular community. Also listed is information about the estimated median household incomes in these communities. It will be noted for comparison that the California statewide median household income (MHI) in the term 2007-2011 was $61,632. Based on the formula for disadvantaged communities (i.e. a community with an annual median household income that is less than 80% of the statewide annual median household income), the relative threshold for recognition as a disadvantaged community (DAC) would be $48,706. A severely disadvantaged Community is identified as having 60% of the state's MHI, or about $36,979.

City of Mt. Shasta:
The City of Mt. Shasta had a population of 3,416 as recorded in the 2010 census. The City's population dropped since 2000 by about 6.3%. Estimated MHI for the City was $38,504, identifying the City of Mt. Shasta as a disadvantaged community.

City of Dunsmuir:
The City of Dunsmuir hosted a population of 1,782 in 2010, dropping since 2000 by about 14.2%. The estimated median household income in 2010 was $35,283, making the City of Dunsmuir a disadvantaged community.

McCloud:
The population of the unincorporated area of McCloud in 2010 was 1,210, lowering since 2000 by about 18.0%. The estimated 2010 median household income was $28,750, identifying the community

as severely disadvantaged.

Lakehead/Lakeshore:
While not in the DWR DAC mapping tool, information for Lakehead and Lakeshore was gathered from the ACS data available on the census information page. Population for the area in 2007 was 723, with an estimated median household income in 2009 of $64,429. This area is not economically disadvantaged per the information gathered here.

Castella:
While not in the DWR DAC mapping tool, information for the community of Castella was gathered from the ACS data available on the census information page. The estimated population of the Castella area (based on zip code 96017) in 2010 was 322, growing by 45% since 2000. The estimated median household income in Castella for 2010 was $36,955, making Castella a severely disadvantaged community.

Montgomery Creek:
The population identified for the Montgomery Creek Census Designated Area in 2010 was 75, with a growth of 69.8% since 2000. The estimated MHI was $11,346, making Montgomery Creek a severely disadvantaged area.

Big Bend:
The population of the Big Bend census-designated-place in 2010 was 91, with 55 households. Population has gone down since 2000 by about 31.5%. The estimated median household income in 2010 was $38,125, identifying Big Bend as a disadvantaged community.

Indigenous Populations:
Pit River Tribe in this IRWM region manages three Rancherias in Shasta County. These consist of Big Bend Rancheria (estimated population of 10); the Montgomery Creek Rancheria (estimated population of 15), and the Roaring Creek Rancheria (estimated population of 14).

The Winnemem Wintu number 127. Thirty-seven of their together with their Chief reside at the traditional Winnemem village site of Tuimyali near Shasta Lake Reservoir.

Members of the Modoc Nation live primarily in the northeastern portion of the USR.

The Shasta Tribe is made up of the Shasta Nation and the Shasta Indian Nation. Members of the Shasta Nation currently live throughout the region, though not specifically in the USR. Members of the Shasta Indian Nation are scattered throughout northern California and southern Oregon.

The areas that comprise the Upper Sac IRWMP region are fairly small portions of the two counties in which they are located — Shasta County and Siskiyou County. Also, since much of the population is very rural, and the communities in the region are very small, county-wide numbers are not very applicable to the actual character of this region. Nevertheless, some comments on county statistics are appropriate.

Shasta County:
According to the 2010 census, the total Shasta county population was 177,223, which was a growth of 8.56% since 2000. As of 2010, the median household income in the county was $43,944, which had grown by 27.99% since 2000.

Siskiyou County:

The population of Siskiyou County, according to the census, in 2010 was 44,900, up 1.4% from the 2000 population of 44,301. The estimate for 2012 was 44,639. Siskiyou County median household income was $36,981 in 2010, which had grown by 25.23% since 2000.

3.4.2 Other Economic Characteristics

According to the California Employment Development Department, at the end of December 2012, the unemployment rate in Siskiyou County was 15.9% and 12.0% in Shasta County, compared to the state rate of 9.7% (California EDD 2013).

The communities in the areas of the Upper Sac, McCloud and Lower Pit have been economically depressed since the downturn in the forest products industry in Northern California in the 1980s. One of the biggest economic issues affecting communities in this region and their ability to maintain and upgrade water-related infrastructure has to do with the economy of scale. The communities are small in population and tax base. For example, the City of Dunsmuir, an incorporated city with a fully-functioning water and wastewater system, has a population of less than 1,650. Nevertheless, the city needs to finance maintenance of its aging infrastructure and upgrade systems as necessary. This includes making improvements to comply with regulations and requirements such as those applicable to operating the wastewater treatment plant to ensure protection of water quality in the Upper Sacramento River.

Also relevant in these small communities, which have such low median household incomes, is the challenge and equity of levying necessary monthly household fees to finance operation of and fund improvements to local water and wastewater systems.

As noted above, many communities in the region are experiencing population losses. Again, using the City of Dunsmuir as an example, between 1990 and 2000 the city experienced a 9.7% decline in population. For comparison, during this same time period, Siskiyou County experienced a 1.8% increase in population. The decline in the city's population has primarily been the result of the loss of timber and railroad-related jobs and the relocation of many family wage earners who were employed in those industries. There has also been an increase in the number of dwellings that are being used primarily as seasonal homes rather than year-round residences. Statistics for McCloud and Big Bend also indicate population losses in those communities.

The City of Mt. Shasta has also experienced relatively slow residential growth within the city limits in recent years. The average annual growth rate of the population within the city since 1995 has been less than 1%. Residential growth in the area has predominately taken place in the unincorporated area outside the Mt. Shasta city limits. The 1993 Mt. Shasta General Plan projected that, between 1990 to 2010, the population of the planning area would increase to a population of between 6,500 and 8,500 persons, depending on whether the Plan's higher growth rate of 2.25% per year or the 1.5% per year historic growth pattern took place. The 1993 General Plan intended to provide land area and densities to accommodate a population of 10,201 persons in the planning area.

3.4.3 Disadvantaged Communities

According to DWR, as indicated in its Disadvantaged Communities Mapping Tool (DWR 2013), the following areas in the USR (listed with their MHI and population as quoted by DWR) are specifically recognized as disadvantaged communities:

Big Bend *(MHI: $38,125; Population: 91)*
City of Dunsmuir *(MHI: $35,283; Population: 1,782)*
City of Mt. Shasta *(MHI: $38,504; Population: 3,416)*

McCloud *(MHI: $28,750; Population: 1,210)*
Montgomery Creek *(MHI: $11,346; Population: 75)*

For the unincorporated communities above, the designation is applicable to the census designated place, (CDP), in which the communities are located. As described on the DWR website:

> The maps and GIS files are derived from the US Census Bureau's American Community Survey (ACS) and are compiled for the 5-year period 2006–2010. DWR has included, in the maps, a calculated field entitled DAC (y/n), which indicates the DAC status for different census geographies (Place, Tract, and Block Group). DAC status is determined based on the DAC definition provided in DWR's Proposition 84 and 1E IRWM Guidelines, dated August 2010. A MHI of less than $48,706 is the DAC threshold (80% of the Statewide MHI).

As noted above, a disadvantaged community (DAC) is defined as a community with an annual median household income that is less than 80% of the statewide annual median household income. Based on the formula for disadvantaged communities, if the statewide annual median household income is accepted to be $61,632 (based on 2011), the relative threshold for recognition as a disadvantaged community would be $48,706. Reviewing the numbers given above for the various communities in the region, it is evident that virtually all of the communities with the exception of the Lakehead area have median household incomes below the DAC threshold. Some communities such as Dunsmuir, Big Bend and Montgomery Creek, may even be considered to be severely disadvantaged (i.e. median household income less than 60% of statewide median).

The majority of the population of the region resides in Siskiyou County. According to the 2010 Census, Siskiyou County had a median household income of $36,981. Compared to a DAC threshold of $48,706, the county median income is below the qualification for Disadvantaged Community (DAC) status.

As described in the regional acceptance process proposal for recognition of the Upper Sac IRWMP region, it is not much of a stretch to say that the entire proposed region is a disadvantaged community. The majority of the communities in the region have median incomes below 80% of the state average, which places them in the Targeted Income Group for most federal grant programs. For this reason, any groups that represent general community interests can be said to be representing disadvantaged communities as well.

In Shasta County, based on 2010 census data, 18.5% of the county population and 14.35% of families were rated as being in poverty. This can be compared to the state rate of 13.71% of the population in California (10.21% of families), and the federal rate of 13.82% of the population (10.08% of families). However, the poverty rates for Shasta County as a whole are not representative of the very rural population in the USR. For example, for the community of Big Bend, 46.15% of the population and 36.84% of families were rated in poverty. For Montgomery Creek, 37.33% of the population and 53.33% of families were rated as in poverty.

In Siskiyou County, the 2010 county-wide poverty rates are reported to be 17.13% of the population and 12.99% of families. The poverty rates within the IRWM region vary. The poverty rate in Dunsmuir is reported to be 22.5% of the population and 12.87% of families, McCloud is 21.82% of the population and 18.07% of families, and Mt. Shasta is 9.91% of the population and 8.75% of families.

Indigenous tribes throughout the USR, while not separately identified as DACs through the census process, could be considered disadvantaged because of the history they have survived as a people.

Pre-contact population numbered in the tens of thousands. After European contact, Native Americans were prohibited from owning or leasing land, selling timber, mining, or pursuing other income-generating activities. By 1853, Indians were starving and begging for food. Congress appointed Edward Beale as the first Indian superintendent for California (Hurtado 1988). The administrations of Beale and his successor, Col. Thomas J. Henley, lasted over a decade and were rife with corruption and incompetency. Cattle for starving Indians wound up with subagents; reservation boundaries were changed, land was lost to squatters; vouchers were irregular; and the books were incomplete (Hoveman 2002; Sanchez 2003). It was not until the 1870s and 1880s that the efforts of humanitarians advocating reform of the living conditions and treatment of Indians began to make a difference.

The late 1800s brought the first allotments to local tribes. Given the poor condition of the land, shortage of water, and lack of start-up farm equipment, animals, or seed, most tribes could not make a subsistence living from agriculture on the allotments. Because so much land had already been patented to the railroads, the allotments were discontinuous, which fragmented the tribes and made it difficult to maintain a tribal relationship with the BIA agents. Agent efforts to secure replacement land were often half-hearted, underfunded, or blocked by private owners. Agents frequently supported the efforts of interested buyers to purchase allotment land because they believed the land was useless to the Indians. In 1906 C. E. Kelsey, a special agent for Indian Affairs, reported that 2,058 allotments had been made in California with 261 canceled, leaving 1,797 outstanding. The majority of these outstanding allotments were in Lassen, Modoc, Plumas, Shasta, and Siskiyou counties (Robinson 1948; Theodoratus Cultural Research 1981).

This history indicates the disadvantaged and disenfranchised status of the tribes from a societal and cultural perspective (as well as with regard to economic status and condition). While not identified as disadvantaged through the census calculations used by the state for formal identification and calculation, it is important for the USR RWMG members and all participating State and federal agencies to remember the difficult history each and every one of these tribes has experienced as part of the members' relatively recent past. The continued existence of these tribes is a testament to the strength of their cultures, the cohesion of their families, and their belief in traditions. Participation in any resource management process is a survival technique that is undertaken with few resources for some of the tribes involved in this IRWM planning effort.

3.4.4 Social and Cultural Values

Regional cultural values must be approached cautiously, as generalizations are difficult to apply in a region where background and values vary widely. Thus, following this introduction are sections relating to the variety of cultural and societal values held by groups living in and passing through the region. These qualities make the USR a challenging region to consider in this regard, but they also add to the attraction of the region by a diverse group of people, and the real investment in time, energy, money, and emotion by a vast number of individuals and groups.

Landscape

A fairly common regional personal and social value is appreciation, if not profound affection, for the scenic landscape and abundance of environmental resources in this area. Whether local residents were drawn to this area because of the beauty of the forested, mountainous region (with Mount Shasta as a premier icon) and the abundance of natural resources, or they simply enjoy those resources as incidental amenities in their lives, it is a common personal and social value to have a strong sense of admiration for the scenic quality of the area and the wealth of natural resources.

The indigenous people living in the Upper Sacramento, McCloud, and Lower Pit watersheds value some portions of the landscape so greatly that ancestral tradition forbids entry. This can be seen in the designation of Mt. Shasta, above treeline, as a Cosmological District by the National Registry of Historic Places (NRHP). Likewise, a number of sites throughout the USR have been identified as sacred to single or multiple tribes active in the region. The designation of a place, piece of infrastructure, or landscape by the NRHP will usually bring with it a variety of use protocols and rules. Sites identified as Traditional Cultural Properties cannot, by law, be identified to the public but must still be considered in any land use planning. Other sites may not have been identified as "National Register eligible", but when considered in any federal undertaking will need to be evaluated as eligible. It is important for stakeholders in the region to be aware of these designations when planning projects and/or programs by consulting the Native American Heritage Commission (NAHC) and tribes who may be impacted. Table 3.2, below, shows the variety of NRHP designations found in the USR.

Table 3.2: A list of the NRHP designations and locations within the USR.

Place	Designation	Reason
Mt. Shasta above treeline	Cosmological District	Historic indigenous values and the clarity of the sky
Medicine Lake Highlands	Traditional Cultural District	Indigenous cultural values
Dunsmuir Historic Commercial District	Historic District	Historic events and architecture
McCloud Historic District	Historic District	Historic events and architecture

Small Towns and Rural Character

Local values in many parts of the USR reflect appreciation for the rural or small town character of communities in this region. There is much value for and, frequently, conviction to protect what is valued as the local quality of life. For example, the mission statement included in the Mt. Shasta Community Action Plan reflects this concern. That statement reads, "The mission of the Mt. Shasta Community Action Plan is to maintain the character and resources of our 'small town' community while striking an appropriate balance between economic development and preservation of our quality of life." (City of Mt. Shasta 2002) This statement acknowledges the value that, while community development and economic growth is understood to be necessary for a variety of important social reasons, local communities are also aware that growth needs to be managed carefully to avoid or minimize disturbance to existing resources and community characteristics that are highly valued.

Natural Resources

It is a common social value that communities in the region are proud of their relationship with the environment and resources. In the City of Dunsmuir, there is the motto, 'Home of the Best Water on Earth'. The Dunsmuir Chamber of Commerce proudly states in its website that visitors can walk from their hotel to one of the best sport fishing streams in the country. The City of Mt. Shasta is also proud to report on its website that the city has won several state and national awards for its pure, unfiltered and untreated water.

Certainly, a large number of residents would agree that natural resources in this area are major elements for their personal and social recreation. Local residents and families value the abundance and quality of recreation opportunities and the convenient access to such resources provided by living in such an area. Some people would also add that natural resources are an important factor in their spiritual values. A variety of social groups and non-profit organizations have been formed to address concerns regarding various aspects of the natural environment and particular environmental issues. These groups include organizations that advocate the development of hiking and multi-use trails; protection and enhancement of fishing-related resources and wildlife habitat; support for backcountry skiing and other snow sports; and support for a variety of other environmental and recreational resources and activities. In some cases, certain groups have and will actively challenge development proposals (e.g. large water bottling facilities and geothermal development) that they feel will jeopardize valued resources, and some organizations will engage in litigation when they feel it is necessary.

For many people and businesses in the region, values relating to natural resources are intensively focused on concern for the success and viability of their businesses, employment opportunities, and related economic factors. Many of the local communities first evolved due to resource-related industries such as mining and timber extraction, production, and processing. Even though there are no longer any major mills located within the region itself, timber management, production and transporting of material to mills and biomass generators in outside communities (such as Anderson, Burney, and Weed) are still significant components of the local economy and job market. Forest material is produced from both large holdings of private land as well as from National Forest land. The community of McCloud, once an actual "company town" developed and owned by a lumber corporation, still largely reflects the heritage of its origin as a mill town, as do other communities in the region.

It can be said that support for resource-related businesses and timber production is still a strong social value in this region. Both Shasta County and Siskiyou County continue to strongly support the timber industry and the goals of private companies to manage their lands as productive business operations. These counties and other local governments recognize the important contributions that private industry provides to local economies including the creation of jobs. With this recognition are the values that local governments continue to embrace for private property rights and resistance to what is regarded as "unnecessary" regulatory constraints to land management practices on timberland, agricultural land, and other private lands.

Indigenous cultures historically active in the region hold the land and the resources as sacred to their people and to all life. These people report a deep sense of loss for the many dramatic changes that have been forced upon indigenous cultures and their homelands in this region over time. These losses and historic struggles have not dampened the interest with which local tribes pursue justice for the restoration and protection of natural and cultural resources, however. Some policy and planning issues on which some local tribes are active include:

- Government-to-government consultation with BLM, Shasta-Trinity, and Modoc National Forests, in addition to other entities involved in implementing regional projects that have the potential to impact cultural and environmental resources;
- Efforts to protect sacred tribal sites from inundation that would result from proposals to raise Shasta Dam;
- Promoting greater understanding and respect for the Medicine Lake area as a cultural area, and protection of this site from impacts related to land uses such as geothermal development;
- The desire for more attention to be given to indigenous resource management principles and practices that are sometimes referred to as traditional ecological or environmental knowledge (e.g., indigenous uses of fire as a land management tool, understanding of forest composition of native plants and biodiversity of species, etc.);
- Protection and restoration of sacred sites and traditional cultural properties that are publicized tourist attractions;
- Safeguarding traditional plant gathering areas from destruction and contamination, including efforts to restore what has been lost; and

- Support for the reintroduction of salmon — both as a food source and as a highly valued cultural element — to the McCloud River and other streams in the region as existed prior to the installation of Shasta Dam.

In addition to these policy issues, tribes are also active in advocating for the protection of source water areas and tribal water rights.

Tourism

Tourism is also a major and growing element of the economy in the region and influences social perspectives and values. The promotion of tourism is closely tied to values concerning conservation of resources, including protection of scenic resources, as well as proposals to improve facilities that support tourism. An example is the promotion of the Volcanic Legacy Scenic Byway along State Highway 89. Tourists share an appreciation and enjoyment of many of the same resources that local residents enjoy for family and social recreation. This includes natural resources such as trout streams, mountain lakes, and hiking areas as well as developed facilities such as local reservoirs, the Mt. Shasta Ski Park, and golf courses. Consequently, there are many common values shared by recreation and tourism interests concerning protection and conservation of related resources. However, it should be noted that, at times, there are also conflicting values when tribes and local residents become concerned that resources may be over-developed and over-used by development proposals to promote and accommodate tourism.

Cultural and spiritual tourism is relatively popular within the USR, even, or perhaps especially, by those living within the region. Ancestral sites of the indigenous people of the region are especially popular locations due to the pre-history values and/or exceptional natural beauty. Generally, indigenous peoples have learned to be guarded about the location of sacred sites because of the appeal those sites have to a variety of non-native groups. The Winnemum Wintu and the Pit River Tribes are no exception, but when Panther Meadows on Mt. Shasta was identified as a potential ski resort, the Wintu became active in the effort to stop it due to its sacred status within the tribe. This $21 million project was to accommodate 5,000 skiers a day with seven lifts and three lodges (Beggs, et al. 2003). The US Forest Service completed the EIS in 1990 and found it to be in compliance with the multiple-use classification of the mountain, and approved the project. Opposition to the ski resort united diverse groups such as Save Mount Shasta, the Native Coalition for Cultural Restoration of Mount Shasta, two nonprofit Native American tribes and various other organizations. Using the 1966 National Historic Preservation Act, they succeeded in getting the US Forest Service to reverse the decision in 1998 (Huntsinger, et al. 2000). The Pit River Tribe continues to participate in quarterly government-to-government consultations with Shasta Trinity USFS over recreational impacts and management activities occurring in Panther Meadows.

Cultural conflict concerning Panther Meadows has continued in various forms, even after the US Forest Service withdrew the permit for the ski resort. Panther Meadows is an alpine wildflower meadow that attracts environmentalists, hikers, rock climbers, and New Age spiritual pilgrims. Heavy use in the area has caused damage to the meadow and spring in the past. To provide visual and physical separation from the path and to protect the spring, the US Forest Service built a U-shaped rock wall that now surrounds it on three sides and they continue to improve signage and trails.

3.4.5 Native American Tribes: Approach to Resource Management and Water Issues

Four ethnographic essays have been prepared and incorporated into the USR IRWMP as part of the Region Description. The intention of this work is to help identify and summarize issues and concerns relating to water resources from the perspectives of the indigenous peoples of this region. The following ethnographic essays, listed in alphabetical order, address the perspectives of the Modoc Nation, the Pit River Tribe, the Shasta indigenous culture (with reference to both the Shasta Nation and the Shasta Indian Nation), and the Winnemem Wintu Tribe.

Two ethnographers were obtained by the River Exchange to author these sections in cooperation with the various tribes that have participated in the USR planning program. Shelly Davis-King (Davis-King & Associates) prepared the two sections that feature the cultural perspectives of the Winnemem Wintu Tribe and the Modoc Nation. Shelly Tiley prepared the sections that feature the cultural perspectives of the Pit River Tribe and the Shasta Tribe. These sections are specific to the tribes identified, and were not opened for comments or editorial changes from other stakeholders.

3.4.5.1 The Modoc Nation

Background and Introduction

The Modoc people (Mowatocknie Maklaksûm), speakers of a Penutian family language, have their geographical heritage in northern California and southern Oregon (e.g. James 2008; Scruggs 2013; Stern 1998), with cultural affinities to California, the Great Basin, and the Plateau. Their prehistoric territory was in the drainages and lakes of Tule Lake and the Lower Klamath River, Little or Lower Klamath Lake, Clear Lake, the Lost River in Oregon and California, and over to the shores of Goose Lake (Curtin 1912; Stern 1998). Much of Modoc country in California is part of the volcanic plateau, some which is held in national reserve as Lava Beds National Monument. The Lost River watershed drains the northern part of the plateau flowing into Tule Lake, while most of the more southerly watershed flows into Big Sage and other reservoirs. The southern territory extended to the north and northeast slopes of Mount Shasta and included Medicine Lake. The portion of Modoc country applicable to the IRWMP is in southern Modoc territory, in the area of Medicine Lake and the Medicine Lake Highlands. This area includes the Medicine Lake volcano and various peaks of the Cascade Range that receive massive snowpack each year. Much of the snow then melts, becoming subsurface recharge that ultimately feeds the Pit River. This area is considered part of sacred Modoc territory, and indeed, the earliest ethnographic and historical work with the Modoc acknowledges that the Modoc lands are sacred and the water, especially, was protected and revered (e.g. Curtin 1912; Stern 1998). As Modoc author Cheewa James (2008:19) has written, "The Modocs were water people, much of their livelihood and culture stemming from waterways."

Kumush created the Modoc world by first making the lakes, rivers, and mountains; naming them; and the first people who became the animals, plants, fish, stones, earthquakes, and all things that are known followed. At about this time the Modoc people were also created and given their territory as noted above — land given by the creator was then considered sacred. Curtin (1912:vi) noted, "…into this country that Kumush gave to the Modocs came white settlers,…" and by 1863 a military fort was established. The Modoc were restricted from practicing their traditional subsistence activities, and according to stories shared, were forced to sign a treaty with the federal government before they were given food and other supplies. The treaty outlined where the 2000 Modoc people could live, what they could do, and provided that they should get some land. Insufficient supplies, a lack of treaty ratification for five years, and other factors meant that by autumn 1872, the Modoc were starving and without access to their traditional subsistence areas. In November of that year, federal troops moved in and fired their weapons on women and children — an act to which the Modocs responded by killing a group of settlers. In April and May 1873, skirmishes between the soldiers and the Modocs continued and the now-famous story of Keintpoos (Captain Jack) and his stronghold occurred. Still the soldiers ultimately prevailed, and the surviving Modoc Tribe was split in two. One group became the federally-recognized Modoc Tribe of Oklahoma, and includes descendants of Captain Jack's band of Modoc, while the other Modocs were sent to live with their traditional enemies, the Klamath.

Today, there is a Modoc presence in the federally-recognized Klamath Indian Tribes (formerly known as the Klamath, Modoc, and Yahooskin Band of Snakes), but Modoc interests are not addressed at the tribal level. Consequently, the Modoc have formed a new governmental group, The Modoc Nation, which ultimately will seek recognition as a California tribe. The Modoc Nation has participated in the IRWMP process specifically because of their concern about the Medicine Lake Highlands.

Ethnohistoric Modoc Water-Related Information

Chief Greywolf (Jeff Kelley) of The Modoc Nation provided much of the background ethnographic information or directed the author to various publications with which he felt his people would agree. Similarly, publications that have presented a viewpoint not shared by The Modoc Nation have not been included in the following discussion (e.g. publications by Joaquin Miller). Chief Greywolf (in an email of 10 June 2013) said that for the sake of this specific IRWMP, the key factor to understand

> "is that the Medicine Lake Highlands are very important to the Modoc... who have been occupying it since time immemorial and can prove the last 15,000 years. That we had a permanent encampment there and hunted, fished, gathered food, herbs, obsidian, and more. That we had Crisis Quest there, used the water for healing, bathing & cleansing ceremonies. That our Creator made this area specifically for our people, that there was no mistake that our people were put here to protect and preserve the lands, animals, water! That even though our numbers are few, we are still strong and will be victorious as Kumush our Creator had stated."

One of the principal chroniclers for the Modoc, Verne Ray (1963), wrote that there were three major divisions of the Modoc historically. Each of these divisions was based on the winter village structure whereby the people would gather in large communal villages after the harvest season. The Gumbatwas (literally "people of the west") had some eight winter villages in an area at the time that he wrote, west of a line that included much of Tule Lake, Lower Klamath Lake, and the western part of Lost River Valley; the pasganwa·s (river people) or Lower Lost River division, had numerous winter villages on Lost River near the mouth of Tule Lake; and the Kokiwas (ġoġewa·s) or Eastern division, had at least 12 winter villages on the Lower Lost Lake drainages into parts of Tule and Clear lakes, extending as far as Goose Lake. There was a summer village in the Kokiwas area on Medicine Lake, near Mt. Hoffman. The village, called Lani'shwi, was a base camp for obsidian quarrying at Glass Mountain, and a hunting base camp (Ray 1963:208).

Like most California native groups, the life of the Modoc was subject to a seasonal round, based on their subsistence needs. Their traditional area, largely in the Klamath Basin, included thousands of acres of marshland, areas of volcanic rocks, and to the east, areas mimicking Great Basin environments. Seasonal fish runs, especially suckers (e.g. the Lost River Sucker [Deltistes luxatus] or the Modoc Sucker [Catostomus microps]), seasonal water plants, such as water lily seeds (Nuphar polysepala), and waterfowl were all important for food, medicine, or utilitarian objects, but hunting game and seed gathering were equally significant. Stern (1998) mentioned that the Modoc would submerge their tule boats to preserve and prevent them from rotting, and in March would take them to Lost River to fish for suckers. When the sucker population was waning, later in the spring, the women, especially, would go in search of biscuitroot (Lomatium canbyi; Coville 1897), and then for ipos (Carum oregonum), while others searched for waterfowl eggs (Stern 1998). In early summer rich blue flowers in the meadows would signal emerging camas (Camassia quamash), harvested and prized for their bulbs. Ray (1963) documented that the Modoc also harvested white-blooming meadow "death camas" (Toxicoscordion venenosum). In July, the aforementioned water lilies (wokas) were ready to harvest (Coville 1904). Throughout this part of the year, the dependence of the Modoc on clean, fresh water was crucial, and this is part of the reason that water remains so important today. While hunting, berry gathering, and nut harvesting remained a subsistence focus through the rest of summer, a second run of suckers brought some Modoc back to Lost River while others went to the Mount Shasta or Tule Lake uplands to gather huckleberries and hunt. Hunting involved purification, usually via sweat lodges, and then rinsing in spiritual lakes or streams to rid the hunter of human scent. In the autumn, people returned to their winter villages to reassemble the large houses, build storage pits for food, gather firewood to use against the upcoming cold wind and snow, repair tools, and hunt pronghorn (Antilocapra americana; Barrett 1910). The activities listed here have varied some in the prehistoric past, but are relatively the same as noted by Howe (1979) and Sampson (1985) as existing for thousands of years.

An important aspect of Modoc life was the quest an individual took when there was a crisis of some sort in their life. These times of crisis were often times rites of passage such as birth, death, marriage, illness, or loss, and the Crisis Quest would involve "fasting, isolation, strenuous artificial activities, and ritual bathing" (Ray 1963:77). With the exception of the puberty crisis quest, the basic ritual pattern was the same, and "preparation for the dream required swimming in pools or streams significant because of their mythological associations" (Ray 1963:77). As noted by one Modoc, the quest included,

> "One [that] was a male coming of age ceremony on Mt. Shasta. Adults would also do the quest if they need wisdom or guidance. Some quests were in other sacred places too. Part of the quest involved the physicality, the physical exertion of stacking up rocks. The stacking of the rocks had to do with fasting. One of our stories has to do with Isis, the son of Kumush. And when he died, he laid down on the top of Mt. Shasta and that is why it is white and snow-capped today."

According to Ray (1963), all full-scale quests involved ritual bathing, as noted, in places where some important event had occurred, and while such places would not be recognizable to those unfamiliar with the associated stories, the place and the necessary rituals there were well known to the person on the quest.

Another aspect of Modoc life was summed up in Ray (1963: Chapter 15), where he noted that the Modoc did not often battle, but when they did, the battles were bloody. The Shasta and Pit River people were traditional enemies, and the Paiutes to the east were added to this list once the horse was introduced. There were also raiding parties for horses and women, and the Klamath and Modoc might team together in a battle with the Shasta. Today, the Modoc assert that the Klamath were also their traditional enemies, and it was a terrible event when they were forced together on the reservation after the Modoc War. The Modoc War itself has been documented in several books and studies, including the Modoc versions in James (2008) and Riddle (1914). Newspaper accounts of the war have been recently compiled into an independent volume (Woodhead 2012). Of major importance is that the Tribe was split asunder, with one group forced on the "terrible 2000-mile winter ride in railroad cars intended for hauling cattle" to Kansas and the others forced north onto the Klamath Reservation (Scruggs 2013). Some Modoc chose not to go to either place.

The Modoc were among the first California Indians beyond those taken to the Missions to have contact, albeit indirect, with western introductions, the horse being the principal item, followed by various firearms. By 1826, fur trapper Peter Ogden (Elliott 1910:210; Layton 1981), in traveling through Modoc area, noted that the "Klamath" (sic, Modoc) had one horse that he observed. If one horse had been seen, there were bound to be others. It has also been documented (e.g. Heizer 1942; Sapir 1909) that Columbia River Indians went to the Sutter's Fort area near Sacramento, and had been doing so for some time, at least back to 1800. More information on this topic can be found in Layton (1981), but the important point is that the Modoc had acquired and become accustomed to the horse and weapons long before the Modoc War.

Germane to the present study, the Medicine Lake Highlands are a volcanic region that consists of the caldera, hills and, lakes. Water there is sacred to Native American tribes, as it has been for at least 10,000 years, according to archaeological studies and some tribal oral histories. For the last 30 years or so, Native American groups have been arguing against development of the Medicine Lake Highlands for geothermal or other industrial uses because such development at the sacred lake is considered offensive to the Modoc Nation and other tribes. The lands are sacred grounds and it would be "like building a power line in a Catholic cathedral or something."

In terms of the Native American battle against the power development companies who wish to harness geothermal power, to date, the Modoc Nation has aligned themselves with the Pit River Tribe who has been arguing against development since the early 1980s. The Tribes promoted a study of cultural uses of the Medicine Lake Highlands, provided information that indicates prime cultural significance of the Medicine Lake Highlands. By 1995, although geothermal exploration projects had been approved by the US Forest Service and the Bureau of Land Management, there had been no proper consultation with tribes. Although some consultation with occurred the following year, the Pit River Tribal Council passed a resolution expressing opposition to geothermal development in the Medicine Lake Highlands, and requesting a Cultural Management Plan for the Highlands. An ethnographic study resulted in the July 1999 designation of the Medicine Lake caldera as a Traditional Cultural Property (TCP). The Modoc were included in this TCP designation, and the Modoc Tribe agrees with the findings.

The Advisory Council on Historic Preservation (ACHP) which advises Congress and the President on matters related to historical (cultural) resources, stated the following with regards to the highlands:

> "The Medicine Lake Highlands contains an interrelated series of locations and natural features associated with the spiritual beliefs and traditional cultural practices of the Pit River and Klamath/Modoc Indian tribes. For centuries, the area has been vitally important to the culture of these two tribes as a place for physical healing, prayer, spirit quests and other traditional activities. These cultural values and practices by the tribes depend entirely on maintaining within the district the environmental qualities that now exist, including natural land forms, heavy forested cover, scenic vistas, and a natural quiet that reinforces a sense of solitude and contemplation. The Pit River Tribal Chairman, in a recent letter to the Council, emphasized the natural qualities needed for continued use of the traditional cultural places within the Medicine Lake district. [ACHP 2002]"

The Keeper of the National Register of Historic Places, in her determination of eligibility, said the unique nature of the area in relationship to important traditional spiritual activities and practices, was supported by "...multiple lines of evidence substantiate the historic and continuing value of the Medicine Lake area and the volcanic caldera it rests in to Native Americans in maintaining their traditional cultural identity" (ACHP 2002).

The Modoc believe the waters of Medicine Lake have power to heal and to renew, and consequently they return to the lake annually when possible. The Pit River Tribe and the Modoc Tribe (Nation) have annual ceremonies they hold jointly at Medicine Lake, simply called "Medicine Lake Gathering of the Modoc and Pit River People." There, for four days, a sacred fire is lit, people gather to share stories, reminisce, honor elders, dance traditionally, drum, sing, conduct ceremony at Schonchin Springs, visit sacred sites, and of course, heal. The healing powers of the water are important and are involved in the training of medicine practitioners. This is one reason why the tribes, including the Modoc, are fearful that groundwater removal and fracking might alter the metaphysical healing powers. Those who argue against the Native American position say that the Medicine Lake Highlands are no longer pure because of the tens of thousands of people who use the area; the number of vacation homes on land adjacent to Medicine Lake; and other nearby activities that occur throughout the year (e.g. snowmobile trails and parks and cross country skiing). Mining and logging have also altered the landscape. While this may affect the spiritual landscape, the healing powers of the water are not affected, except in as much as recreational users foul the water quality. This is the main reason that the Modoc desire a groundwater monitoring project, as described below.

A Stanford Law Clinic (Stanford Law School [SLS] 2006) study stated that for at least 10,000 years, the Modoc, members of the Pit River Tribe, and other tribes have used and continue to use Medicine Lake and the Highlands for religious activities such as vision quests, religious prayers and teaching, traditional shaman/doctoring practices, life cycle ceremonies, collection of traditional foods, medicines, and materials, spiritual renewal, and quiet contemplation. These benefits depend on the physical, environmental, and visual integrity of these areas, and their quietude. In that SLS document a tribal member was quoted as saying: “We are only the transient stewards of this land, picking up the sacred thread from our ancestors, and making sure it stays sacred for generations to come.” In the words of a Modoc man,

> “The Spirit of Creation, just being there with what I call my relatives—sun, wind, trees, rocks, brush, everything that God has created. I’m part of that when I’m out there at that altar, and it continues when I come away from that altar. That water out there, Medicine Lake, is sacred because it’s the life-blood of Mother Earth. It’s also the life blood of the people.”

Among the Modoc, certain features of the landscape were an important part of prayers. Ray states “parts of the earth were frequently addressed... most often called upon were mountains and bodies of water... for example, a prayer to the mountain where hunting was to be done for luck on that particular venture...” (1963:21). Through dreams and vision quests, shamans acquired power from spirits that were associated with sacred places, such as “former gathering places of mythological beings” (Ray 1963:32). Medicine Lake is one of those places.

Modoc Examples of Caretaking of Water

The Modoc Nation, since its inception, has been concerned about the quality of sacred water in their traditional territory. As such, they have participated in numerous studies and programs, of which a select few are listed here as examples.

1. Legislative Council of The Modoc Nation Resolution 2013-14 states tribal opposition to geothermal or and other industrial development activities in the Sacred Medicine Lake Highlands
2. IRWM Roundtable, April, 2013
3. California Tribal Water Summit, April, 2013
4. Department of Water Resources California Water Plan Update, 2013
5. Upper Sacramento, McCloud, and Lower Pit River IRWMP, 2012-13
6. The California Delta Plan H.R. 1837, 2011
7. House Bill (HB) 2873 Protecting Oregon’s fish populations, 2011
8. Native American Heritage Commission, 2011
9. California Department of Fish and Game opposition of Draft Suction Dredge Mining EIR, 2011
10. Tribal resolution to have Medicine Lake Highlands protected from development, geothermal, fracking; Although the move is led by the Pit River Tribe, the Modoc Nation supports this, 2013
11. Legislative Council of The Modoc Nation Resolution 2013-15 states Modoc Nation opposition to removal of Klamath Dams (Klamath Basin Restoration Agreement & Klamath

Settlement Agreement) because the Klamath Tribe has signed away all rights to water, fishing, and hunting, gathering, and any other rights, 2010-2013

Modoc Projects
For the Upper Sacramento, McCloud, and Pit River IRWMP, the main project the Modoc Nation would like to promote is that of groundwater monitoring in the Medicine Lake and Medicine Lake Highlands area.

3.4.5.2 The Pit River Tribe

Pit River Background Information

Territory:
Pit River Territory encompasses a 100-mile square from Mount Shasta on the northwest to Mount Lassen on the southwest and to Goose Lake on the northeast and Eagle Lake on the southeast. The Territory of the Tribe consists of all ancestral lands recognized by the Indian Claims Commission in its July 29,1959, (7 Indian Claims Commission, 815-863 Appendices A & B pages 1-49; findings of fact and opinion in Docket No. 347, i.e., the 100-mile square as described in Docket No. 347).The Pit River Indians consist of 11 bands — nine from the northern or Achumawi division and two bands of Atsugewi people (Dixon 1908; Kniffen 1928; Merriam 1926). The IRWMP study area includes territories of the northern Achumawi bands.

It is beyond the purview of this study to propose the locations of boundaries either between Pit River bands or between the Pit River people and neighboring tribes. The post-contact period brought significant disruption of native life-ways, and the recorded boundaries may reflect only historic land use accommodations. However, it is abundantly clear that various groups converged on particular areas of the lower Pit River and the McCloud River in the ethnohistoric period (Merriam 1926).

Pit River Bands:
The Pit River bands have always been autonomous, a practice which continues today, where cultural resource management is conducted not only with the Tribe but also with cultural representatives of the bands. From east to west, the bands involved in the lower Pit River watershed include the Ilmawi, whose major habitation and resource area included the vicinity of the confluence of the Pit River and Hat Creek, much of which is now inundated by Lake Britton, the Itsatawi, who occupied the next stretch of river down and territory to the south adjacent to Goose Valley, and the Madesi, the westernmost Pit River band, occupying the area from Big Bend to Montgomery Creek (Kniffen 1928).

The river was divided into sections, not just in terms of band territories, but sections under the control of individuals, often people of authority who directed community activities for as many as four adjacent settlements. Even finer breakdowns of territory, recorded for the Madesi but probably common practice, occurred: the banks of the river in Madesi territory alone were broken into 21 sections owned by individuals.

Subsistence and Settlement:
As hunter-gatherer-fishers, Pit River people used the various life zones in their territories on a seasonal basis. Waterfowl hunting in the swamps was important in the spring, when tules, grasses, and roots were also available. They moved to the river's edge for summer salmon fishing, dispersed in the fall for hunting and the procurement of nut crops, and wintered in sheltered valleys near the

river in wintertime. Winter was the best time for sucker fishing. Major winter settlements, therefore, were mostly strung along the river.

Very dense populations were noted in ethnographic and historic accounts along the river, particularly near the Hat/Pit confluence and at Big Bend. In the westernmost part of the territory, the steepness of the adjacent banks precluded riverside habitation, but salmon fishing was undertaken, and the north shore of the Pit River was a popular hunting retreat. Since Pit Rivers are a riverine people, a large range of activities took place along the riverbanks, including residential placement, fishing, gathering, cemeteries, and social and sacred uses.

The land is as rich in ritual as it is in resources. With a worldview revolving around nature where everything is sentient, potentially powerful, and deserving of respect, a large number of places figure into myths or are the home of nature spirits. Thus the landscape itself reflects the mythical past, and recalls moral teachings.

Religion:
De Angulo stated that, for Pit River people, life is "a continuous religious experience" (de Angulo 1926). He further describes "The spirit of wonder, the recognition of life as power, as a mysterious, ubiquitous, concentrated form of non-material energy, of something loose in the world and contained in a more or less condensed degree in every object" (de Angulo 1926:354).

Religious history was taught during the long nights between December 20 and March 20 (Merriam 1928). Stories such as An-nik-a-del, the Coyote stories, and others were meant to give people a sense of their place on earth and to explain the genesis of various landmarks and customs. Since Merriam's recording of the account of the beginning of the universe was taken from Madesi man, Istet Woiche, many of the referents in the story are local places, plants, and animals.

Ethnohistoric Pit River Water-Related Information:
Historic events have alienated large portions of the Pit River, but the Pit River Tribe has consistently attempted to maintain their relationship with this life-giving resource. The Pit River became a conduit for early Euro-American exploration and immigration, exposing the river-dwelling Pit River Indians to outside trade, diseases, and violence from the early 19th century. Peter Skene Ogden travelled down the Pit River on his 1826–1827 Snake Expedition. Later, one of the major trails of the Hudson Bay Company between Sacramento and Klamath Falls, Oregon ran along the Pit River, partially retracing Ogden's route. The route was established by Alexander R. McLeod. Ogden's route was subsequently followed by Michael Framboise and John Work between 1829 and 1833, and John C. Fremont in 1846 (Neasham 1957). In the 1840s, it guided Euro-American emigrants, settlers, and then military personnel into Pit River lands (Wheeler-Voegelin 1974).

Only a few conflicts took place between the early explorers and trappers and the Pit River people, but the John Work expedition was the vector for a massive epidemic that spread through California and Oregon in 1832–1833 (Cook 1955). There is no debate about the severity of local effects; the impacts were catastrophic for the Pit River people, with casualty estimated at or above 40% of the population (Wheeler-Voegelin 1974). Other waves of Euro-American diseases continued into the twentieth century, including smallpox, diphtheria, measles, and tuberculosis (Gillihan and Shaffer 1921).

The Pit River portion of the trail west for the settlers passed through the high-density residential areas around the Pit River/Hat Creek confluence. Pit River people acted immediately to protect their territory. As the two groups competed for resources, conflict escalated quickly, and by 1857, a number of vigilante groups formed to attack the Indian residents. Described as "armed, drunk, and dangerous" even by some in the local Euro-American community, they quickly became the cause of and not the solution to ongoing hostilities between the groups. Fort Crook was established five months after this conflict began, and the military alternated between punishing attacks on villages and providing shelter and protection from marauding vigilantes (Tiley and Pierce 2004).

Two years later, the Pit River people were rounded-up and forced to march to Round Valley in Mendocino County. They were then taken out to sea in a boat, which was meant to disorient them so that they could not return to their territory. One family's horrifying account of this journey is provided by Wilson (1997). Conditions were so wretched on the reservation that most people escaped en masse after men on a hunting trip spotted Mount Shasta and, subsequently, the way home.

After their return, Indian people found many of the old village sites already occupied by Euro-American ranches along the Pit River and its confluences with Hat, Burney, Kosk, and Clark Creeks. They were forced into some sort of accommodation of these new circumstances. Initially, most labored for Euro-Americans as ranch hands or domestic help, setting up camps close to their employers. After seasonal work such as haying or fruit picking was over, families returned to the more traditional pursuits of hunting, fishing, and acorn and pine nut collecting.

The Dawes Act of 1887 was meant to transform Native American social organization, replacing group-based strategies with a life-way centered upon independent family farms. Indian families were allowed to file for parcels of land which would pass into their ownership after 25 years, at which time they would be owned and taxed like any other land. To an extent, the allotment system was used successfully by Pit River people in protecting some of their important ancestral areas, and in re-forming communities along the river. In the area now beneath Lake Britton, small Indian towns locally referred to as districts, formed at Fishing Creek, Carbon, Albion, Indian Springs, and the Peck's Bridge areas. Though the land released for allotments was often poor, waterless, and steep, some families were quite successful in establishing small ranches or orchards. As was true elsewhere, however, many allotments were lost when taxes became due, or when the immediate economic needs of the families became too critical and the land was sold.

By far, power companies bought out the largest number of allotments. In 1920, James Fitzpatrick and a Dr. Archer visited the Pit River to set the prices for the Pacific Gas and Electric purchase of the land adjacent to the river. Some of the arrangements made are still controversial. Many Indian people could not read at the time, and thought they were leasing, not selling, their land. Evictions regularly occurred, with the entire story documented in the documentary films prepared in the early 70's: 47 Cents/Acre and The Dispossessed. As Lake Britton filled and families were again displaced, indigenous communities remained, particularly at Big Bend and Roaring Creek.

The subsequent building of the Pit 1, 2, 3, 4, 5, 6, and 7 Hydroelectric Plants drowned the little settlements and their pre-contact precursors, halting the salmon runs, and restricting access to large and culturally important stretches of the river. Dispossessed again, and economically and socially crippled by the loss of their major resource, the Pit River people continued the struggle to remain stewards of their ancestral lands.

The Madesi area also underwent of impacts not common for the region as a whole. At Big Bend, the hot springs had drawn Yana, Wintu, and Pit River people to their waters. In the historic era, they were purchased by a Mr. Henderson, who turned the area into a resort. Access to this once-shared place of healing now was dependent upon the whim of the current landowner. Other sacred sites as well fell just out of reach on private lands.

The Madesi area was also somewhat unique in the amount of impacts on lands remote from settlements. Government timberland went on sale in 1878, and allowed the purchase of up to 160 acres at $2.50 an acre. Outlying areas were victim to a speculative boom as a result, and large acreages passed into private hands. The area was subsequently heavily logged. Timber harvesting in Big Bend remains a concern today. Clear-cutting large patches of land erodes the topsoil, which flows into the river. The Pit River Tribe remains very active and in ongoing consultation with the USFS and other private entities that continue to conduct heavy logging activities. The Pit River Tribe continues to express concerns over current watershed activities that impact cultural resources such as water quality, water quantity, loss of botanical biodiversity of forest ecosystems, wildlife and fisheries.

Land claims in the Pit River region continue to be disputed by the Pit River Tribe. In 1928, various tribes were allowed to sue the government for compensation for the loss of their lands since they had never been compensated. Stewart's documentation of Pit River claims for the Land Claims Commission received a favorable preliminary judgment (Olmsted and Stewart 1978). However, attorneys advised the Pit Rivers to join in the larger Indians of California case. The community was split with many people opposed to — and who continue to be opposed to — the settlement.

Pit River Caretaking of Water:

A continuing reverence for the land and water has been noted by virtually every researcher in Pit River territory. In the 1870s, Powers states that "they are not content with designating the river as a whole, but every reach, every cataract, every bend, has a name to itself" (Powers 1976). de Angulo remarked upon the "extremely intimate contact" with nature characteristic of the Pit River people in the 1920s. In the 1970s, Olmsted wrote that "Pride in the knowledge of the extent and resources of their aboriginal home territory is matched only by Achumawi self-esteem for successful survival in their homeland…" In spite of the many disruptions over the last 150 years, band-specific ties to the land and its waters remain. It is important to note that Pit River people draw no distinction between prehistoric, historic, and current use, stressing rather their continuous association with the land.

Beginning in the 1960s, a group of educated, activist tribal members have sought recognition of the Pit River's rights to their ancestral territories. This led to several well-documented protests, one of which took place at The Cove. In 1974, three tribal elders were interviewed as a part of the Oral History Program at California State University, Chico. In what was meant to be an address to the public at large, they stated that the Pit River people needed land for not only economic reasons but for spiritual fulfillment as well (Lego, et al. 1974). In an argument used today, they pointed out that each group was created on a specific piece of land (and often a specific stretch of river) and was responsible for its stewardship. Therefore, Pit River people alienated from their land base are spiritually "lost." These views have not changed in forty years and the new generation continues to assert and act upon their beliefs.

The Pit River Tribe and individual members have worked tirelessly with various state and federal agencies to continue their stewardship of the land and the water. They have provided patrols and site protection programs for State Parks, assisted the Forest Service with plant restoration projects, participated in land management planning with licensee, Caltrans, Pacific Gas and Electric, and other entities, and actively stood for their cultural and spiritual interests at Medicine Lake and Mount Shasta. Among their greatest achievements of stewardship were the designations of three Cultural Districts eligible for the National Register of Historic Places, including the Mount Shasta Cosmological District, Medicine Lake Highlands Traditional Cultural District, and Pit River Aboriginal Cultural District. All of these districts recognize the importance of the lands and waterways not only to current tribal members, but to future generations.

Current projects include: the Pit River Tribe Native Greenhouse, aims to provide for the propagation of native plants for enhancing regional restoration projects; the Hat Creek Riparian Restoration, Cultural Protection, and Recreation Improvement Project in coordination with California Trout and the Parkway Conservancy serves to protect and restore riverfront lands near the Hat Creek/Pit River confluence; The Pit River Tribe Tribal Workforce Training Program in tandem with Lomakatsi Restoration will encourage forest jobs in ecological restoration, and; the Pit River Tribal Forest Enterprise will focus on best management practices, and traditional environmental knowledge application to produce sustainable yields. The Pit River Environmental Department supports the development of these activities under the direction of Tribal Council, Cultural Representatives and tribal community. Tribal departments continue to coordinate with Federal and State and local entities to monitor regional projects, protect cultural and environmental resources, and identify and create employment opportunities for Pit River Tribal membership.

The Pit River Tribe's Environmental Department and Tribal Historic Preservation Office are responsive to numerous projects that involve cultural resource management, and individuals from the tribe have actively participated as archaeological monitors and as ethnographic tribal interviewees. They also actively review regional land use planning in order to keep them aligned with tribal planning documents. Their dedication to the protection of their ancestral resources goes far beyond words alone.

The tribe believes that federal Consultation between the tribe and federal agencies is not taking place to an adequate degree, and that the State of California should be in formal Consultation with the Tribe over natural resource issues, water quality, and allocation issues that affect Tribal rights and interests.

In addition to being a part of the Upper Sacramento and Upper Pit River IRWM; the Pit River Tribe is part of the North Coast IRWM. The Pit River Tribe is currently coordinating with North Coast Tribes; building needed partnerships to address IRWM planning issues impacting California Indian Tribes to identify solutions for future IRWM regional planning. The Pit River Tribe continues to advocate for adding a Beneficial Use Designation protection for "Cultural Use" of waters" in the Upper Sacramento and Upper Pit River IRWM Regions; as modeled in the North Coast Region.

Proposed Pit River IRWMP Projects:
The Pit River Tribe is unable to propose projects for this IRWMP because of the lack of funds to cover the work prior to reimbursement. Needs are expressed below in order to alert agencies of their needs and concerns and in the hope that some of these needs will be met under other programs.

Some general concerns were expressed including the need for the restoration of salmon to the river through the building of fish dams (promised since the 1920s but never completed); the need to restore biodiversity (particularly along stretches of formerly-flowing water) and management of invasive species; the need for access to the river for economic and cultural activities (large stretches of shoreline are held by Pacific Gas and Electric); continuing recognition and maintenance of tribal water rights; and the need for water quality monitoring, roads decommissioning, and ecological restoration to restore the many rivers and tributaries, in Big Bend, Burney Creek and particularly around Lake Britton and the stagnant waters associated with the Pit 6 and 7 hydroelectric projects, where swimmers have been catching impetigo and algae blooms have killed off mussel populations. There was a request for the protection of pools, falls, and seeps along the river course — which are often sacred locations. The sucker fishery has been closed down; one project desired by the tribe would be the establishment of a native species hatchery.

Concerns about natural and atmospheric mercury contamination were expressed by Native American stakeholders during public outreach. The state has just completed environmental scoping for a statewide Total Maximum Daily Load (TMDL) for mercury in reservoirs. Discussions with RWQCB staff confirm that elevated levels of mercury have been documented in some species of fish in Lake

Britton. Of importance to tribal interests is the posting of advisories for water bodies known by the RWQCB to show evidence of elevated mercury.

Low flow events in the Pit River are a concern as they impact aquatic and wetland-dependent species important to traditional and recreational uses such as redband trout. Tribal interests wish to assure water reliability for "cultural beneficial uses," including habitat restoration and to support sustained fisheries for redband trout.

Clear-cutting of timber around Big Bend continues, creating heavy loads of silt in the river. The lack of management of fuel loads on neighboring forested areas have contributed to several large, destructive fires in the area in the last decade, further impacting water purity. The old PG&E tunnels north of the river are still leaking potentially toxic materials. Neighboring Kosk Creek is observed to be warmer than it was, previously. There are also concerns that people drink and eat fish from these contaminated water sources. For those that abstain, the loss of salmon, sucker fish, crawdads, and mussels has meant a processed diet and the proliferation of health problems. The tribe does have water-monitoring stations and would like to be more involved in regional water quality and quantity testing and restoration.

Many Pit Rivers are still without access to safe drinking water and wastewater treatment systems. Many Pit River communities have undeveloped drinking water sources and community members rely on untreated surface waters; a lack of wells and water systems exists to supply water to households on tribal lands and allotments. A project to provide safe drinking water to the rural allotments and rancherias would constitute and major improvement. Water and wastewater infrastructure continue to be a major issue affecting the tribe.

Tribal members expressed significant concerns about PG&E's current cloud-seeding projects as well as proposals mentioned in the State Water Plan Update 2009 to potentially conduct cloud seeding in the watershed as it has pursued in other watersheds in California. They cite the lack of scientific data regarding impacts from the process of injecting substances into clouds (primarily silver iodide, but also liquid propane and dry ice) that causes raindrops to form and the unknown effects of how cloud seeding affects weather and precipitation over neighboring regions. Public disclosure of these activities was also desired.

Access to waterways for traditional subsistence foods and fisheries remains of great cultural and economic importance to the Pit River Tribe.

3.4.5.3 The Shasta Indigenous Culture (including both the Shasta Nation and the Shasta Indian Nation)

Shasta Background Information

Territory:
Shasta territory extended from the forks of the Salmon River on the south to the Rogue River in Oregon, encompassing most of current Siskiyou County.

Bands:
The three main divisions included in the Ikiruka'tsu group are Oregon's Jackson and Klamath Counties along the Rogue River and Jenny Creek and the Klamath River near Bogus Tom; the Iruaitsu in Scott Valley; and the Katiru or Wiruwhitsu downriver along the Klamath River near Seiad Valley. Three smaller groups included the New River Shasta along the North and East Fork of the

Salmon River; the neighboring Konomiho on the Salmon River's North Fork; and the Okwanuchu on the upper reaches of the Sacramento River and Squaw Valley Creek. The Okwanuchu and Shasta Valley groups were located adjacent to Mount Shasta and are of the most relevance to this overview. Heizer and Hester (1970) synthesized various sources in order to detail 156 known villages and discuss boundaries between groups.

The Okwanuchu, most closely associated with the Sacramento and McCloud Rivers, were described by Dixon (1905) as a small tribe occupying the head of the Sacramento River to Salt Creek and the upper McCloud as far as Squaw Creek and Squaw Creek Valley. Merriam also associates them with the upper McCloud (Merriam 1926). Wheeler-Voegelin thinks that Okwanuchu, Pit River, and Wintu people shared Squaw Valley (Wheeler-Voegelin 1974) based upon an historical account (Anonymous 1873). Silver (1978) accepts Dixon's location and adds that Voegelin (1942) suggests that they were inter-married with the Ajumawi Pit River band. A recent master's thesis (O'Donnell 1994) provides more detail, but the resolution of exact boundaries is beyond the scope of the current effort.

Subsistence and Settlement:
Shasta territory abounded in resources, from the rivers with salmon, trout, and other fishes and mussels to rich valleys with a wide variety of vegetal foods including acorns (a staple), roots, bulbs, greens, and berries, to forested uplands with deer, elk, and bear. Such natural bounty in all seasons facilitated high-density populations and complex cultures (Silver 1978:216).

Permanent settlements were made close to waterways, particularly the Klamath, Scott, and Shasta Rivers (Theodoratus, et al. 1989:17). Substantial rectangular winter homes (umma), a sweathouse and, if the village was large, an assembly house were the dominant features of settlements (Holt 1946:305-306). People moved to brush shelters along the river in the summer and to the hills for acorns in the fall.

The subsistence economy was focused upon riverine resources, particularly the bi-annual salmon runs, which provided both immediate food and dried winter stores. Salmon were obtained using nets, basket traps, weirs, hook and line, and spears. Specific rules and ritual practices surrounded fishing. Fishing platforms were built each season in April at the onset of the summer salmon run, with the first use blessed with a prayer. The winter salmon run occurred in the late fall. Steelhead also made a run in the fall. The first fish of the run was allowed to pass, since it brought "salmon medicine" from the Yurok First Salmon ceremony downstream. First Salmon ceremonies were also held in Shasta territory at Hamburg on the Klamath River and at Big Bend on the Shasta River. The first fish caught after that was hung to dry. Only when this first fish was dried and a portion eaten by all the fishermen, could people consume the salmon (Dixon 1907:430-431). Fish were also caught in artificial pools formed by piling rocks. These locations were owned and named, and the owner sprinkled tobacco and herbs in the water and prayed. Such pools were fished at night and on the last day a feast was held for friends and relatives (Holt 1946:310). Dixon (1907:428) also noted two large dams located at the mouth of the Shasta River and the Scott River which were individually owned, but at which anyone was welcome to fish. Women and children also collected mussels in spring and fall. In very dry years, water was diverted from rivers to the smaller streams so that salmon could ascend. It is believed that the salmon must return for the Shasta to prosper.

Religion:
The Shasta respect the spiritual/supernatural power existing throughout the environment and believe an individual has intimate day-to-day contact with such power (Renfro 1992:25). Each area has special places especially imbued with this force, such as pools, rock outcroppings, and secluded places that can be visited for special powers (Theodoratus, et al. 1989:4). Spirits (axe'ki) with

mysterious powers occupy rocks, cliffs, lake, mountain summits, and rapids and eddies in streams (Dixon 1907:470). Prayers and offerings accompanied many daily activities as well.

Ethnohistoric Shasta Water-related Information:
Earliest contacts with Euro-Americans were fur traders in the 1820s and 1830s — many of whom were associated with the Hudson Bay Company. Scott's Valley, known to them as Beaver Valley, was rich in beavers; Thomas McKay collected 1,800 beaver pelts there in one month in the winter of 1836 (Silver 1978:212). The Shasta used the beads and mirrors they acquired in weaving, basketry, and on clothing. As has been recorded elsewhere, however, the amicable contacts had deadly consequences. Measles, malaria, and smallpox decimated native populations (Cook 1955).

The Shastan peoples acutely felt the Gold Rush; miners quickly crowded them from their fisheries and hunting grounds (Silver 1978:212). They were driven away from the river. Cook noted, "all along the Sierra foothill belt, and on the tributaries of the Klamath, the miners followed the watercourses and in doing so, drove out the heavy Indian populations" (1976:281).

But most of the impact was more direct. Gibbs (1853:162) reports that "many of their villages were burned and their people shot… [The Whites] had determined to wage a war of extermination against the Indians on the upper Klamath and its tributaries…" Hunted by individual citizens, "vigilantes" funded by the State of California, and the U.S. Military, with their children kidnapped as slaves, the Shasta were nearly wiped out (Renfro 1992:92-93). Those that survived did so in a "great state of destitution" (Gibbs [1853] 1972:59). Some of this poignant history has been recounted in Hall and Hall (2004).

Individual Shasta bands signed the treaty of November 1851, which was then never ratified by Congress. Shasta lands were taken at-will by settlers, though no agreement had been completed.

The Oregon bands of the Shasta joined the Klamath, Takelma, and Tututni in the Rogue River Wars of 1850-1857. When they were vanquished, they were sent to the Grand Ronde and Siletz Reservations on the Oregon coast. Some of the remaining Shasta found refuge with sympathetic white ranchers.

Shasta people took hope in this dark time by participating in three different waves of the 1870 Ghost Dance movement. It was hoped that dances, lasting for days in specially-constructed long houses, would to allow people to consult the dead on how to make their way in a changed world (DuBois 1946).

All of these forces tended to scatter the surviving Shastan peoples. In 1907, Dixon spoke to individuals at Siletz, Yakima, and the Grand Ronde Reservation in Oregon, Yreka, Scotts Valley, and along the Klamath River (Dixon 1907:390). Their survival of the genocidal forces mounted against them in the historic era is remarkable.

In 1910, the federal Forest Allotment Act allowed Indians to legally homestead lands on the Forest Reserve (Winthrop 1986:52). Since no ratified treaty existed, the Shasta never were provided a reservation and these small landholdings quickly became population centers for groups of landless people (Renfro 1992:99). Working through the legal system for reparations for the lands they lost, they were awarded $600 (or about 58 cents per acre) per person by the Indian Land Claims Commission in 1973 after consolidating their claims with other California Indians in Dockets 31 and 37 (Winthrop 1986:66). The 1934 Indian Reorganization Act allowed Shasta people to form the Quartz Valley Rancheria comprising 600 acres in 1940. As federal policies changed, the Rancheria was terminated in 1958, but then reinstated in the early 1980s.

Shasta Caretaking of Water:
Visits to culturally important springs to which access was possible, probably never stopped. Carraway George recalled attending Shasta ceremonies in the 1930s located at the Sacramento headwaters at the Mt. Shasta City Park. Many people would travel some distance to attend these ceremonies. Others camped at various other springs with mineral water, particularly for healing. Springs continued to be sacred as well as having healing values (Winthrop 1986:59).

In the 1970s, the Shasta became politically organized in order to gain federal recognition, fight desecration of their traditional lands, and maintain traditional life-ways (Renfro 1992:21). Formal and informal gatherings allow people to sing, dance, pray, and pass on their culture. Traditional healing methods also continue. Winthrop (1986:45) notes that many long-term continuities in both beliefs and practices persist.

The Shasta have actively expressed their concerns at the federal, state and county levels regarding resources in their ancestral territory and have advocated the incorporation of Native American perspectives in the decision-making process (Theodoratus, et al. 1989; Winthrop 1986). Their opposition to land development in Graveyard Gulch in Scott's Valley meant frequent intervention with the Siskiyou County Planning Commission. They have collaborated with the Klamath National Forest in land use planning and the protection of cultural resources (Winthrop 1986). Their opposition to the Salt Caves Dam proposed for the Klamath Canyon in 1986, for which California Indian Legal Services filed their comments "exemplifies their concern with the sacred landscape that remains a focus of Shasta religion" (Winthrop 1986:58).

Theodoratus, et al. (1989:33) note that traditional uses of the area are ongoing, though only the participants might know these activities. They also caution that information on such places might not be given unless they are in danger of imminent destruction.

Proposed Shasta IRWMP Projects:
At present, the Shasta people are represented by two groups: the Shasta Indian Nation and the Shasta Nation, both of whom are stakeholders in the IRWMP process.

The Shasta Nation (Shasta Tribe, Inc.), in letter dated April 3, 2013, stated in their Tribal Ordinance #432013 that all regional governmental agencies and contracting agencies are in violation of the Shasta Nation's Inherent Sovereign Authority. This is based upon the un-extinguished title the Shasta lands. This was also strongly stated at the June 5, 2013 IRWMP meeting. Their position is that the price is too high for sovereignty to be relinquished for development dollars — that is, anyone taking the money will relinquish their water rights.

An addendum to the Shasta Nation Tribal Sovereignty document dated February 2, 2013 also stated "The Shasta nation declares it's sovereign and exclusive authority over the air, water, Indian lands, mineral, wildlife, and other natural resources within our boundaries to the exclusion of competing tribes."

In a brief meeting, members of the Shasta Nation pointed out that they have a different view regarding the lowering of Shasta Dam because they still have burials beneath the water that would be exposed. They are concerned about burials in other places as well.

The Shasta Indian Nation has a different view, stressing that they want their concerns about water heard. It was stated that, because of the importance of fish and fish runs both economically and ceremonially, fish are a cultural resource for the tribe — that water itself is sacred. In the past, they have worked for the restoration of the watershed, through cooperative actions with the US Forest Service, including plantings and cleanups.

3.4.5.4 The Winnemem Wintu Tribe

Winnemem Wintu spiritual leader Charlie Keluche said:

> "The first Indians appeared near where the hatchery on the McCloud River now is. NomLɛstowa [supreme being] looked down and said: 'What kind of people are we going to bring up? They need water.' So he drew his finger down from Mount Shasta, forming the McCloud River. Then he made fish and deer and all kinds of food. In four or five days all the McCloud Valley was full of people. [Du Bois 1935:74, quoting Charlie Keluche about 1934]"

Background and Introduction

The indigenous Wintun people of northern California are divided into roughly nine regions, with the most populous of those regions being along the McCloud River, a place called *winnemem*, or "middle water" in the Wintu language. The indigenous people of the McCloud, now politically formed into the Winnemem Wintu Tribe, have occupied this drainage, portions of the lower Pit River, and the meeting of the two rivers at the Sacramento River since the beginning of time. The Winnemem Wintu Tribe, recognized by the State of California and the California Native American Heritage Commission as an existing and historic California Native American Tribe, has traditional tribal lands within the Upper Sacramento River Watershed that includes the Upper Sacramento River, the McCloud River, the Pit River, and Squaw Creek. Far up the slopes of *Bullyum Pui Yuk*, or Mt. Shasta, the McCloud River begins as a series of springs and seeps, ultimately becoming the 50-mile-long river the Winnemem consider their central homeland. The origin of the Winnemem Wintu at Mount Shasta makes them, in the words of former spiritual leader Florence Jones (Jones and Sisk 2002),

> "... people of nature. It also is the foundation of our religion, provides us our place of worship, and makes us responsible for the care of the mountain, which we do through prayers, songs, and dances. We have other places, too... made by the great Creator for the [Winnemem] Wintu Tribe to take care of. In return, the mountains and sacred places take care of the people by sending the healing spirits, herbs and medicines, and by teaching the doctoring ways. Our trails once formed a spider web on our sacred mountain and the many sacred places that must hear us sing and listen to our prayers. Unfortunately, today many huge areas have been lost due to clear-cut logging methods and strip-mining techniques, and land developers who support the non-Indian life styles and economy."

Numerous books have been written about and for the Winnemem Wintu and their neighbors, including Cora Du Bois' 1934 *Wintu Ethnography*, Christopher Chase-Dunn and Kelly Mann's 1998 *The Wintu and Their Neighbors*, and Alice Hoveman's 2002 museum exhibition catalog entitled *Journey to Justice: The Wintu People and the Salmon*. While a number of other books and articles have been published, there are also many unpublished investigations by Jeremiah Curtin, John P. Harrington, and Margaret Guildford-Kardell that documented the cultural richness and population density of the Winnemem Wintu along the McCloud River, especially prior to the construction of the Shasta Dam. It is a testament to their cultural persistence, despite all odds, tremendous roadblocks, and near annihilation, that their ceremonies and focus on water continue to uplift and energize the Winnemem people today. These are a people who struggle to protect their sacred places in landscapes of unusual power. The central principal on which the United States of America was founded — that of religious freedom — is a fundament where the indigenous Winnemem Wintu are still losing ground — sacred ground. The Winnemem Wintu Tribe are a proud, spiritual people who "have survived the settlement of America, the extermination and termination policies of the United States and the sicknesses brought to us by those who came to 'civilize' us" (Jones and Sisk 2002). Chief Caleen Sisk notes that "now we find that U.S. Government, after killing our people and taking our land, can't remember who we are so we must prove that we are a tribe in order to regain federal acknowledgment so we can protect our religious practices and sacred places."

The section that follows summarizes some of this story, especially with respect to the Winnemem relationship to water, salmon, and the health of the earth.

Ethnohistoric Winnemem Wintu Water-related Information
Until non-Indians came to California, the Winnemem Wintu lived a relatively peaceful spiritual life along the McCloud River. Soon after 1492 though, explorers and adventurers began their encroachment into what became California. Space does not permit a full discussion of the intrusions, but in less than 100 years after Columbus landed on the eastern coast of America, men like Hernando de Alarcón and Francis Drake were exploring the Pacific coast. This was soon followed by Spanish explorers, Mission fathers, French and Russian trappers, and American adventurers in the 1700s and early 1800s. Each of these groups brought their own form of destruction upon the native people, disrupting trade patterns, ceremony, and basic lifestyle. By the early 1800s, disease had affected most native populations of California. The influenza epidemics of the late 1700s and early 1800s wiped out whole villages, followed by the major Sacramento River Valley epidemic of the 1830s. J. J. Warner, a member of a trapping party observed:

> In the fall of 1832… The banks of the Sacramento River, in its whole course through the valley, were studded with Indian villages… Upon our return, late in the summer of 1833 we found the valleys de-populated. From the head of the Sacramento to the great bend and slough of the San Joaquin, we did not see more than six or eight Indians; while large numbers of their skulls and dead bodies were to be seen under almost every shade-tree near water, where the uninhabited and deserted villages had been converted into graveyards. (Cook 1955a:318)

Although there is some conjecture among physicians as to what caused this sudden illness, most think that some form of malaria caused the 1833 epidemic. Cook (1955a:322) noted that some specialists estimated the death toll to be between 40–100% of the villages and that he personally thought it was about 75% for the Central Valley. From Cook:

> "This is a startling and disturbing result. It means that fully 20,000 natives of the great Central Valley died in 1833; my own opinion is that this figure is too small. It means that three-quarters of the Indians who had resisted 70 years of Spanish and Mexican domination were wiped out in one summer. It also means that the red race in the heart of California was so crippled that it could offer but a shadow of opposition to the gold-mining flood that swept over it in 1849. It means that the ethnography of the Sacramento and San Joaquin valleys should be restudied from the standpoint of a far greater population than has ever been conceived as occupying the area."

With this catastrophic population decrease, the Americans and others who arrived in the 1840s and 1850s to explore for gold, till the land, and settle in California, had less resistance from California natives than they might have had just 30 years prior. The native people were living modified and reduced lifestyles vastly different from their prehistoric past.

It can be argued that based on the geographic remoteness of Winnemem villages from the goldfields and major settlement areas, the people were not subject to the same annihilation as the rest of native California. Yet throughout native America, economy and livelihood were based, in part, on vast and proscribed trade networks where each group was affected by the groups with which they traded and, as such, a group exposed to non-native disease, tools, destruction would transfer that pathogen, technology or stories to the next group and they to the next, and so it went. That people were relatively mobile and were able to visit/trade with a number of groups meant the advancement of disease in particular could be frighteningly rapid. If the encroachments along the coast were not sufficient to intrude, the introduction of the horse on the eastern portion of the IRWM area made for vast changes in the region (see The Modoc Nation section). This was soon followed by the American advance of the Gold Rush and, in the years following statehood, the Winnemem Wintu have seen their land taken for resource extraction, especially by utility companies, federal land managing agencies, and by private property owners. No longer do the Winnemem own land where they hold sacred ceremonies.

Perhaps the most important point to convey about the Winnemem Wintu is that they are a spiritual people whose spiritual world includes the heavens, the earth, and the water. The sanctity of the water is of critical importance and each incremental reduction of purity makes it increasingly difficult to maintain cultural continuity. As Nomptipom-Tunai Wintu Frank LaPena (2002:15) wrote, “with the loss and destruction of each sanctuary on the land, a little more of our heritage as Wintu and our cultural legacy was hidden away from each succeeding generation...” With the impounding of the Sacramento River there came the inability of the Chinook salmon to get past Shasta Dam — a disastrous event for a people who relied principally on salmon for their sustenance. Homelands were inundated and subsistence base removed so the Winnemem had no choice but to leave the McCloud. With this eviction came the additional “eviction” of those Winnemem who had already passed on and had been interred in their homeland. When the 1941 Central Valley Project [CVP] Indian Land Acquisition Act was signed into law, the creation of a trust land cemetery in Central Valley was one of three stipulations to compensate the Winnemem Wintu for the loss of their land. None of these stipulations were ever completely fulfilled. Florence Jones was called upon by the Bureau of Indian Affairs to pinpoint cemetery locations along the river so that the bodies could be removed to this new cemetery. The piece of border land that became the Black Canyon Cemetery was never placed into federal trust for the tribe or the families of those buried in the new cemetery. For this reason and since the government did not honor their promises, the Winnemem Wintu Tribe feel that they have not relinquished ownership of the allotment lands under the Shasta Reservoir — these lands still belong to the tribe. The end result is that both Winnemem ancestors, the people who had passed and the salmon who could no longer return home, were casualties of the CVP construction.

Until one has seen a Chinook salmon (*Oncorhynchus tshawytscha*), it is difficult to believe just how enormous in size they can be. Adult specimens of more than 120 pounds have been caught and they might have been even larger in aboriginal times. Since the construction of Shasta Dam, the winter run of Chinook has decreased so dramatically that it was thought there were only 100 or so individuals remaining in the early 1990s (National Marine Fisheries Service 1997 and 59 FR 440). In 1994, the winter-run salmon were listed in the Federal Register as endangered under the Endangered Species Act. Central Valley spring-run Chinook were subsequently listed as a threatened species on September 16, 1999 (Good, et al. 2005). In his report to the U.S. Fish and Fisheries Commission in Washington D.C., Livingston Stone (1874) noted:

> “... the McCloud Indians... [are] so singularly connected with the abundance of the salmon in the Sacramento River. Had white men come here and required salmon for food, this main artery of the supply system of the river would have been stopped; or, had white men come and engaged in mining — as they have done on the Yuba and

> on the Feather and American Rivers — the spawning beds would have been covered with mud and ruined, as in those rivers and in less than three years the salmon supply of the Sacramento would have shown a vast decrease. The presence of the Indians, therefore, as far as it implies the absence of the whites, is the great protection of the supply of the Sacramento salmon."

Even though the salmon have been removed from the Winnemem Wintu daily diet, these are a hearty people who continue because of their commitment to honoring the sacred spirits/places, laying down prayers, and acknowledgment of the intimate connection of the people to Mount Shasta and its waters via a network of sacred sites. Even upon death, a soul may go to Mount Shasta and then on to the Milky Way (Milky Way in Winnemem is *LɛsyɛmɛrL*, meaning spirit or soul trail; Du Bois 1935:78-79). Secondarily, the soul may go to a certain spring to drink water until the stomach is filled, and then rise like a balloon (Du Bois 1935:78).

Du Bois (1935:88) observed that the Wintu generally were a deeply spiritual people and that shamanism (or spiritual doctoring in this case) "must have been their chief preoccupation with the supernatural." She (1935:118) continued:

> "From a description of various phases of Wintu religion and from a discussion of shamanism itself, it becomes evident that the supernatural experiences were had by most of the tribe. The custom of praying and fasting at sacred places, the care of sacred objects,… the contacts with souls and spirits, were all common experiences of lay persons [in the tribe]."

That the spirituality continues today is part of the motivation for environmental and political activism evidenced by the Winnemem Wintu Tribe. These are the people responsible for the salmon, responsible for the water, responsible for the sacred fires, and, overall, responsible for the health of the earth. Despite the broken promises of the federal government with treaties, allotments, and rancheria land, the Winnemem Wintu have survived, they persisted in the face of ongoing opposition. Their caretaking of the water throughout their recorded history is well documented (e.g. Chase-Dunn and Mann 1998; Du Bois 1935; Hogue 1995; Hoveman 2002; Knudtson 1977; LaPena 1978; Masson 1998; and Stone 1874, 1876, and 1880). A few examples follow to indicate that participation in the IRWMP process is only one activity among numerous others that occupy the tribe's time and efforts.

Winnemem Wintu Caretaking of Water

Following are examples of the generations of civil and spiritual action by the Winnemem Wintu to protect and preserve the waters of the McCloud River.

1. The Winnemem Wintu have always held that water is essential to their well-being and survival as a people. Chief Caleen Sisk notes that the first of many major protests by the Winnemem regarding their water rights was related to the establishment of the first federal fish hatchery in California, soon to be known as Baird Fish Hatchery. In 1872, Livingston Stone was appointed Deputy Fish Commissioner with the specific task of establishing a salmon hatchery to provide salmon eggs to replenish the depleted Atlantic salmon population on the east coast (Heizer 1973 records excerpts from Stone's annual reports). Although Stone studied many locales, he chose the McCloud River as the best site (Hedgpeth 1941:129). In writing to Washington, DC, he provided detailed information about the Winnemem he found there because their presence was especially germane to the abundance of salmon. The Winnemem supported that stance in that "they evidently entertained the belief that they should continue, like their ancestors before them, to keep the McCloud River from being desecrated by the presence of the white man... Individuals frequently said... that I was stealing their salmon and occupying their land" (Stone 1875:408).

The Baird hatchery was built across the river from the sacred salmon heart rock where the "arteries of the heart are distinguishable. Near it a streak of black earth was identified with the blood vessels lying along the salmon's backbone" (Du Bois 1935:80). When the leaders of that time saw what the white men were doing, in 1873, they held a war dance at this rock to protect tribal rights to the salmon. Stone said the Winnemem "assembled in force, with their bows and arrows, on the opposite bank of the river, and spent the whole day in resentful demonstrations" (Heizer 1973:7). In 1887, the Winnemem Wintu held what was to be their last public war dance, at the Baird Fish Hatchery. However, since that time, the Winnemem have held war dances at Shasta Dam, at the State Capitol, and elsewhere in the state to gain recognition of their position: the Winnemem then and now believe that their salmon and land have been illegally taken.

2. In 1851, a treaty (known as the Cottonwood Treaty) was made and signed between the United States Indian Agents and Chiefs of various tribes, including the Winnemem (Heizer 1972). The Winnemem Wintu were represented by Num-te-re-man. The treaty, as with all 18 treaties made between the Indian Agents and California Tribes, was never ratified by Congress; the ratification would have provided a 35-square-mile reservation for the Wintu. Four decades later, in 1889, Norelputis, a Winnemem leader, sent a letter (often called the Wintu-Yana Petition) to President Benjamin Harrison, pleading with the United States Government for clarification and rectification of the conditions heft on the Winnemem due the incursion of non-Indians onto Winnemem land. He was also concerned about of the duplicity of the un-ratified Cottonwood Treaty. The letter pleads for better treatment of the Winnemem, other Wintu bands, and the Yana — all of whom had suffered horribly at the hands of the non-Indian. The letter concludes by asking for justice for the Wintu. The President sent A. M. Tinker to investigate the claims made in the Wintu-Yana Petition. In 1890, Tinker wrote a letter to the President describing the condition of the Baird Indians, and recommended providing allotments on the McCloud River to rectify the problems. Some allotments were provided, but then, in 1937, they were taken away to begin removal of Winnemem from the McCloud River, in anticipation of the Shasta Dam. In 1938 construction on the dam began, ultimately inundating Winnemem territory on the lower McCloud River. Five years later, the Winnemem were removed from their McCloud River homelands as Shasta Lake water would soon inundate their villages and sacred sites.

3. In the 20th Century, the Winnemem Wintu continue historic traditional ceremonies and practices along McCloud River at known historic places, all of which might be determined eligible for the National Register of Historic Places. Florence Jones successfully argued for religious freedom, using the American Indian Religious Freedom Act (AIRFA) to obtain a US Forest Service Special Use Permit in 1979 for an ancient doctoring and prayer site on the McCloud River where traditional ceremonials are held every year. Annually, ceremonies are held at a National Register site on Mount Shasta that include a ritual where tribal members and guests dive into the water and participate as salmon swimming upriver, completing different tasks at the three different falls on the McCloud River. Numerous sacred sites on the McCloud River and up to and including Panther Meadow on Mount Shasta are still used for prayers, sacred fires, fasting, visions, swimming for spiritual tasks/healing, and ceremonial runs among other actions. In 2006 the Winnemem Wintu brought back their puberty ceremonies on the McCloud River, dancing and taking care of sacred sites all along the river, although the tribe has had great difficulty holding this ceremony in peace and dignity on their traditional site. The tribe has received three cultural easements within this IRWM region, including access to a sacred spring from a private timber company. There are also two spring

ceremonies conducted by the tribe on the McCloud River each year that include climbing a sacred mountain and rock and a seven-mile run.

4. The Winnemem hold an annual medicine gathering and prayer journey throughout Winnemem Wintu territory. The ceremony, known as "Round the World" involves visiting and praying at sacred springs, at historic sites along creeks, streams and the McCloud River and gathering certain plants necessary for spiritual and physical healing. Traditional activities along the McCloud and the Sacramento rivers and tributaries include the cultivation and harvesting of plants for traditional uses: medicine, food (berries, acorns, fruit, roots, bulbs, leaves), arrow shafts, ceremonial fires, gathering bark for ceremonial huts, and more.

5. In June 2002, Winnemem Wintu Chief Caleen Sisk testified before Congress on sacred sites protection, particularly in light of the proposed raising of Shasta Dam and the catastrophic effect it will have on remaining sacred sites and ceremonial grounds still in use after all of the years of cultural genocide.

6. In 2004, the Winnemem Wintu Tribe held the Hu'pChona (a war dance, the words of which mean "dance in the old way") at Shasta Dam to oppose the raising of the dam and the proposed flooding of tribal cultural properties. It was also held at the state capitol in 2009 and at BałasChonas (puberty ceremony) in 2012.

7. The Winnemem Wintu say that when they first bubbled out of the sacred spring on Mount Shasta at the time of creation, humans were helpless and unable to speak. It was salmon, the Nur, who took pity on the humans and gave them their voice. In return, the Winnemem have promised to speak for them always. The Winnemem Wintu Tribe has never given up on the possibility of reintroducing McCloud salmon to the McCloud River. Perhaps the only positive thing to come of the Baird Fish Hatchery for the Winnemem was the taking of McCloud salmon eggs to the Rakaia River in New Zealand. The McCloud River salmon have survived only in New Zealand. Tribal members journeyed to visit and apologize to the salmon in 2010 and the story has been captured in an award-winning documentary film, Dancing Salmon Home. The tribe continues to speak and dance for the salmon, in ceremony (such as at Glen Cove; Carquinez Strait where the salmon return to the fresh water from the ocean; the Salmon Dance at the Coleman Fish Hatchery; and again in New Zealand) and through ongoing planning and discussions with the National Oceanic and Atmospheric Administration (NOAA) and the Bureau of Reclamation (USBR) for the reintroduction of McCloud River salmon to the McCloud River.

8. The Winnemem Wintu Tribe has had active involvement in California and federal water issues, a few of which are listed here:
    - Participation in California Water Plan Updates and representation on the Tribal Advisory Committee
    - Tribal Water Summits from 2009-2013
    - The only participating tribe in the Upper Sacramento Watershed Assessment with a two-year involvement and significant input in the final document
    - One of the founding members of the Upper Sacramento/McCloud/Lower Pit IRWMP; tribal members participated in writing the planning grant, and over a three-year period have attended every general meeting; they have had significant participation in special meetings/committees relating to governance, projects, and future funding, including meeting with John Laird, California Secretary for Natural Resources on the important

issue of Tribal Sovereignty; the Tribe is a cosponsor of a ground water monitoring project that will be in the IRWM Plan

- Member of the Delta Visions Stakeholders Advisory Committee from 2007-08
- Continues to oppose the raising of Shasta Dam and has objected directly to USBR as well as commenting on the Draft Feasibility Study and now Draft Environmental Impact Statement (EIS); the Tribe has fought raising of the dam since 2002 and will continue as long as needed; on this issue, the tribe is involved with ongoing meetings with representatives from the Governor's office and California departmental heads
- The tribe is in coalition with other environmental and fisheries organizations to protect the Sacramento/San Joaquin River Delta and is currently a plaintiff in a lawsuit against USBR regarding alleged illegal water contracts
- Tribal members spoke at Mt. Shasta City Council meetings, Siskiyou County Board of Supervisors meetings, and Mt Shasta community meetings against Pacific Gas & Electric (PG&E) Cloud Seeding Towers, and the threat of polluting nearby pristine water and sacred sites with silver iodide; they are also vocal opponents of chem trails and the use of geo-engineering chemicals that pollute the land, air, and water with toxins
- The Tribe has been a staunch active opponent of water bottling plants such as the proposed Nestlé plant in the town of McCloud and had been actively involved in the local movement to prevent the construction of this facility; the tribe contends that such large international corporations extract large amounts of water and reap huge profits that do not benefit local disadvantaged communities or the environment

9. As a traditional spiritual tribe, the Winnemem Wintu have always protected their sacred sites. The tribe received international recognition because of their stance, along with other allies, to stop development of a destination ski resort on Mount Shasta. The proposed ski area would have been located directly over the National Register-eligible Panther Meadow, one of the tribe's more sacred sites. They actively monitor sacred and historic sites throughout Shasta Trinity National Forest and have voiced opposition to the Federal Energy Regulatory Commission Relicensing (and proposed raising) of McCloud Dam. Actively involved in a lawsuit against the National Forest, the tribe asks that the Forest Service repair and/or mitigate damages to Winnemem sacred sites caused by Forest Service projects. One action asks the Forest Service to prevent pollution of a traditional Winnemem stream. The tribe is actively seeking National Register of Historic Places listings for their Traditional Cultural Properties that include sacred sites, ceremonial areas, and traditional cultural landscapes. The tribe is working with the Forest Service to document these places. The landscape of Wintu sites along the McCloud River is said to be one of the richer landscapes — next to only Yosemite or the Grand Canyon.

Proposed Winnemem IRWMP Projects:
More complete information on the conceptual projects can be found in Chapter 10. What follows here is a Winnemem Wintu story about the importance of beaver in the watershed and a summary list of some projects the Winnemem Wintu promote.

The Story of Besus as told by Chief Caleen Sisk:

> "Bring back the beaver to the side streams of the McCloud River. We call beaver by the name Besus, and he is the sacred center. He brings in the life by creating the central place that the birds can come, the plants can grow, the fish can spawn, and all of the animals and plants can live and revive. What beaver does is beneficial for the watershed. Every year they build their

dams and little huts, and every year the water flows down and breaks through the dam so the water can flow freely again. Beaver are vital to the health of our water statewide. We want to bring back the beaver in earnest to the high mountain pools that feed the river McCloud at Trout Creek. These natural reservoirs create sponge-like meadows that allow a natural seepage. Without the beaver, the water in the creeks all flows too fast. The US Forest Service has a model of this. We need a study of the beaver — what is their population now on the McCloud? Zero? We get them down on the creeks near here [Bear Mountain] but how many are still in the McCloud? The ancient rainbow, like the red band trout (Oncorhynchus mykissstonei) that we used to see on the McCloud would especially be helped by the return of the beaver because the trout need calmer pools during the spawning season to lay their eggs and there are no pools anymore because the river flows through without any place to rest. It needs to be understood that a study of the beaver should not be just a study of the beaver, but a study of the whole center that the beaver bring to the creeks and river. That is why we call Besus the sacred center."

1. Pilot project to bring the beaver back to the watershed
    a. The tribe advocates for more education about how the beaver historically improved the entire watershed. This project would be an educational opportunity to learn about the benefits of returning the beaver to its historic territory. Advantages of returning the beaver could include increased water retention, creation of cold-water pools, and improving and expanding habitat for other beneficial species. The project would include mitigation for possible economic loss to private landowners in the study area.
2. Protect, rehabilitate, and restore Mount Shasta high alpine meadows
3. Restore and enhance native fisheries; remove invasive species from riparian ecosystems; work with landowners to bring back anadromous species such as the McCloud River salmon
4. Monitor chemical composition of precipitation in high mountain meadows
5. Restore historic conditions in the meadow, the Ash Creek Sink, and at Coonrod
6. Groundwater monitoring and spring study throughout the region

Conclusion
Given the diversity of interests concerning natural resources in this region, it can be expected that, at times, there will be conflicting values and objectives. The RWMG for the USR is interested in helping avert and resolve adversity whenever it can by encouraging greater understanding of diverse interests and values. Such efforts can include support for education, opportunities for dialog and exchange of ideas among various stakeholders, and increased appreciation for the different social and cultural values related to water and related natural resources.

3.5 Water Supply and Management

This section includes an overview of water supply and management in the USR. Looking at a 20-year planning horizon, the year 2035 is the general horizon year for this planning process.

One of the challenges in a largely rural planning area is that there are few, if any, urban water providers as defined by DWR's definition (3,000 or more connections, or delivering at least 3,000 acre-feet annually). The USR has no purveyors qualifying as an urban water supplier. As such, they do not complete urban water management plans nor are these agencies required to implement best management practices for water use efficiency. In addition, there has never been a development of the size that would trigger a water supply assessment (at least 500 units, an industrial development using at least that amount of water, or any development that will increase water demand within a single system by at least 10%) by the water agency, land use planning entity, or developer. It is possible that an industrial development such as the proposed water bottling facilities throughout the region would trigger an assessment, but as yet none has been completed. While operators and Boards of Directors are aware of service area issues and needs, these conditions are often not represented in a formal water supply assessment for small purveyors.

In response to these circumstances, this section is arranged to address water supply on a general level first, then getting at greater specifics as supply and demand relate to individual water agencies. It will then go into more detail with municipal water supply and management infrastructure, including topics of recycling, transfers (including inter-basin), and water infrastructure.

This section also identifies the major components of infrastructure related to water resources in the USR. It recognizes the primary community service systems as well as major impoundments and conveyance infrastructure. Also recognized in this section are special water-related infrastructure components such as Box Canyon Dam, the hydroelectric system operated by Pacific Gas and Electric Company, and Shasta Dam that, while located outside the region, has substantial impacts to and implications on the rivers and watersheds of the Upper Sac IRWMP region.

Importantly, the DWR Guidelines request that regions respond to how this planning process may reduce reliance on the Sacramento-San Joaquin Delta. Since the USR is not dependent upon the delta for water, this question is not applicable. However, decisions made by state and federal entities in support of delta health and statewide water reliability could affect the quantity and timing of water availability within the USR. The outcomes of these negotiations are yet to be seen and stakeholders will rely further on increasing in-region flexibility and self-reliance to the extent that they are not already there.

3.5.1 General Water Supply Sources

The USR includes the complete watersheds of the Upper Sacramento River and the McCloud River and, therefore, these watersheds do not receive water from outside areas. The Medicine Lake Highlands surface flow contributes to the USR, but that area is also a significant recharge area for the Fall River Springs, which have an estimated output of approximately 869,000 acre-feet per year (USGS, 1998). The Fall River Springs feed Fall River, which is a tributary to the Upper Pit River. With the exception of the Lower Pit River watershed, whose source originates in the Upper Pit IRWM Region, it may be said that virtually no water enters the region from other than natural precipitation within the region. The Lower Pit River receives water from both the Upper Pit River watershed and from the diversion of water by PG&E from the McCloud River (which is within the same IRWM region but a different watershed).

As described in Section 3.5.5, the only conventional transfer of water out of the Sacramento River Basin to another basin (in this case to the Klamath River Basin) results from a small diversion from the North Fork of the upper Sacramento River to the watershed of the upper Shasta River. Some stakeholders consider the bottling and export of spring and ground waters throughout the region to be a water transfer.

3.5.2 Environmental Water Demands

DWR's 2012 IRWM Plan Guidelines ask for consideration of important ecological processes and environmental resources within the region and the associated water demands to support environmental needs. This is a complex and highly-specific subject, fairly localized relative to where particular impacts of a project may occur. For example, much more could be said in this chapter about the impacts that construction of Shasta Dam, McCloud Dam, and PG&E's hydroelectric facilities on the Pit River have had on ecological processes as a result of disrupting natural stream flows in specific areas. The operational protocols of particular facilities relative to ecological processes are important, as well, in the health and continuity of many downstream ecosystems. Operations policies and practices also have effects on recreational resources.

Along with the issue of the quantity of water supplies, water quality, including variations of water temperature, can significantly impact ecological processes. This has been noted, for example, in evaluations of how the changes of water temperature in the Lower McCloud River caused by McCloud Dam have affected aquatic resources such as the variety and distribution of particular species of fish.

Another example of a localized ecological concern was when the Nestle Corporation proposed a water bottling facility adjacent to the community of McCloud. Prior to the project being abandoned, various studies were conducted as part of the environmental review process to evaluate the potential impacts that water diversion and consumption might have on Squaw Valley Creek and related aquatic species and ecological processes.

This IRWMP will not affect water supplies or quality in any way, however, stakeholders have indicated a goal of increased coordination and communication throughout the region in order to implement projects that protect and/or improve the water supply and/or water quality conditions for in-region uses. It important to note that the IRWM process in this region relies upon the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA) when applicable and as administered by varies state and federal agencies to evaluate projects that may affect water supplies and related environmental resources. There is wide concern from tribes, community organizations, local governments, and other stakeholders that political pressures and regional water demand from state population centers may impact (negatively) available regional water supply. Commodification of water resources has promulgated many discussions and will likely be an ongoing topic for RWMG consideration.

3.5.3 Future Supplies and Demands

Given the upper watershed nature of this region, a typical regional water balance is irrelevant and not available to the region. Compared with the total outflow, there is no substantial diversion of water for consumptive use. The various agencies and communities in the region have a variety of master plans and other planning documents to project their future water supplies and consider needs in terms of expected future demand. With those analyses, they have identified improvements needed to accommodate future demand as well as to alleviate their current system deficiencies. Agencies adopt planning horizons for their master plans based on their resources, projections and needs.

Groundwater supply is an area where stakeholders acknowledge significant gaps in knowledge. While in-region resident experiences suggests that extensive groundwater withdrawals — as seen with water bottling facilities — negatively affect residential wells, there are no formal studies to back up this finding. The unknown nature of the resource has resulted in a lack of public protections. It is imperative for all stakeholders to gain a better understanding of this resource and there are in-region efforts to work with local, state, and federal agencies to better determine supply, potential yield, quality and connectivity, and other impacts.

Based on conversations with water system managers in the region and review of the applicable master plans and planning documents, it appears that the current sources of water for water suppliers in the region are, in most cases, adequate to meet the use demands that are expected by the year 2035. That expectation assumes: 1) that recent (slow or negative) growth trends continue; 2) that storage capacity and water distribution systems are maintained; 3) that regulatory activity remains as it currently stands with regard to withdrawal rates, and; 4) that the region isn’t subjected to prolonged droughts in that period.

There are systems that rely on sources of water that are particularly vulnerable to droughts, or which are not adequate to serve the extent of development that those sources are now expected to serve. Some of these systems, such as the County Service Areas in Shasta County, have been upgraded as needed. Some systems within the region will not realize the connectivity between surface infiltration and groundwater/spring sources until a prolonged drought occurs. Those communities reliant upon a single source of water — spring-, ground-, or surface water — acknowledge this weakness and are assessing alternatives to address it.

It should be noted that, in addition to water supply systems, a major constraint to communities in effectively meeting demands for community services is likely to be the lack of capacity of wastewater infrastructure to meet evolving standards and regulations for discharging treated wastewater. The City of Mt. Shasta, which partially discharges water into the Upper Sacramento River, is an example of a community facing that challenge and needing to upgrade its wastewater collection and treatment system.

Because of various physical and economic constraints to municipal development in the region, and considering recent growth trends, there are few indicators to suggest that there will be substantial growth of population and related water use in the region by 2035. Substantial increases in water use, if any, are likely to be related to water bottling and beverage production, and/or to development and operation of recreational uses such as new golf courses. Such uses will need to either develop their own water sources or enter into agreements with purveyors (e.g. cities, CSDs) for service, provided the purveyors have the capacity to accommodate the demand. For example, the City of Mt. Shasta's General Plan recognizes the prospects for residential and other development on the north side of town in what is known as the Spring Hill area, but developers will need to work with the city to extend the municipal water system with adequate storage to that area.

There are no known projects or changes in conditions (aside from potential impacts related to climate change) in the USR that can be expected to substantially decrease the amount of water that currently leaves the region. The in-region reservoirs are so small in relation to Shasta Lake reservoir that any flow criteria developed by the State Water Resources Control Board to address delta and other downstream needs will likely be insignificant for these upper reservoirs. Due to the rugged topographic character of this upland region and lack of land suitable for large-scale agricultural production, an appreciable increase in the use of water for agriculture is not expected.

What may be significant for the region are possible (and potential) unexercised water rights by Native American tribes. While currently unknown and un-quantified, federally recognized tribes do hold federal — and therefore correlative state — rights to water resources (DWR, 2009). As climate change alters regional hydrology, and more pressure is put on regional resources by interests south of the region, it will be important for the region — and for the state — to get a better understanding of these unexercised aboriginal water rights that may be called upon in the future.

Understandably, since the water that flows from or through the Upper Sacramento IRWM region is an important resource for the Central Valley Project (CVP), the U.S. Bureau of Reclamation and the users who are dependent upon that project have their own concerns about the impacts of climate change and other issues in the region that may impact the demands on resources. The same may be said for PG&E in regard to water used for hydroelectric production.

There are no substantial diversions in this region from the rivers that feed the CVP that would result in a net loss to the inflow of Shasta Lake Reservoir. Issues related to the water supplies of the CVP that are discussed in the IRWM plan include local concerns about the impacts of cloud seeding and weather modification and the proposal to raise Shasta Dam and the level of the reservoir (see Chapter 6, Issues and Interests). The potential impacts of geothermal development in the Medicine Lake area on the recharge and water quality of Fall River, which eventually flows into Shasta Reservoir via the Pit River, is also discussed. Also, concerns with the capacity of the cities of Mt. Shasta and Dunsmuir to treat wastewater that is discharged into the Upper Sacramento River (which flows into Shasta Lake Reservoir and supplies the CVP) in compliance with water quality regulations is an important concern in the plan (see Chapter 6).

In some ways, this region is insulated from many of the larger water resource concerns of California due to the fact that most of the water from this region flows into Shasta Lake Reservoir, which is managed by the Bureau of Reclamation for the CVP (the Bureau has not participated in this IRWM planning effort). In other respects, however, this region needs to be regarded as one of the primary resource areas for the entire Sacramento River system and the State of California. As climate change alters the hydrologic regime, it will be important that the state look to source water areas and invest in healthy ecosystems, fire-safe landscapes, and the communities relying on these resources.

3.5.4 Municipal Water Supply and Management Infrastructure

Much of the information presented below is shown in the measurement convention used by the water purveyor and/or city. There are two conditions under which water is measured—water at rest and water in motion. Water at rest is measured in units of volume. Water in motion is measured in units of flow— unit of volume for a convenient time unit. For easy conversion, the list below provides some common conversion metrics:

Volume:
1 cubic foot (cf) = 7.41 gallons
1 acre foot (af) = 326,000 gallons = 43,560 cf

Flow:
1 cubic foot/second (cfs) = 450 gallons per minute (GPM) = 0.646 million gallons/day (MGD)
1 GPM = 1/450 cfs = 0.00144 MGD
1 MGD = 1.547 cfs = 694.4 GPM

Dunsmuir

As one of the two incorporated cities in the region, the City of Dunsmuir maintains a municipal water system and a municipal wastewater system.

The Master Water Plan for the City of Dunsmuir was completed in 1994 and includes a summary of the existing water system, future water demands, recommended improvements, and estimates of cost. The Master Water Plan estimated raw water usage (metered and unmetered water consumption) in the year 1994 at approximately 0.45 million gallons per day (MGD) and estimated water usage for the year 2014 at approximately 0.62 MGD. Based on “ultimate development” conditions, which includes expanding the water system to serve unincorporated areas of the county, future water demand in the city is estimated to be 1.03 MGD.

The City of Dunsmuir is supplied water through the diversion of four of 16 springs known collectively as Mossbrae Springs. These four springs have an effective capacity of approximately 1.5 MGD and are located near the northern extent of existing development in the city. Based on a 1957 license for the diversion and use of water issued by the State Water Resources Control Board, the city has rights to 1.97 cubic feet per second (CFS), or approximately 1.27 MGD.

Water from the four springs is collected and discharged to a concrete weir box, where most of the water is discharged into an 18-inch steel water supply main. The remainder overflows the weir box and is allowed to flow down the hillside along with the remaining spring waters to form Mossbrae Falls, which flows into the Sacramento River. The entire Mossbrae Springs system (i.e. all 16 springs) is estimated to have a total yield of approximately 15 CFS, or about 9.6 MGD.

Water from Mossbrae Springs is of excellent quality and requires no treatment or chlorination at this time. However, existing chlorination facilities are available adjacent to the head-works. These facilities were constructed in the late 1970s when the water system began to show evidence of bacterial contamination from up-gradient sewage disposal systems. However, soon after the completion of the treatment facilities, the up-gradient development responsible for the problem was connected to the city's wastewater collection system and the contamination ceased.

The city also operates the Airport Well, which was established in the 1970s in order to provide potable water to Dunsmuir's Mott Airport in the northernmost area of the city. Given that the well was never designed to serve development beyond limited airport operations, the well has very limited production capacity, delivering only about four gallons per minute.

The city has two water storage reservoirs: North Dunsmuir, which was completed in 2007, and Woodridge, which dates back to 1905. Together these reservoirs provide approximately 1.0 million gallons (MG) of storage. The city's water distribution system consists of approximately 18.4 miles of 1- to 18-inch diameter pipeline of varying construction and ages. With a theoretical useful life of 55 to 75 years, depending upon the type of lining and coating used, most of the existing steel pipelines are very near the end of their useful life. According to city staff, a number of water main sections require frequent repair and are in need of replacement as soon as possible.

The City of Dunsmuir has applied to various state and federal agencies for grant monies to complete approximately $9,613,000 worth of improvements to the municipal water system as recommended by the Master Water Plan. While some of the recommended improvements have been made, such as the addition of a 600,000-gallon water storage reservoir in 2007, the city is still in the process of determining the best funding strategy for the remaining improvements. In the meantime, the city has adopted a water rate increase that will be phased-in over the next several years, which will cover some of the highest priority water projects.

The City of Dunsmuir Wastewater Treatment Plant (WWTP) is located approximately 1.3 miles south of the city limits in Shasta County, adjacent to the Sacramento River. The 2007 Master Sewer Plan for the City of Dunsmuir was prepared by PACE Engineering, Inc. and includes a summary of the existing sewer system, future sewer demands, recommended improvements, and estimates of cost.

The sewer system was originally constructed in the downtown area in the early 1900s, with the majority being replaced in 1975. The north Dunsmuir area was sewered in 1968. Some sewers in the downtown area experience a significant amount of infiltration and inflow (I&I), which is groundwater and stormwater that seeps into the sewer system during extremely wet weather. This I&I component increases the wastewater flows at the WWTP from an average dry weather flow (ADWF) of about 0.25 MGD during the summer to a peak wet weather flow (PWWF) in excess of 2.1 MGD during the winter.

The WWTP was completed in 1975 and has an ADWF design capacity of 0.41 MGD and a theoretical PWWF capacity of 2.0 MGD. Treated effluent is discharged directly into the Sacramento River during the winter (from September 16 to June 14). During the summer (June 15 to September 15) all effluent is discharged to the percolation ponds. The existing WWTP facility has capacity limitations in the secondary clarification process, which becomes ineffective at flows above about 0.6 MGD. During higher flows, solids are not removed in the clarifier and effluent is severely degraded, which prevents discharge to the river. During these conditions, effluent is discharged to the ponds, which consumes storage volume for summertime flows and violates effluent discharge requirements set by the Regional Water Quality Control Board.

The City received a Cease and Desist Order from the Regional Water Quality Control Board (RWQCB) on December 8, 2006, wherein it was charged that effluent copper, zinc, and dichloroboromethane (DCBM) concentrations at the treatment plant exceed permissible limits under the National Toxics Rule, the California Toxics Rule, and the Basin Plan (CDO No. R5-2006-0136, RWQCB). Some improvements have been completed at the WWTP to improve effluent water quality since 2006, though there is not adequate capacity to treat wet weather flows above about 0.6 MGD, resulting in poor effluent quality during wet weather conditions. This limitation prevents the city from being able to meet effluent discharge requirements, affects the city's ability to discharge to the river during high wintertime flows, and impacts the available effluent storage volume onsite for summertime use. Aside from the current need to enlarge the secondary clarifier, the treatment plant has been continually upgraded to meet state requirements and the needs of the city and is in good condition.

Mt. Shasta

The City of Mt. Shasta operates the municipal wastewater collection system, and the city-owned wastewater treatment facility has three means to dispose of treated effluent. The city releases treated water into the Upper Sacramento River in the canyon just below Box Canyon Dam during the winter. During the summer, reclaimed water can be used at the Mt. Shasta Resort Golf Course. The city can also pump treated effluent to a leachfield located on a Forest Service tree plantation near Highway 89 when the other two discharge methods cannot be utilized.

The City of Mount Shasta also owns and operates the municipal water system. The city captures water from Cold Spring (also known as Howard Spring) and delivers it to city residents. It also uses two groundwater wells to supplement demand in the summer if needed. The City of Mt. Shasta monitors the flow and usage rates of this spring. The average spring production fluctuates from month-to-month and year-to-year, with its lowest monthly production of 2.9 cfs (1,317 gpm) having been recorded in March 1992. It was also noted that maximum spring production generally occurs in the summer months; however, this varies from year to year, where in 2006 production peaked in June (with usage peaking in July).

The city has owned and operated its own water system since 1912, when it was purchased from the Sisson Development Company. Through the years, Cold Springs has been the primary source of water for the water system. The city's current water right is 100% of the Cold Springs yield, which is about 3.2 MGD based on a 20-year average annual production. The city also has two wells that can produce approximately 1.7 MGD to supplement the spring water resources in the summer and fall. In 2009, the city had 1,695 water service connections with an average day demand (ADD) of 1.7 MGD, and a MMD of 3.2 MGD.

The total estimated water production needed to serve build-out of the city's current water service boundary by the year 2030 is approximately 4.3 MGD. In addition, the city's General Plan planning boundary encompasses property that is outside the current water rights service boundary. Therefore, if the city wishes to achieve full build-out of its current water rights service area boundary or to serve areas outside of that service area boundary, then it will need to develop supplemental water supply sources. Interest in obtaining additional supply from Big Springs has been expressed by the city. Although multiple parties have rights and/or claims to Big Springs, and the acquisition of water rights for Big Springs would involve a lengthy and expensive process, the city's Master Water Plan suggests that the city may want to consider pursuing water rights in order to acquire additional cost-effective water supplies to meet future demands.

Because the city does not meter water usage, the city's current annual average water usage per household equivalent (HE), based on the current consumption rate of 1,026 gallons per day per HE, is very high; about 3.5 times that of Dunsmuir. A recommendation in the 2010 Master Water Plan is that the city may need to employ aggressive water conservation policies in order to postpone the need for future capital improvements needed to expand its water system.

The City of Mt. Shasta provides sewer service to a population of approximately 3,500. The regional sewage treatment plant, which serves the city and some unincorporated development in the vicinity, was completed in 1976 and is located approximately two miles south of the city limits. A gravity collection system connects the city infrastructure with the wastewater treatment plant. The collection system consists of approximately 30 miles of gravity sewer line. During the winter, as noted above, the wastewater treatment facility releases treated wastewater into the Upper Sacramento River at Box Canyon, just below the dam. During the summer, reclaimed water can be applied on the Mt. Shasta Resort Golf Course (the only occurrence of water reuse in the USR) and, as noted above, the city also periodically pumps effluent to a leachfield located on a Forest Service tree plantation when it cannot utilize the other two discharge points.

The wastewater treatment plant has increased its capacity from 0.75 to 0.80 MGD, which is sufficient to handle an additional 434 household equivalents. The average daily demand is 230 gallons per day per person. The City of Mt. Shasta, like Dunsmuir, also experiences significant I & I during wet weather. This I & I component increases the wastewater flows at the WWTP from an average dry weather flow of about 0.65 MGD during the summer to a peak wet weather flow in excess of 3 MGD. In conjunction with the climactic conditions during the winter months, this makes it very difficult to treat wastewater effluent to the required levels.

The City of Mt. Shasta 1992 Master Sewer Plan for the Sewage Collection and Treatment Facilities contains the results of an investigation of the sewage collection system and treatment facilities. The plan includes conceptual plans, staging, and cost estimates for the major capital improvements that were thought would be necessary for the time period of 1992–2012. The city also completed a Wastewater Treatment Plant Capacity Evaluation report in 2003. The report concluded that the plant was currently operating at 80% capacity. For the treatment plant to reach its existing design capacity, improvements would need to be made, some of which include upgrading of wastewater collector and interceptor lines.

The City of Mt. Shasta is currently under interim effluent limitations for operation of its wastewater treatment facility and is pursuing an upgrade of its current aerated pond wastewater treatment system to provide treatment levels equivalent to Title 22 Standards for reclaimed water prior to discharging to the Upper Sacramento River below Box Canyon Dam. In addition, the City has to reduce effluent concentrations of zinc, copper, and ammonia to meet new final limitations. These enhanced treatment requirements are considered necessary by the Regional Water Quality Control Board to preserve that stretch of the Upper Sacramento River as a pristine white water rafting and fishing area.

McCloud CSD

In addition to other community services, the McCloud Community Services District (CSD) maintains both a water system and a wastewater treatment system for the unincorporated community of McCloud.

The water supply capacity of the district comes from three springs — Upper Elk, Lower Elk, and Intake Spring — which provide approximately 13.4 cfs, or about 6,000 gallons/minute. The district is currently using approximately 25% of this capacity. The current residential water usage during summer is 4,500 gallons per day per connection, while winter use is 900 gallons per day per connection. (It is important to note that the McCloud Community Service District, like most other communities in the region, does not currently meter water usage, which contributes to the high estimates of water usage). Based on a usage of 4,500 gallons per unit per day, it is estimated that approximately 2,085 residential units could be built before reaching capacity.

The two Elk Springs used by the McCloud community have been identified as slightly vulnerable to contamination and potential over-use (CalTrout 2010). This is largely due to short residence time and age of the water, high usage, and the local nature of land uses in the recharge area.

The capacity of the McCloud CSD's wastewater system is 300,000 gallons per day, and the district is currently operating at 50% of capacity. With the current capacity and water supply availability, the district projects that a total of 500 residential units can be built (Siskiyou County 2010). McCloud's treated wastewater is discharged into Squaw Valley Creek.

Shasta County Water Agency

The Shasta County Water Agency was established in 1957 to develop water resources for the beneficial use of the people of Shasta County. The Water Agency's governing body is the Shasta County Board of Supervisors. On June 30, 1967, the Water Agency negotiated and entered into a contract with the Bureau of Reclamation for the delivery of up to 5,000 acre-feet of Central Valley Project (CVP) water annually for agricultural, municipal and industrial uses. Much of this amount was eventually assigned to cities, community service districts, and water districts in Shasta County. The Water Agency currently administers 1,022 acre-feet of Central Valley Project water that is subcontracted to private parties and other water purveyors in Shasta County. The Water Agency supplies portions of its CVP allocation to two county service areas located within this IRWM region (i.e. 77 acre-feet to CSA No. 3 – Castella, and 119 acre-feet to CSA No. 23 – Crag View). These CSAs are described below.

The Water Agency also serves as staff to the Redding Area Water Council, which was formed as a response, in part, to the drought period of 1987–92. The Water Council is dedicated to preserving the quantity and quality of water available in the Redding Basin. In May 2007, Shasta County adopted an AB 3030 Groundwater Management Plan for the Redding Groundwater Basin. In June 2007, Shasta County approved the Redding Basin Water Resources Management Plan to help ensure water supply reliability in the Redding basin during drought conditions. Shasta County is also a member of the Northern California Water Association (NCWA).

In 2010, Shasta County joined as a participating agency in partnership with Butte, Colusa, Glenn, Sutter and Tehama Counties for preparation of the Northern Sacramento Valley Integrated Regional Water Management (NSVIRWM) Plan. It was noted by the county in considering participation in the IRWM planning process that failure to participate could result in local water purveyors in Shasta County being disqualified from pursuing various types of state grants (Shasta County 2010). Shasta County maintains that its role is that of a "purveyor" of water as well as a jurisdictional agency due to its resources and functions as the Shasta County Water Agency.

County Service Areas

The County of Shasta has established eight county service areas (CSAs) that provide water service to rural unincorporated communities in the county. Three of these CSAs are located in this IRWMP region: CSA No. 2 – Sugarloaf; CSA No. 3 – Castella; and CSA No. 23 – Crag View. These CSAs, which are all located in the Upper Sacramento River watershed portion of the region, are described below.

The governing board of county service areas is the County Board of Supervisors. Some CSAs in Shasta County have an advisory committee to facilitate communication with the county concerning management of the particular district. Members of each community advisory board (CAB) are landowners and/or residents in the district who are informally elected by the landowners and residents of the district and formally appointed by the Board of Supervisors to two-year terms. Currently, none of the CSAs in the USR have an operating CAB.

The Shasta County Public Works Department is assigned responsibility for operation and administration of county service areas. CSA operations are under the Deputy Public Works Director for Operations with the Development Services Division retaining CSA administration duties including billing and collection and budget development and administration. CSAs are not supported by general funds of the county. Each CSA operates as an enterprise fund with water usage charges and related fees used as the basis for financing delivery and system operation and maintenance. A budget for CSA operations is presented annually to the County Board of Supervisors.

As reported in the Shasta County LAFCO *Municipal Services Reviews, Volume 1, County of Shasta and County Service Areas* (May 2003), all of the water CSAs in the county, including the three that are located within this IRWM region as described below, have sufficient water supply and access to water supply to meet the essential needs of its customers within its existing service area in the foreseeable future. It is recognized that the source and supply of water to all CSAs could be adversely impacted by severe drought conditions. Under such conditions, the county would take appropriate demand management actions necessary to ensure that any rationing or reductions would not impose a health and safety risk in affected communities.

CSA No. 2 – *Sugarloaf*: County Service Area No. 2 is located approximately 20 miles north of Redding at the upper reach of the Sacramento River arm of Shasta Lake Reservoir across from the Salt Creek inlet. The community, which is comprised of the Shasta Lake Subdivision, is located on the shore of the reservoir and is accessed from Interstate 5 at Lakehead via Lakeshore Drive. CSA No. 2 was formed in 1976 to establish an entity to secure financing, construct, operate, and maintain a new water system to serve the Shasta Lake Subdivision, which is the only development served by this CSA. The estimated population living primarily within the 86-parcel subdivision is 150 (Shasta LAFCO 2003). The population fluctuates seasonally. Residents are comprised of a mix of seasonal summer users, retired or semi-retired residents, and year-round owners who commute to nearby areas of employment.

Prior to 1976, residents in the area obtained water from a small spring-fed creek west of the subdivision. A small rock dam was constructed in the creek and water was diverted by gravity into a steel pipe to a concrete tank. In the summer, however, the spring would go dry and water would need to be hauled in. A loosely organized water company operated the system. The system was found to be unreliable and, when residents petitioned the county to assume responsibility, the county initiated proceedings to form a county service area. The CSA was formed in 1976 and construction of the water distribution, storage, and treatment facilities was completed in November 1978 (Shasta LAFCO 2003). Funding for initial construction was obtained through a grant and loan from Farmers Home Administration. An annual parcel charge was levied to collect funds to pay the annual debt service on the original loan. Three subsequent expansions of the distribution system were completed by late 1982. The expansions were financed entirely by the developers of the parcels to be served by the expansions.

CSA No. 2 obtains water from two sources. The primary source, and most of the total water available, is from an appropriative water right to an unnamed spring-fed stream located on a hillside in the northeast sector of the CSA. The water available through the diversion structure at the stream source is largely dependent upon the amount of rainfall in a given year and varies annually. A backup source, which is a well that pumps water from a mountain aquifer, was developed for when low rainfall results in inadequate supply from the stream.

As currently constructed, the system has a designed capacity of 86 services (Shasta LAFCO 2003). When LAFCO prepared the municipal services review in 2003, it found that there were 58 active services and 28 standby accounts (service available, but not connected). Therefore, the system was found to be operating at 64% capacity and, if the standby accounts were converted to consumer status, the system would be operating at full capacity. This CSA has not expanded its boundary by annexation since it was formed. In 1984, Shasta LAFCO adopted a sphere of influence for the CSA that provided for three expansion areas. The sphere of influence study noted that, should there be proposals to add more development within the CSA, the current water system would need substantial modification. An additional source of water would need to be developed and storage, treatment, and distribution facilities would need to be expanded (Shasta LAFCO 2003).

CSA No. 3 – *Castella*: County Service Area No. 3, which serves the community of Castella, is located in Shasta County approximately 50 miles north of Redding near the Siskiyou County line. The CSA is located on the west bank of the Sacramento River south of Castle Crags State Park and north of the community of Sweetbrier. Castle Creek flows west to east and into the Sacramento River through the community. Interstate 5, the Union Pacific Railroad, and two major power transmission lines traverse the area (Shasta LAFCO 2003). Land use consists generally of a mix of retired and semi-retired or unemployed residents, summer users, and year-round residents who mostly commute out of the community for employment. Commercial development includes two small grocery stores and a tavern. The community also has an elementary school and a fire station manned by a volunteer fire company.

Prior to 1976, the community’s water was diverted by a privately owned system through an open ditch from Castle Creek. The ditch ran through a pasture to a pit with sand that was intended to serve as a filter before the water was piped to the community. The filter and pipe inlet were not secure and rodents and small animals could get into the system and further diminish the water quality. The distribution system was also antiquated. The water quality problems were very severe and, in times of drought such as in 1976 and 1977, Castle Creek ran so low that surface diversions were difficult. These issues prompted the residents to petition the county for assistance in securing federal funding for a new water system. The Board of Supervisors requested initiation of proceedings to form a county service area and CSA No. 3 was formed in 1976 to provide and maintain an improved water system to serve the community of Castella.

The CSA obtains its water from an appropriative water right and an allocation from the Shasta County Water Agency. The source of water continues to be Castle Creek. The total water available to the CSA is 157-acre feet per year, based on the appropriative water right, which entitles the CSA to up to 80 acre-feet per year, and the Shasta County Water Agency allocation (derived from a Central Valley Project allocation through the Bureau of Reclamation) that provides for up to 77 acre-feet to the CSA per year (Shasta LAFCO 2003).

Construction of the district’s new water storage, treatment and distribution system was completed in November 1980. The water storage tank is located on a Forest Service parcel on a hillside on the east side of the district. Funding for initial construction was obtained by a grant and loan from Farmers Home Administration and a loan from the Shasta County General Fund. An annual parcel charge was levied in the district to pay the annual debt service on the original loan. The developers of the parcels to be served by such expansion finance any expansion of the system.

The water system, as currently constructed, has a designed capacity of 123 services. In 2003 there were a reported 90 active services and 21 standby accounts (service available, not connected) in the community of Castella. The system is approximately 68% capacity. If the standby accounts were all converted to consumer status, the current system would be operating a 90% capacity (Shasta LAFCO 2003). The CSA has not expanded its boundary by annexation since it was formed in 1976. Shasta LAFCO adopted a sphere of influence for the CSA in 1984, recognizing that the district might someday expand south into the community of Sweetbriar. However, there has been no effort on the part of landowners in Sweetbrier to convert from private water sources to water service from CSA No. 3 (Shasta LAFCO, 2003).

CSA No. 23 – *Crag View:* The community of Crag View is located immediately south of the Siskiyou County line along the west bank of the Sacramento River. The river generally bound the area to the east, the Siskiyou County line to the north, and Interstate 5 to the west.

Prior to 1992, the Crag View Community Services District (CSD) provided water service. By that year, the CSD was experiencing financial and organizational difficulties and its board of directors asked the County of Shasta to initiate a re-organization that would dissolve the CSD and create a county service area to assume responsibility for the water system. The Local Agency Formation Commission approved the re-organization for formation of the CSA in February 1992; the assets and liabilities of the Crag View CSD were transferred to the new CSA; a schedule of fees and charges was established; and CSA No. 23 began operating the water system (Shasta LAFCO, 2003).

The source of water is Castle Creek and the intake facility, storage tank, and treatment equipment is located near the Dunsmuir Railroad Park. The CSA receives an allocation of 119 acre-feet from the Shasta County Water Agency. The estimated population in the CSA is 180 (Shasta LAFCO, 2003). The CSA encompasses 73 parcels, of which 69 are connected to the water system. Therefore, the system is operating at approximately 90% capacity. There have been no annexations to the CSA since it was formed.

Other Infrastructure Systems

There are several systems operated by private companies in the region. These include the Lake Siskiyou Mutual Water Company, serving the community immediately surrounding Siskiyou Reservoir, and the Lakeshore Heights Mutual Water Company, which serves the community of Lakehead. The Lakeshore Heights MWC obtains its water by a diversion from Charlie Creek and has a permit to divert up to 128 acre-feet per year.

Individual domestic wells throughout the region utilize groundwater for human consumption and there are larger wells that supply water to bottling plants in Mt. Shasta and Dunsmuir.

Individual septic tanks are commonly used outside of areas served by community systems.

3.5.5 Inter-basin Transfers

The only case of a man-made inter-basin transfer in this IRWM region consists of a transfer of water out of the Sacramento River Basin to the Klamath River Basin resulting from a small diversion from the North Fork of the Upper Sacramento River to the watershed of the upper Shasta River. A small diversion dam on the North Fork diverts up to 15 cfs of water in winter and early spring for storage in Hammond Reservoir. The diversion site is on the south side of Mt. Eddy and transfers water northward via what is known as Eight Mile Ditch to the reservoir located southwest of the City of

Weed. Water is distributed from Hammond Reservoir to water right holders for summer irrigation in the upper Shasta River Valley during the irrigation season.

A diversion of between 2 and 8 cfs of water from the Upper McCloud River to the community of McCloud and ultimately to Squaw Valley Creek (a tributary to the Lower McCloud River below McCloud Dam) is made possible by Lakin Dam. The McCloud River Lumber Company constructed that small diversion dam in 1925.

As noted in the Resource Management Strategies (Chapter 8), the water bottling and beverage manufacturing that occurs within the USR could be thought of as a transfer, though non-traditional. This “transfer” is un-quantified and the effects of it on local resources (e.g. groundwater that supplies local wells) have not been assessed. This is a knowledge gap that USR stakeholders would like to address.

3.5.6 Dams, Reservoirs, and Hydroelectric Infrastructure

Box Canyon Dam and Lake Siskiyou

In 1969, the first construction phase of Box Canyon Dam was completed, creating Lake Siskiyou reservoir. Lake Siskiyou represents the only impoundment on the Upper Sacramento River between the headwaters and Shasta Lake Reservoir. The dam is 209 feet high with a length of 1,100 feet. Lake Siskiyou has a storage capacity of 26,000 acre-feet with a normal surface area of approximately 430 acres.

The Flood Control and Water Conservation District manages the flood control and water conservation in Siskiyou County and the county is the main landholder around Lake Siskiyou. These lands were acquired to facilitate construction and operation of the Box Canyon Dam and provide recreational opportunities, including water-based recreation and camping. Of the 2,240 acres owned by Siskiyou County, approximately 550 acres are below the ordinary high water mark of the reservoir, 1,390 upland acres are adjacent to the lake, and approximately 300 acres have been set aside as deer winter range (SHN 2004).

The reservoir captures water from the North, Middle, and South forks of the Upper Sacramento River and other streams that flow directly into the lake, many of which are spring fed (e.g. Wagon Creek). The hydroelectric plant at the dam has a total rated capacity of 5 megawatts (MW) of electricity. Siskiyou County owns the dam as part of the Siskiyou County Flood Management District. The County contracts out the operation of the power plant and leases out operation of the campground on the west side of Lake Siskiyou.

McCloud Dam and Related Hydroelectric Infrastructure

The infrastructural system developed and maintained by Pacific Gas and Electric Company (PG&E) to produce hydroelectric power from the waters of the McCloud River and the Pit River are substantial features relating to the hydrologic character of those streams. It is helpful to describe the system as two related systems: 1) the part of the system related directly to McCloud Dam with diversion from the dam to the Pit River, including the components of the system on the Pit River below that outlet, and 2) the part of the system that generates power from the Pit River prior to the point where the Pit River receives waters diverted from the McCloud River. These two systems are consistent with the licensing framework administered by the Federal Energy Regulatory Commission (FERC) for PG&E’s operations in the USR.

McCloud dam was constructed in 1965. It is a 241-foot-high, 630-foot-long earth- and rock-filled dam located on the McCloud River that impounds McCloud reservoir. The McCloud reservoir is approximately 5 miles long and has a surface area of 520 acres with a maximum storage capacity of about 35,197 acre-feet.

McCloud dam has been primarily a diversion facility for PG&E, as described below. However, PG&E has proposed to construct a new powerhouse at the base of McCloud dam as a new electrical generation component of its system. The McCloud Dam hydroelectric plant would use water stored in McCloud reservoir and released into the Lower McCloud River to meet instream flow requirements. No new impoundment is proposed. The turbine and generator set would have an installed capacity of about 5 to 8 MW. The Lower McCloud River runs approximately 24 miles from the dam to Shasta Lake Reservoir.

McCloud dam diverts flows from the McCloud River via a 7.2-mile-long tunnel (the McCloud tunnel) and a 563-foot-long pipeline section at the Hawkins Creek crossing that hydraulically links McCloud reservoir with Iron Canyon reservoir.

Iron Canyon Dam is a 214-foot-high and 1,130-foot-long earth-filled dam that impounds diverted water from the McCloud River as well as water from Iron Canyon Creek tributaries to create Iron Canyon reservoir on the ridge between the McCloud and Pit River watersheds. The reservoir has a maximum storage capacity of 24,241 acre-feet and a surface area of about 500 acres. The dam has a slide gate leading to a pipe for instream flow releases to Iron Canyon Creek.

The 2.9-mile-long Iron Canyon tunnel diverts water from Iron Canyon reservoir. An associated 1,194-foot-long pipeline at the Willow Spring Creek crossing and a 5,467-foot-long steel penstock provides water to the James B. Black powerhouse near the Pit River. The powerhouse contains two turbine generator units with a combined maximum capacity of 172 MW. The powerhouse is located about 0.5 miles upstream of the Pit 5 powerhouse described below. Flows discharge from this powerhouse via a tailrace leading directly from the generation units to the Pit River.

It is noted that, at this point on the Pit River, the waters from the two PG&E systems (i.e. the McCloud dam diversion and the facilities operated on the Pit River, described below) basically come together above the Pit 6 reservoir.

Pit 6 dam and reservoir are located on the Pit River downstream of James B. Black powerhouse. The Pit 6 dam is 183-foot-high and 560-foot-long concrete structure, and the Pit 6 reservoir has a maximum storage capacity of about 15,619 acre-feet and a maximum surface area of about 268 acres. The reservoir serves as the forebay for the Pit 6 powerhouse. Two 18-foot-diameter steel penstocks with a total flow capacity of 6,470 cfs extend 602 feet from the dam to the Pit 6 powerhouse turbines located at the base of the dam. The Pit 6 powerhouse is located at the base of the Pit 6 dam. The powerhouse contains two turbines with a maximum generator capacity of 80 MW. Water is discharged from the Pit 6 powerhouse directly into the Pit 7 reservoir.

Pit 7 dam and reservoir are located on the Pit River downstream of the Pit 6 powerhouse. Pit 7 dam is a 228-foot-high and 770-foot-long concrete gravity dam. The Pit 7 reservoir, which is approximately 8 miles long, has a maximum storage capacity of 34,142 acre-feet and a surface area of about 468 acres. Pit 7 reservoir serves as the forebay for Pit 7 powerhouse. Two penstocks extend 572 feet from the dam to the turbines in the powerhouse located at the base of the dam. The Pit 7 powerhouse contains two turbines with a maximum combined capacity of 112 MW. Water is discharged from Pit 7 powerhouse directly into the Pit 7 afterbay.

Pit 7 afterbay has a surface area of about 69 acres at a normal maximum water surface elevation of 1,067 feet msl (which is the maximum water surface of the reservoir). The afterbay dam is a 30-foot-high, steel reinforced, rock-fill structure. The Pit 7 afterbay serves to attenuate changes in the water flow from Pit 7 dam and powerhouse before entering Shasta Lake Reservoir, which abuts and sometimes inundates the afterbay.

PG&E has proposed to add a Pit 7 afterbay powerhouse, which would use water released upstream from the existing Pit 7 powerhouse and dam. No new impoundments are proposed.

The Pit 3, 4, 5 Hydroelectric Project (Pit 3, 4, 5 Project) is an existing combination of related hydroelectric facilities located on the Pit River above the James B. Black powerhouse. The Pit 3, 4, 5 Project consists of hydraulically connected developments with a total of four dams, four reservoirs, three powerhouses, associated tunnels, surge chambers, and penstocks. The powerhouses contain nine generating units with a combined normal operating capacity of about 325 MW. After passing through this network of facilities (including the Pit 6 and 7 facilities described above), the Pit River flows into Shasta Lake Reservoir.

While mention will be made of the Pit 3 reservoir, more popularly known as Lake Britton, it is noted that this reservoir is not actually in the USR. The region may be said to begin at the base of the dam. The Pit 3 development includes the 1,293-acre Pit 3 reservoir (Lake Britton). The reservoir has a gross storage capacity of 41,877 acre-feet. The Pit 3 dam is a concrete gravity structure with a crest length of 494 feet and a maximum height of 130 feet. The facility includes a tunnel and penstocks to deliver water to the powerhouse. The three generating units in the powerhouse have a total normal operating capacity of 69.9 MW.

The portions of the actual Pit River between hydroelectric facilities are described as reaches. The Pit 3 reach of the river extends approximately 6 miles from the Pit 3 dam to the Pit 4 reservoir. A steep-walled canyon confines the reach.

The Pit 4 development consists of the 105-acre Pit 4 reservoir, with a gross storage capacity of 1,970 acre-feet. The Pit 4 dam directs water through a long tunnel and penstocks to the powerhouse, which contains two generating units with a combined total operating capacity of 95 MW. The Pit 4 reach of the river extends approximately 7.5 miles from the Pit 4 dam to the Pit 5 reservoir. Similar to the Pit 3 reach, it is confined by a steep-walled canyon.

The Pit 5 development consists of the 32-acre Pit 5 reservoir, which has been described as “long, narrow, and riverine in character.” The reservoir has a gross storage capacity of 314 acre-feet. The Pit 5 dam, with a concrete gravity overflow structure 340 feet long and 67 feet high, diverts water via the 5,109-foot-long tunnel No. 1 to Tunnel Reservoir, also known as the Pit 5 open conduit. Tunnel Reservoir has a surface area of approximately 48 acres and a gross storage capacity of 1,044 acre-feet. The Pit 5 Tunnel Reservoir dam is a compacted earth fill embankment structure that is approximately 3,100 feet long and 66 feet high. The outlet of tunnel No. 1 and the inlet for tunnel No. 2 are both located in the bed of the Tunnel Reservoir. Water from the tunnel No. 1 enters the east end of this reservoir/open conduit below the water surface, creating the appearance of a large upwelling spring. At the west end of the reservoir water enters Pit 5 tunnel No. 2, which leads to the Pit 5 powerhouse. Tunnel No. 2 has a total length of 23,149 feet, leading to four penstocks that are 1,380 feet long. The penstocks feed the powerhouse, which contains four generating units having a total combined capacity of 160 MW.

The Pit 5 reach of the river extends approximately 9 miles from the Pit 5 dam to the Pit 6 reservoir. The upper portion has a very high percentage of riffle habitat and very few large pools. The middle portion near Big Bend flows through a more open canyon that narrows somewhat along the lower portion.

The Pit 6 reservoir represents the tailwaters of the Pit 5 powerhouse. Water surface elevations fluctuate in response to peaking flows entering from the Pit 5 powerhouse at the head of the reservoir and from the J. B. Black powerhouse (McCloud-Pit Project), which is on the Pit 5 reach a few hundred yards upstream of the Pit 6 reservoir. The Pit 6 reservoir and PG&E facilities downstream are described above as elements of the McCloud dam and Pit project facilities.

Shasta Dam

While Shasta Dam and its impoundment, Shasta Lake Reservoir, are technically not included in the USR (since the lower portions of the watersheds in the region terminate at the lake), the dam, reservoir, and related features are significant factors concerning water resources in the region and warrant discussion as related to this region.

The Bureau of Reclamation, which manages the facility, completed construction of the dam and reservoir in 1944. Shasta Dam is a curved gravity concrete dam on the Sacramento River about 9 miles north of Redding. The dam is 602 feet high and 3,460 feet long, with a base width or thickness of 543 feet. The dam controls runoff from about 6,420 square miles. The four major tributaries to Shasta Lake Reservoir are the Upper Sacramento River, McCloud River, Pit River, and Squaw Creek, in addition to numerous minor tributary creeks and streams. The dam has a current reservoir capacity, at full pool, of 4.55 million acre-feet (MAF) and a water surface area of 29,500 acres. Seasonal flood control storage space in Shasta Reservoir is about 1.3 MAF. The elevation of the lake, which also represents the approximate lowest elevation of the IRWMP region, is 1,070 feet.

Shasta Dam was constructed for flood control, irrigation water supply, municipal and industrial water supply, hydropower generation, and recreation purposes. Shasta Dam was constructed as an integral element of the Central Valley Project. The Central Valley Project (CVP) is the largest surface water storage and delivery system in California. The program supplies water to more than 250 long-term water contractors in the Central Valley, Tulare Lake basin, and San Francisco Bay Area. Shasta Reservoir accounts for approximately 40% of the total storage capacity of the CVP and provides for over half of the total annual water supplies delivered by the CVP. The CVP also provides flood damage reduction, navigation, power, recreation, and water quality benefits. The power plant at Shasta Dam consists of five main generating units and two station service units with a combined capacity of 715,000 kilowatts (kW).

Shasta Lake Reservoir supports extensive water-oriented recreation. Recreation within these lands is largely managed by U.S. Forest Service (USFS) as part of the Whiskeytown-Shasta Trinity National Recreation Area (NRA). There are also some privately owned and managed recreation facilities.

Shasta Dam is operated in conjunction with Keswick Dam, located about 9 miles downstream from Shasta Dam. Keswick dam was completed in 1950. In addition to regulating outflow from Shasta Dam, Keswick Dam controls runoff from 45 square miles of drainage area. Storage capacity of Keswick Reservoir below the top of the spillway gates at full pool is 23,800 acre-feet.

The USBR has initiated environmental compliance documentation for the Shasta Lake Water Resources Investigation. A feasibility study was reinitiated in 2000 to examine the potential of raising the dam and, consequently, the level of the lake. Reclamation and cooperating agencies are analyzing alternative dam raises from 6.5 to 18.5 feet and corresponding increases of reservoir storage. Issues related to raising the dam are discussed in the Hydrology and Water Resources section of this Region Description.

Cultural Effects of Shasta Dam on Aboriginal Lands and People

The site of Shasta Dam was a logical engineering solution to the challenge of delivering adequate water supply to the San Joaquin Valley and southern California, but the location was selected without regard to tribes' location and history. When Shasta Dam was completed, it created the largest man-made lake in North America, covering traditional ancestral villages, homesteads, cemeteries, and sacred sites. It submerged most of the habitable terrain in the region, including the Baird Fish Hatchery, Kennett, Copper City, and the Pit River Railroad and it blocked the salmon run that used to fill the rivers. (Clark 2005; Franco 2007; McTavish, 2010)

Among the many tasks required in order to build Shasta Dam, was a requirement that the USBR acquire the Redding Allotments (previously committed to the ownership and management of indigenous people) and move the graveyards that were below the impoundment level of Shasta Lake Reservoir. Each allotment case was unique. Determining the ownership and probate status, finding all the heirs, and completing the document search was likely time consuming. The acquisition of all of the required allotment titles was far from completed in 1941. Faced with the realization that lack of titles to the allotments might actually hold up progress on the project, the USBR turned to Congress for assistance. The Central Valley Project Indian Lands Acquisition Act (CVPILAA) of July 30, 1941, 55 Stat 612, gave the USBR "all the right, title, and interest of the Indians in and to the tribal and allotted lands within the area embraced by the Central Valley Project." The funds were to be deposited with "the superintendent of the appropriate Indian Agency." Given the issues with probate and the difficulty of finding all the heirs, it is unlikely that all entitlements were distributed. Many affected tribes continue to consider this an issue of environmental and legal justice, and continue to press the federal government to fulfill all the CVPILAA provisions and to fulfill promises[6] and provide payment and/or like lands for the allotments now submerged.

3.5.7 Integration and Coordination of Management Activities

While the water supply systems supplying communities with pressurized water are themselves fairly remote — from each other and from larger urbanized areas — there are opportunities to manage resources together in order to achieve common goals. Many of these are identified in the more specific objectives identified by the USR stakeholders, including quality water for human consumptive use, the environment, and for commercial use. While there may not be the opportunity for integrating infrastructure needs, gaining knowledge and recommendations from each other through regular communication and coordinated project development and implementation could represent a significant resource savings in time and money for all water purveyors involved in the USR planning process.

Throughout the IRWM planning process, stakeholders identified the lack of information as a hurdle for many types of planning activities, including knowledge of glaciation patterns, the connectivity of springs to surface and groundwater, understanding how groundwater connects to other resources throughout the USR, and understanding the probability and potential outcomes of future regulatory activities. All stakeholders agree that additional knowledge, shared by all participants, would go far in helping the USR to move forward with regional resource management. The details of the study development and data gathering can be difficult to establish collaboratively before adequate trust is established, and stakeholders anticipate conversations regarding standard practices and acceptable transparency as the RWMG continues to meet.

[6] The CVPILAA created a cemetery in the town of Shasta lake to replace historic burial grounds. Part of the CVPILAA promised to place this property in trust for the Winnemem Wintu and other affected families.

3.6 Climate and Geology

3.6.1 Climate

The elevations of the USR range from the lowest points at the lake level of Shasta Lake Reservoir at 1,067 feet above sea level to the highest point on top of Mount Shasta at 14,179 feet mean sea level (msl). Most of the region is located at elevations between 1,100 and 4,000 feet msl.

The region lies within the Mediterranean climatic zone, which extends into the Pacific inland west, from Mexico to south-central Oregon. This zone can generally be characterized as having warm, dry summers and cool, wet winters. Precipitation amounts are highly variable. Elevation and topography in the region vary substantially and exert a large influence on many climatic factors.

At the higher elevations of this IRWM region, approximate annual precipitation averages for the City of Mt. Shasta is 40 inches and for McCloud is 50 inches. Nearly all precipitation falls between October and May and may fall as both rain and snow at the lower elevations below 7,000 feet, while is mostly snow above 7,000 feet. In general, precipitation amounts increase with elevation with more than 70 inches above the 7,000-foot level. Summer rain and thunderstorms occur infrequently but can be intense.

As noted in the Mt. Shasta Watershed Analysis (USFS 2012), each side of Mt. Shasta has a different climate that is largely created by the mountain itself. The south side of the mountain (McCloud area) receives the most rainfall and winds are generally calm. In contrast, the north side of the mountain receives substantially less rainfall, becoming quite arid and is characterized by very windy conditions. The west side (near Mt. Shasta City) also can be quite windy, particularly when north-south winds are funneled through the Sacramento River Canyon and between the mountain and Mount Eddy. The east side of the mountain may or may not experience a rain-shadow effect, depending upon the approach of individual storm events.

Hot, dry summers and a mild climate characterize the lower elevations of the southern part of the region in the vicinity of Shasta Lake Reservoir during the remainder of the year. Average temperatures range from the mid-40s Fahrenheit in the winter months to near 80 degrees in the summer months, with summer days typically reaching near or above 100 degrees. Annual precipitation, mostly in the form of rain, varies from 45 to 75 inches depending on local topography. Approximately 85% of this precipitation falls from November 1 through April 30. Summer thunderstorms are common and can release significant amounts of localized rain. These storms can also be dry with conditions that encourage fire ignition and spread from lightning strikes. High summer temperatures combined with low humidity and limited rainfall are perhaps the strongest climatic influence on local plant communities.

3.6.2 Regional Climate Change Projections and Regional Responses

As a headwaters/source water area, the USR has unique climate vulnerabilities. Because of location, regional inhabitants cannot usually resort to an alternate water supply in times of drought or other crisis; a similar situation is found for environmental water needs. In addition, the risk of catastrophic fire looms large in projections of climate change effects on the USR landscape. Some of the more prominent regional vulnerabilities are listed below. More detail on these vulnerabilities, as well as priorities and adaptation strategies, may be found in the Climate Change section (Chapter 9). *NOTE: General topics are listed below in italic boldface, while specific vulnerabilities are underlined within the text.*

Water Supply/Demand
While the reliance of regional water providers on spring sources has had limited drought vulnerability in the past, a diminishing snowpack could severely affect these springs. Recent studies of have found that both the recharge elevation of these springs and the residence time of the water underground vary widely among the springs indicating that some supplies may be more vulnerable to impacts from climate change than others (California Trout 2010). The resiliency of these springs, and groundwater resiliency in general, is poorly understood due to the volcanic geology of the region. While spring flows do vary seasonally and year-to-year, how these fluctuations are impacted by periods of extended drought is not currently know. Given the vast water resources found in this region, this is an area sorely in need of additional study. In addition to these vulnerabilities, the seasonal water use variability is extreme in the USR, with summer use several times that of winter. This has affected supply in the past, and could negatively affect the amount of water available for inhabitants and the bottle water/drink industry in the region.

The limited storage capacity in the USR compounds regional climate vulnerability through having low-to-no storage capacity for municipal and industrial (M&I) water supply. There are storage reservoirs in the region, but these are dedicated to flood control and power supply and thus are not operated to supply water to M&I uses throughout the summer.

Water Quality
The biggest risk to water quality (and habitat, which will be described below), is the region's catastrophic wildfire risk. The potential for more frequent, extreme fire behavior is undoubtedly a risk associated with predicted temperature increases, longer dry periods, and potentially more storms. This increased risk will likely come with more frequent — and more severe — wildfires, which will affect water supply through increased sedimentation and faster spring melt and runoff. The increased percentage of burned area will affect the water quality shifts during rain events, and increased volume of water going through municipal treatment systems. This could increase the costs associated with water and wastewater treatment and could also affect effluent quality contributions to USR rivers.

In addition, climate change effects will negatively affect the ability of municipalities and wastewater treatment providers to adhere to beneficial use standards and discharge limits. Less instream flow (especially in summer) means that there will be less assimilative capacity in regional rivers.

Flooding
Unmanaged roads, commercial logging, forest management activities, and catastrophic wildfire can increase the hazards related to increased sedimentation and flooding through decreased storage and flow capacity. According to the Siskiyou County Draft Hazard Mitigation Plan (2011), the majority of flood related hazards are transportation related. Roads are typically closed due to varying degrees of erosion-related washout.

Ecosystem and Habitat Vulnerability
Erosion is an ongoing challenge in the region due to a complex and steep topography and numerous waterways, complicated by logging activities and a very active fire regime, which together contribute significantly to regional waterways' sediment load. As discussed earlier, the most significant threat to aquatic habitats is erosion exacerbated by extreme wildfire events.

There are some climate sensitive species in the region — usually those species with narrow distribution or already occurring at the edge of their habitat envelopes. The McCloud redband trout, which only occur in a few small upper watershed streams, may be vulnerable to more frequent or extended dry periods. As discussed further in this chapter, there are several threatened or endangered species in the region. However, overall there has been little research on the potential impacts of climate change on these vulnerable species within the region. The projected effects of climate change on regional waterways could affect the proposed reintroduction of anadromous species throughout the USR. This will be investigated by the federal agencies responsible for this action.

Adding to the climate change complications for native species is fragmented habitat in some places in the USR. Dams, highways, and some types of timber management can prevent the movement of fish and other aquatic species, as well as terrestrial and plant/tree species. This movement will likely be required as climate change alters the temperature and hydrologic regime. Forest composition and structure vulnerability can be seen in the biodiversity of plant species and loss of oak woodland habitat and old growth coniferous tree stands.

Hydropower
Pacific Power is the primary power provider in the region. As of 2011, about 8.4% of their electricity was generated by hydropower. While they operate outside of the USR, the same challenges that will be seen within the region — key being a changing hydrologic regime — will be felt by this company. While energy needs throughout California are expected to increase as the temperature warms, the future energy needs of the USR specifically are likely to be similar to the present, if not lower due to the region's growth rate and increased use and appliance efficiencies. In addition, while there is little opportunity for development of additional major hydropower facilities in the region, the abundant spring water sources and high topographical relief do present opportunities to develop inline hydropower associated with existing water delivery infrastructure, an opportunity that is being explored by local communities to meet local demand and become more self-sufficient.

3.6.3 Geology
The USR is located within portions of both the Klamath Mountains geomorphic province and the Cascade geomorphic province.

Rock units of the Klamath Mountains Province underlie large portions of the western and southern areas of the region. The geomorphic expression of these areas is controlled by the bedrock geology as expressed in topographic features, including the type, rate, and magnitude of erosion processes. The topography is rugged with prominent peaks and steep dissected drainages. Eroding hill slopes dominate the geomorphology features within these areas, although mass wasting features are frequent. Naturally occurring erosion, including mass wasting, is relatively high because of the steep terrain, parent materials and climate. The soils developed from the underlying parent material have distinct and characteristic properties that can affect vegetation patterns and disturbance mechanisms at multiple spatial and temporal scales.

Metasedimentary rock units are located in much of the region, including limestone units in the lower parts of the Upper Sacramento River and McCloud River watersheds. Small intrusions of igneous rock can be found throughout these areas and typically iron-rich ultramafics and silica-rich granitics. In the southern portions of the region in the vicinity of Shasta Lake Reservoir, which fall within the southeastern extent of the Klamath Mountains province, geologic features include multiple limestone terranes, including the McCloud Formation and Hosselkus limestone area. In addition to containing numerous limestone caverns, limestone terranes also provide habitat for many cave-adapted invertebrates and limestone-associated biota (USDA 2010). *(Note: A terrane is a section of the earth's crust that is defined by clear fault boundaries with stratigraphic and structural properties that distinguish it from adjacent rocks.)*

The limestone formation in the area around Shasta Lake Reservoir is unique in its development, composition, and contribution to paleontological significance. Because of its diverse fossil faunas, the area immediately north of the reservoir and between its McCloud and Pit Arms is considered to be one of California's most important areas for paleontological research (USDA 2010).

Castle Crags are a unique geologic feature in this region. This formation, with its towering granitic spires, is known as a pluton. Castle Crags are located within the Klamath Mountains' geological province, but large granitic bodies called plutons intruded into many parts of the province during the Jurassic period around 65 million years ago. Castle Crags are located about 10 miles south of Dunsmuir and are readily visible from Interstate 5. The Castle Crags Wilderness was established in 1984. This 10,500-acre addition to the National Wilderness Preservation System, along with lands within Castle Crags State Park, includes portions of this unique and scenic geologic feature and was formed to protect and manage this area.

Areas on the north and eastern sides of the Upper Sacramento IRWM Region are predominately located within the Cascade Range geomorphic province. The Cascades province is characterized by rhyolitic to basaltic volcanic activity. Many of the characteristic volcanic features of this province can be found in the region. Mount Shasta, at 14,179 feet, is at the top of the Upper Sacramento River and McCloud River watersheds. It is regarded as the largest stratovolcano in the Cascade Range. There are seven named glaciers on Mount Shasta. Mount Shasta has erupted, on average, at least once every 800 years during the last 10,000 years and about once every 600 years during the last 4,500 years (River Exchange 2010). The last eruption is believed to have occurred about 200 years ago.

The Medicine Lake Highlands, located in the northeast corner of this IRWM region, consists of a large shield volcano and volcanic area with a variety of volcanic formations including glass (obsidian) flows, lava flows, pumice deposits, lava tubes, cinder cones, and craters. The Medicine Lake Highlands area exceeds 200 square miles in area with the highest elevation at 7,913 feet above sea level. The most recent major volcanic activity in the area occurred about 300 years ago. The Medicine Lake Volcano includes a down-dropped caldera in which Medicine Lake is located. The caldera is now partly filled with ash deposits, glacial deposits, alluvium, and lacustrine deposits. Geologic features including Mount Hoffman, Glass Mountain, and Medicine Mountain define the rim of the caldera.

Concerning geologic features in this area, the Forest Service recognizes Special Interest Areas (SIAs) to protect areas with unique characteristics including, in some cases, geologic features. SIAs are protected for their educational, scenic, scientific, or recreational values. Special protection policies, such as prohibiting the construction of roads, apply to certain SIAs. For example, the following SIAs have been established in the Medicine Lake Highlands on the basis of unique geologic features.

- Medicine Lake Glass Flow Geologic Area: This 600-acre lava flow is an example of glassy dacite lava, and has been nominated by the Modoc National Forest for National Natural Landmark Status. It is located one-half mile north of Medicine Lake.
- Glass Mountain Glass Flow Geologic Area: This large lava flow, with impressive obsidian features, is located approximately 2 miles east of Medicine Lake.
- Fourmile Hill Tree Molds Geologic Area: This area, approximately 10 acres in size, contains cylindrical hollows in the lava flow which were produced when trees were engulfed by lava flows.

West of the Medicine Lake Highlands and on the north side of the McCloud River watershed is the area known as the McCloud Flats. This is an area of level lava flows and low volcanic buttes. The drainage pattern from this area is very sparse. Mud Creek is the only perennial tributary from the volcanic landscape to the north. However, south of the river is the Eastern Klamath Mountain Paleozoic Belt with its steep, metamorphic mountains. The channel of the McCloud River is of relatively low gradient for its entire length except for three distinctive waterfalls. The Upper McCloud

River is confined within a narrow canyon. The Lower McCloud flows to the southeast through the eastern extent of the Klamath Mountains province for its entire length. The gradient is steeper and the river lies in a wide canyon that has a well-defined inner gorge and riparian zone.

Several Quaternary (1.6 million years and younger) fault zones have been identified in the region, though, historically, the area has not experienced major seismic activity. Four earthquakes with a magnitude of five or greater on the Richter scale have had epicenters recorded in the vicinity within the last 100 years. There are many inactive pre-Quaternary faults throughout the area.

The region has periodically experienced smaller earthquakes in the magnitude range of three to five on the Richter scale. Seismic activity is related to volcanic features as well as fault zones. When magma and volcanic gases or fluids move, they may either cause rocks to break or cracks to vibrate. When rocks break, high-frequency earthquakes are triggered. However, when cracks vibrate, either low-frequency earthquakes or a continuous shaking called volcanic tremor is triggered. Over the past 20 years, an average of approximately five earthquakes per year with magnitudes of one or more have occurred beneath Mount Shasta. From time to time earthquake swarms in which many quakes with similar magnitudes have occurred during a short span of time have punctuated this background seismicity. For example, a quake as part of a larger swarm with a magnitude of 2.4 occurred in this area in September1992. The most seismically active area beneath the mountain lies about 18 kilometers southeast of Mount Shasta City at a depth of 10 to 12 kilometers (Hirt 2001).

Climate, geology, topography and other factors determine soil characteristics. Soil productivity is defined as the capacity of the soil to produce a plant community or sequence of plant communities under natural conditions or a specified system of management. There are a variety of factors that influence the productivity of soil, including soil depth, percent of rock fragments, texture, available water-holding capacity, nutrient status, maintenance of the duff layer, mineral toxicity, and pH. Other environmental factors that influence soil productivity are precipitation, aspect, slope gradient, and elevation. The productivity of the soil types in the region range from very low to high. The most productive soils occur in flat valley bottoms.

While a detailed discussion of soil characteristics is beyond the scope of this IRWMP Region Description for planning purposes, it can be noted that much of the region has been mapped for soil characteristics and the information is available. For example, in the Upper Sacramento River Watershed, the Soil Survey of Shasta-Trinity National Forest Area, California, identifies 62 soil map units with the most common soil families being the Marpa, Nuens, Goulding, and Estel. These four families are well drained and are of fine loamy-loamy/skeletal mixed composition. Approximately 25% of the soils within the area are classified as highly to very highly erodible. The greatest threats to the maintenance of soil productivity are sheet and gully erosion. Nearly all bare soil is subject to erosion if a sufficient amount of surface water flow is present. Some soils have a higher propensity to erode than others. Examples of highly erodible soils in the study area are Estel Family, Neuns Family, Goulding Family, and Deadwood Family. Soil conditions following intense, hot-burning fires are especially conducive to erosion.

3.7 Hydrology and Water Resources

3.7.1 General Hydrologic Features

3.7.1.1 Upper Sacramento River Watershed

The watershed for the Upper Sacramento River itself (as a distinct watershed within the USR) is approximately 600 square miles in size. Many small natural alpine lakes are scattered along the crest of the Upper Sacramento and Trinity River watershed divide, including Castle Lake, Grey Rock Lake, Cliff Lake, Toad Lake and others. Castle Lake is noted for being the site of the Castle Lake Limnology Laboratory of the University of California at Davis, which has been conducting limnology research in the region for decades.

The length of the watershed is approximately 40 miles. The most significant reservoir in this watershed is Lake Siskiyou, which lies behind Box Canyon Dam. This reservoir has a surface area of approximately 430 acres. Average daily flow of the Upper Sacramento River at entry to the reservoir is estimated to be approximately 1,000 cfs with a peak daily flow of 70,000 cfs (recorded in 1974) and an extreme low of 117 cfs (recorded in 1977).

3.7.1.2 McCloud River Watershed

The McCloud River Watershed covers approximately 800 square miles. The headwaters of the McCloud River are said to be at Colby Meadows, from which the river flows approximately 50 miles southwesterly to Shasta Lake Reservoir. The McCloud River is often described as having an Upper McCloud River section above McCloud Dam and a Lower McCloud River section below the dam. Major tributaries to the Upper McCloud River include Mud and Tate Creeks, as well as Big Springs. Most of the flow in the upper watershed enters the river system via springs, most notably Big Springs (more than 600 cfs). The McCloud reservoir, with a surface area of approximately 520 acres, is the only significant surface water body in the McCloud watershed, and is formed by the impoundment of water behind McCloud Dam. As part of the PG&E McCloud-Pit Hydropower Project, McCloud River flows are diverted at the McCloud Dam into the Pit River via the McCloud-Iron Canyon diversion tunnel. The hydroelectric project diverts approximately 75% of the Upper McCloud River's flow through a pipeline to Iron Canyon Reservoir, then conveys it downslope and discharges it into the Pit River at the Pit 6 powerhouse upstream from the Pit River Arm of the reservoir (PG&E 2006). As much as 90% of water flowing in the Upper McCloud River has been diverted at times to the Lower Pit River watershed. The McCloud-Pit Project is currently in the relicensing process administered by the Federal Energy Regulatory Commission (FERC).

The lower McCloud River flows approximately 24 miles from Lake McCloud into Shasta Lake Reservoir. Major tributaries to the McCloud River below the dam include Squaw Valley, Hawkins, Claiborne, and Chatterdown Creeks.

3.7.1.3 Lower Pit River Watershed

The Lower Pit River watershed is approximately 700 square miles. This does not include the portion above Lake Britton, as it is not included in the USR. From Lake Britton, the Lower Pit River flows approximately 40 miles to the confluence with Shasta Lake Reservoir. As noted in the description of the McCloud River watershed, a considerable amount of water is diverted from the McCloud River to the Pit River via the McCloud-Iron Canyon diversion tunnel.

The most significant surface water body in the Lower Pit River watershed is the Iron Canyon Reservoir, approximately 500 acres in size, which receives water from the McCloud River via a diversion tunnel. The infrastructural system developed and maintained by PG&E to produce hydroelectric power from the waters of the McCloud River and the Pit River are substantial features relating to the hydrologic character of those streams. In fact, it is impossible to describe the character of the Lower Pit River in this region without a description of the dams, reservoirs and reaches of river between PG&E's project features. These facilities are described in the Water-Related Infrastructure section of this Region Description.

The Squaw Creek watershed, which is a substantial watershed by itself, is located between the McCloud River and the Lower Pit River. While it may be considered a singular watershed, it flows into the Pit River arm of Shasta Lake Reservoir and, for the purposes of this description, is considered to be within the Lower Pit River watershed. The Squaw Creek watershed is the only large tributary to Shasta Lake that does not contain dams, reservoirs, or diversions.

3.7.1.4 Medicine Lake Highlands

Medicine Lake, from which this area derives its name, lies in a caldera near the top of the highlands at an elevation of approximately 6,680 feet. Medicine Lake has a surface area of approximately 430 acres at full pool. Very small lakes in the vicinity of Medicine Lake include Little Medicine Lake, Bullseye Lake, and Blanche Lake.

Total precipitation in the vicinity of the Medicine Lake Highlands is estimated at approximately 30 inches per year. Much of this precipitation falls in the form of snow. Surface water flow and groundwater recharge occur mainly during snowmelt in the late spring and early summer. There is almost a complete lack of surface runoff in the area. Most streams are intermittent, flowing only during snowmelt or intense rain shower events. One of the only recognized perennial streams in the area is Paynes Creek, which originates at Paynes Springs and flows for less than one mile before returning entirely to subsurface flow. Medicine Lake is fed primarily by emergent springs rather than from surface drainages. Outflow from Medicine Lake is believed to occur via Paynes Springs to the south of the caldera. Isolated springs are located in the area, representing surface outflow of shallow groundwater flow from snowmelt and winter precipitation.

While the springs that feed Fall River are not included in the Upper Pit River IRWM Region, much of the Medicine Lake Highlands area is considered to be a recharge area, via subsurface flows as opposed to surface drainage, to those springs. Fall River is a tributary to the Upper Pit River.

The Medicine Lake Highlands area has significant spiritual meaning and value to all of the tribes having ancestral territory in the USR. Some of these traditions are discussed in the ethnographic descriptions included in Section 3.4.5 of this chapter.

3.7.1.5 Groundwater

As noted in the geology section above, the western and southern portions of the region are largely comprised of geologic characteristics belonging to the Klamath Mountain geomorphic province. Much of that area is underlain by discontinuous sequences of metamorphic rocks and is largely made up of meta-sedimentary and peridotite rock types that are generally impermeable. Fractures and remnant stratigraphic sedimentary features create most void spaces capable of storing groundwater. Overall, the Klamath Mountain bedrock lacks the storage capacity needed to sustain a reliable groundwater aquifer (The River Exchange 2010).

On the northern and eastern sides of the region, typical of the Cascade Range geomorphic province, volcanic deposits underlie the area. These areas are typically a reliable source of clean groundwater.

The region includes two groundwater basins as recognized in DWR Bulletin 118: the McCloud Area Groundwater Basin (Number 5–35) and the Toad Well Area Basin (Number 5–37). The surface area of the McCloud Area basin is 21,320 acres, or 33 square miles. The estimate of groundwater extraction for agricultural use, based on a 1991 DWR survey, is estimated to be 3 acre-feet. Groundwater extraction for municipal and industrial uses is estimated to be 420 acre-feet. Deep percolation of applied water is estimated to be 280 acre-feet (DWR 2004).

The Toad Well Area Groundwater Basin is 3,360 acres in size. That area is fairly remote and unpopulated and there is, according to Bulletin 118, no known data for projecting a groundwater budget.

While there are numerous private wells and some community wells in the region, there are no other areas in the region that overlay designated groundwater basins. The area in the vicinity of Mt. Shasta City was once designated as a groundwater basin, but it is now considered to be a groundwater source area and groundwater use is not monitored. Competition for groundwater has increasingly become a concern in the vicinity of Mt. Shasta. Residents in the vicinity of a water bottling plant located immediately north of the city limits (formally known as the Coca Cola/Dannon plant) are concerned that the facility has the capacity to extract water in amounts that will adversely impact household wells. The plant has been dormant, but it was announced in the Mount Shasta Herald in October 2013 that the plant was purchased by Crystal Geyser, with an anticipated date of December 2014 to begin operations.

A significant data and knowledge gap is a real understanding of how groundwater resources are connected in this area and how industrial-scale water bottling affects surrounding residential wells. While residents proximal to these facilities have reported a lowering of their water levels and getting sandy or silty water during periods of operation, the connection to industrial activities has not yet been investigated. As the facilities operate using groundwater, which is not regulated, there are no requirements for studies or monitoring when placing a facility like this other than the basic CEQA requirements. With current groundwater law in California being the correlative use doctrine, the burden of proof lies on adjacent landowners to show that their water is being impacted by a neighboring owner. Thus, any investigationinto the effects of industrial-level groundwater effects on surrounding users will need to be completed by stakeholders or other “outside” interest groups.

The USGS Open File Report 86–65 (Water Resources Data for the Mount Shasta Area Northern California) assessed water quantity and water quality data collected from March 1981 to August 1984 at wells, springs, streams, and lakes in an 800-square mile area in the vicinity of Mount Shasta. Groundwater levels, discharges, temperatures and chemistry from 1981–84 are documented in the report. Although this is the most detailed study known, the data for continuous groundwater levels, rather than intermittent, is very sparse.

Groundwater quality in the Sacramento River Hydrologic Region is generally excellent. The cities of Dunsmuir and Mt. Shasta, and the McCloud Community Services District, obtain most of their water from springs and the water requires no treatment. However, most of the actual groundwater quality data are collected from areas downstream of the upper Sacramento River watershed. There is therefore a lack of groundwater quality, quantity, and residency/replenishment data.

In the rural mountainous areas of the watershed, domestic supplies come almost entirely from groundwater. A few communities are supplied by surface water, but most communities rely on groundwater supplies for public use. In these regions, groundwater supplies are extracted from highly fractured rocks within the subsurface, but these supplies are highly variable in both quantity and quality.

3.7.2 Water Quality

Water quality is important to the regional economy, residents’ health, and is an important spiritual value to indigenous people of the region. Thus, the protection of water quality and preservation of the purity of water used within this region and sent south to other parts of California is a concern of local residents on both an ethical and regulatory compliance level. Though multiple organizations – private, federal, and tribal – monitor water quality on an ongoing basis, some stakeholders believe that more effort could be made to monitor and track local water quality.

3.7.2.1 Regulatory Framework

There is an extensive federal and state regulatory framework in place to protect and improve water quality for beneficial uses. Today, many of these regulations directly influence water management actions in the region. The regulations are designed to support continued, long-term use of water supplies for drinking water, agriculture, and ecosystem benefits. Federal and California law mandates most of the water quality monitoring activities in the watersheds of the region. The primary laws governing water quality in the watershed are the federal Clean Water Act and the Porter-Cologne Water Quality Control Act (Porter-Cologne Act).

The 1972 Federal Clean Water Act (CWA) established strategies for managing water quality including requirements to maintain a minimum level of pollutant management using best available technology and a water quality strategy that relies on evaluating the condition of surface waters and setting limitations on the amount of pollution that the water can be exposed to without adversely affecting the beneficial uses of those waters. Section 303(d) of the CWA bridges these two strategies. Section 303(d) requires that states make a list of waters that are not attaining standards after the technology-based limits are put into place. See the following section for information regarding the USR's 303(d)-listed waters.

The US Environmental Protection Agency (EPA), State Water Resources Control Board, and Regional Water Quality Control Boards (RWQCBs) have permitting, enforcement, remediation, monitoring, and watershed-based programs to prevent and reduce pollution through both the CWA as well as the Porter-Cologne Act.

Pollution can enter a water body from point sources such as wastewater treatment plants and/or other industries that directly discharge to rivers and from non-point sources (NPS) over a broad area, including run-off from a city and/or agricultural farmland or grazing areas located adjacent to streams. Some NPS contaminants are naturally occurring in local rocks and soils, such as heavy metals (e.g. arsenic, chromium, selenium), but also come from urban runoff and include heavy metals, oils and greases, as well as herbicides, pesticides, and fertilizers. Preventing pollution from most point sources relies on a combination of source control and treatment, while preventing NPS pollution generally involves the use of best management practices (BMPs), efficient water management practices, and source control. In addition to mining, non-point source regulations and related best management practices are applicable to other types of ground-disturbing activities including construction and timber harvest.

Sediment has been identified by the EPA as a primary contaminant over the entire United States. Sedimentation levels and rates are affected by a number of management practices/oversights, including a suppressed fire regime and unmaintained roads. The topic is covered in the Upper Sacramento Watershed Assessment (River Exchange 2010), but an excerpt here provides context: "…fire suppression has changed the fire regime in the watershed from frequent low-intensity surface fires to infrequent stand-replacing fires. Large fires can pose a substantial risk to water quality as a result of causing a cascading sequence of flooding, accelerated erosion, channel scour, and increased sedimentation often related to water repellent soils, which can destroy productive habitats over large areas for years to decades."

NPS pollution is not typically associated with discrete conveyances. Congress originally passed the Federal Safe Drinking Water Act (SDWA) in 1974 to protect public health by regulating the nation's public drinking water supply. SDWA applies to every public water system in the United States. SDWA authorizes the U.S. EPA to set national health standards for drinking water to protect against both naturally occurring and manmade contaminants that may be found in drinking water. Originally, SDWA focused primarily on treatment as the means to provide safe drinking water. Amendments in 1996 enhanced the existing law by recognizing source water protection, operator training, funding for water system improvements, and public information as important components of safe drinking water. Under the SDWA, technical and financial aid is available for certain source water protection activities. The California Department of Public Health (CDPH) is responsible for enforcing the SDWA and drinking water regulations specific to California as defined in Title 22 of the California Code of Regulations.

The rivers of the USR are subject to compliance with the Basin Plan prepared by the Central Valley Regional Water Quality Control Board (Regional Water Board) in 2009. Even though the Basin Plan does not include actual monitoring activity, it is the document that sets the water quality objectives and drives on-going water quality monitoring efforts. The 2009 Basin Plan applies to the entire watersheds of both the Sacramento and San Joaquin Rivers, an area of approximately 27,210 square miles in size.

The recognition of beneficial uses is a critical component to water quality management in California. State law defines beneficial uses of California's waters that may be protected against quality degradation to include (and not be limited to) "...domestic; municipal; agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" (Water Code Section 13050(f)). Protection and enhancement of existing and potential beneficial uses are primary goals of water quality planning. Typical categories of beneficial uses (often overlapping) that are applied to rivers in this region are:

- Agricultural Supply (AGR): Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing. For example, this use, specifically irrigation and stock watering, is designated as existing for the Upper Sacramento River from the source to the Box Canyon Reservoir and Box Canyon Dam to Shasta Lake Reservoir.
- Water Contact Recreation (REC-1): This applies to uses of water for recreational activities involving body contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, and use of natural hot springs. Canoeing and rafting is a separate subcategory.
- Non-Contact Water Recreation (REC-2): Uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water or the likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, sightseeing, or aesthetic enjoyment in conjunction with the above activities.
- Warm Freshwater Habitat (WARM): Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates. This use, for example, is designated as existing for Lake Siskiyou and McCloud Reservoir.
- Cold Freshwater Habitat (COLD): Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
- Spawning, Reproduction, and/or Early Development (SPWN): Uses of water that support high-quality aquatic habitats suitable for reproduction and early development of fish. Two

subcategories, warm and cold, are included to further describe spawning habitat type. For example, this use is designated as existing for the Box Canyon Dam down the Upper Sacramento River to Shasta Lake Reservoir and is considered a potential use for Lake Siskiyou.

- Wildlife Habitat (WILD): Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g. mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.
- Hydropower Generation (POW): Uses of water for hydropower generation. The McCloud River and the Lower Pit River are recognized for hydroelectric uses.

The Basin Plan identifies both numeric and narrative water quality objectives applicable to water draining out of the watershed. The Upper Sacramento River above Shasta Lake Reservoir is not listed as water quality limited under Section 303(d) of the CWA (Central Valley Regional Water Quality Control Board 2006). For the 36.4-mile reach listed in the Basin Plan, all the beneficial uses are listed as threatened, but supporting (U.C. Davis 2010). The threatened status is related to the suspicion that metals from urban runoff and storm sewers are degrading water quality and threatening beneficial uses. Additionally, significant impacts to water quality have occurred within this reach, namely the Cantara spill of herbicides in 1991 and metals contamination from mine drainage near Shasta Lake Reservoir.

The McCloud River is designated in the basin plan for municipal and domestic water supply, contact and non-contact recreation (including fishing, canoeing, and kayaking), power production, cold freshwater habitat, coldwater spawning, and wildlife habitat. The Lower Pit River is designated for all of the beneficial uses designated for the McCloud River, as well as for water supply for irrigation and stock watering, warm freshwater habitat, and warm water spawning.

The Federal Clean Water Act (CWA) includes provisions for reducing soil erosion relevant to water quality. It makes it unlawful for any person to discharge any pollutant from a point source into navigable waters unless a permit was obtained under provisions of the Act. This pertains to construction sites where soil erosion and storm runoff and other pollutant discharges could affect downstream water quality. For free flowing streams, the turbidity levels are often a function of the suspended sediment.

The National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. NPDES is authorized by the CWA and is administered by the State of California through EPA authorization. Point sources are discrete conveyances such as pipes or ditches. Industrial, municipal, and other facilities must obtain NPDES permits if their discharges go directly to surface waters. Facilities may also need to obtain a NPDES permit if they discharge pollutants into a storm sewer system. Below is a table listing those permits awarded to entities operating within the USR boundary.

Table 3.3: NPDES Permits awarded within the USR boundary.

County	Holder	NPDES Permit Number	Details
Siskiyou County	California Cedar Products Company	NPDES Permit No. CA0082139	Adopted on 30 January 2003
	City of Dunsmuir	NPDES Permit No. CA0078441	Wastewater Treatment Plant, Adopted on 4 October 2012

County	Holder	NPDES Permit Number	Details
Shasta County	City of Mt. Shasta	NPDES Permit No. CA0078051	Wastewater Treatment Plant, Adopted on 4 October 2012
	Union Pacific Railroad Company	NPDES Permit No. CA0083178	Dunsmuir Railyard, Adopted on 27 January 2005
	Mining Remedial Recovery Company, Inc.	NPDES Permit No. CA0081876	Various mine locations, Adopted on 6 September 2002

The Sacramento Watershed Coordinated Monitoring Program (SWCMP) is a monitoring effort by the California Department of Water Resources (DWR), Northern Region, and the Regional Water Board. The SWCMP is designed to meet the monitoring needs of the Regional Water Board's Surface Water Ambient Monitoring Program (SWAMP) and the DWR Northern District. The purpose of the SWAMP is to implement comprehensive statewide water quality monitoring (DWR 2009). The SWCMP program monitors and assesses ambient water quality of the Sacramento River and its larger tributaries at locations from upstream of Shasta Lake Reservoir downstream to the lower ends of all of the larger tributary streams to the Sacramento River.

There are a variety of state laws in California pertaining to local land use planning and consideration of water resources and related impacts. These laws mandate detailed consideration by local agencies of water availability, use, and quality, as well as wastewater and stormwater management. For example, the California Environmental Quality Act (CEQA), codified in the California Public Resources Code (§ 21000 et seq.), requires identification of potential impacts that may result from proposed land use plans and projects. If potential impacts may be significant, detailed analysis, typically with an environmental impact report (EIR), and formulation of mitigation measures to eliminate or reduce those impacts to acceptable levels is required.

Counties and cities typically become the lead agencies for projects proposed in their jurisdictions, which means they become responsible for ensuring that review of the proposed project complies with CEQA. State agencies have their own CEQA procedures for projects in which they are the lead agency. Federal agencies have similar environmental review requirements pursuant to the National Environmental Policy Act (NEPA).

Concerning water resources, CEQA requires local agencies to consider hydrology and water quality impacts with specific questions such as whether the project would:

Substantially deplete groundwater supplies
Substantially alter existing drainage patterns or the amount of runoff water
Substantially degrade water quality
Place housing within a 100-year flood hazard area

Concerning utilities and service systems, CEQA analysis requires consideration of questions including whether the project would:

- Have sufficient water supplies available to serve the project
- Require or result in the construction of new water or wastewater facilities or expansion of existing facilities
- Exceed the capacity of the wastewater treatment provider

- Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board

3.7.2.2 General Source Water Quality

Much of the water in the USR is derived from snowmelt. As a result, the water in the system is generally very pure and low in dissolved minerals. The quality of surface waters in the region is generally considered good by the Central Valley Regional Water Quality Control Board (CVRWQCB), although some water bodies are affected by nonpoint pollution sources that influence surface water quality: high turbidity from controllable sediment discharge sources (e.g. land development and roads); high concentrations of nitrates and dissolved solids from range and agricultural runoff or septic tank failures; contaminated street and lawn runoff from urban areas, roads, and railroads; acid mine drainage and heavy metal discharges from historic mining and processing operations; and warm-water discharges into cold-water streams. (CVRWQCB 2009)

The quality of water in underground basins and water-bearing soils is also considered generally good throughout most of the region. Potential hazards to groundwater quality involve nitrates and dissolved solids from agricultural and range practices and septic tank failures. The ability of soils to support septic tanks and on-site wastewater treatment systems is generally limited particularly on older valley terrace soils and certain loosely confined volcanic soils in the eastern portions of the region (CVRWQCB 2009).

The surface water quality of streams and lakes draining the Shasta-Trinity National Forest and adjacent private lands generally meets standards for beneficial uses defined by the Basin Plan (CVRWQCB 2009). However, there are some areas where the water quality does not meet standards during periods of storm runoff; in some places, as a result of drainage from historic mining and processing operations.

While Shasta Lake Reservoir is not technically in the USR, the lake has a direct relationship with the region in several respects, including the case that the lake receives water directly or indirectly from streams and subsurface flows from the region before that water continues flowing downstream as part of the greater Sacramento River basin. The lake, therefore, is the recipient of pollution that may come from lands located in the USR (e.g. from mine sites in the region) or, in the case of the Pit River, pollutants that come from the watershed above the region, but which flow through the region (i.e. the Lower Pit River) before entering the reservoir.

Annually, approximately 6.2 million acre-feet of water flows into Shasta Lake Reservoir from the Sacramento River, McCloud River, and Pit River drainages. A favorable inflow-outflow relationship of 1.4 to 1 contributes to generally good water quality, both in the lake and downstream (USFS 1996).

Nutrient inputs and bacteria are not a major concern in the Upper Sacramento River and McCloud River drainages. However, they have been a concern in the Lower Pit River as a result of runoff from agricultural and range lands in the Upper Pit River watershed. Water quality concerns are influenced largely by the quality of the river coming out of the upper watershed. The main stem of the Pit River (headwaters to McArthur) is listed per CWA Section 303(d) as impaired for temperature, dissolved oxygen, and nutrients. In addition, several tributaries have been listed as impaired for elevated levels of fecal coliform bacteria (E. coli). Lake Britton, located on the Pit River immediately above this IRWM region, is subject to nutrient enrichment and algae blooms. In addition, 123 miles of the Pit River from the confluence of the North and South forks to Shasta Lake Reservoir is listed for Nutrients, organic enrichment/low dissolved oxygen, and water temperature. The river is targeted as low priority for the development of total maximum daily load (TMDL) standards, with proposed TMDL scheduled for completion in 2013 (California Water Board 2006).

Waters discharged by stream channels draining the areas disturbed by the mining of sulfide ore deposits are generally acidic and contain high concentrations of dissolved metals including iron, copper, and zinc. The sources of the metals are surface and groundwater discharge from underground mines and waters flowing through open pits, tunnels, mine tailings, waste rock, and tertiary deposits that include modern alluvium along the shoreline. Interaction with sulfide minerals and erosion of metal-rich material commonly result in low (acidic) pH readings and high metal concentrations.

For example, one source of the metals in the region is associated with the Bully Hill/Rising Star mining complex adjacent to the Squaw Creek Arm. Although the mines are no longer operational and remedial action continues, these areas are a documented source of metals and continue to be subject to an abatement order issued by the CVRWQCB. A containment structure constructed sometime during the early 1900s has filled with sediment downstream from the Bully Hill Mine. No information is available on the character of the material stored behind this earth fill dam. In 2006, North State Resources, Inc., conducted a Phase 1 Site Assessment of an area adjacent to, but over a small divide from, the Bully Hill Mine. That assessment documented elevated levels of sulfide minerals in sediment samples and extremely low pH values in surface waters draining the mine. A recent study conducted by the State Water Resources Control Board sampled mercury accumulations in fish at a number of locations throughout Shasta Lake Reservoir. That study documented elevated levels of mercury in some specimens (Davis, et al. 2010).

Another study of mercury contamination in fish from Northern California lakes and reservoirs found tissue mercury concentrations in fish from Shasta Lake reservoir (DWR 2007), That DWR report also discussed factors in addition to past mining activity that affect bioaccumulation of mercury in fish (DWR 2007). For example, the report cited that mercury is a natural element with many soils and rocks such as serpentine having low concentrations of mercury. Erosion and leaching carries minute quantities of mercury to downstream water bodies. Atmospheric deposition is also a factor. Deposition from burning of coal is a known source of mercury; research indicates that California is a receptor of mercury across the Pacific Ocean from Asia where coal combustion is heavily relied upon for fuel. Wildfires can also release significant concentrations of mercury stored in foliage and ground litter to the atmosphere and distant volcanoes can contribute to atmospheric deposition of mercury.

Other tributaries in this IRWM region to the main body of Shasta Lake Reservoir are also a source of metals, along with acid mine drainage from a number of mines in the Dry Creek and Little Backbone watersheds. In addition to runoff from the historic workings (i.e. adits and portals), there are a number of large tailing deposits that are currently leaching various metals into tributaries to the reservoir (CVRWQCB 2003a).

The *Upper Sacramento River Watershed Assessment* included discussion of mines on Little Backbone Creek. The Mammoth, Golinski, and Sutro mines are estimated to contribute, respectively, copper loads of 70.55, 1.1, and 0.11 pounds per day on an annual basis to Shasta Lake Reservoir. Additionally, it has been reported that a significant portion of the cadmium loads that are present downstream of Shasta Dam may come from the reservoir and its tributaries, depending on the flow regime (The River Exchange 2010).

Sampling has demonstrated low levels of chemical constituents regulated under Title 22 of the California Code of Regulations. Although limited data are available on metals in the McCloud and Pit Rivers, samples collected in 1985 and 1986 indicated generally low metals concentrations near or below laboratory reporting limits. Levels of minerals in samples collected in the project area and surrounding watershed in 2007 did not exceed the applicable maximum contaminant levels.

Federal and state agencies as well as PG&E and The Nature Conservancy have collected water quality monitoring data for the McCloud River. DWR maintains water quality information on the McCloud River in the California Data Exchange Center database. The Nature Conservancy monitors water quality at its McCloud River Preserve. Water quality monitoring of the lower McCloud River includes measures of water temperature, dissolved oxygen, pH, specific conductance, and turbidity, as well as correlated data on weather, air temperature, and debris movement. PG&E monitors water quality in compliance with its FERC licenses.

Natural processes and land use activities influence the water quality of the McCloud River. Turbidity and water temperature are two important factors that influence the water quality of the river and affect aquatic habitat. Turbidity is caused by suspended sediment transported from upstream waters and in surface runoff, particularly from disturbed landscapes. Water temperature is affected by a variety of conditions, such as river flows, solar radiation, and density of vegetation along the river. In the Lower McCloud River, water temperature is influenced by flows released from the McCloud Reservoir.

Mud Creek, a tributary upstream of McCloud dam, adversely affects water clarity in the McCloud River by periodically delivering large amounts of fine volcanic sediment from the Konwakiton glacier on Mount Shasta. The turbidity of the lower McCloud River is influenced by the water quality and water levels of the McCloud Reservoir and runoff from upland areas throughout the basin. Turbidity levels are generally low during most of the year, ranging from 5–10 nephelometric turbidity units (NTU's)[7], but can spike to more than 900 units during periods of intense rainfall and flood flows (FERC 2011). Sediment becomes trapped at McCloud Dam and is released into the lower river during large storm events, temporarily increasing turbidity levels, especially in the upper segments of the lower river. Testing of the McCloud Dam bypass valve can cause high turbidity for a short period when sediment is discharged from the reservoir into the Lower McCloud River.

Although little data exist on anthropogenic pollutants such as oil and grease, pesticides, and herbicides in the region, pesticide screening samples collected upstream of Shasta Lake Reservoir in the Pit and Lower McCloud Rivers in 1999 and 2000, respectively, contained low pesticide levels (FERC 2011).

Concerning water quality on the Medicine Lake Highlands portion of this IRWM region, the quality of water in that area is reported to be good. Water quality of Medicine Lake was monitored by the USGS in 1992, which found the lake to have good clarity, low nutrient levels, and low buffering capacity. Monitoring of oil, grease, and petroleum hydrocarbons in the lake found that all were below detectable levels. Additional sampling of Medicine Lake, as well as of Little Medicine Lake and Bullseye Lake, was conducted in November 1997. The results reported that the water quality of Medicine Lake, Little Medicine Lake, and Bullseye Lake is excellent, and that no sample indicated that an EPA water quality standard was exceeded for any constituent (U.S. Department of Interior 1998).

Clean Water Act Section 303(d) Listing

The State and Regional Water Boards assess water quality data for California's waters every two years to determine if they contain pollutants at levels that exceed protective water quality criteria and standards. This biennial assessment is required under Section 303(d) of the Federal Clean Water Act.

[7] Turbidimeters using the nephelometric principal compare the light scattered due to contamination with the light scattering from a standard reference suspension. The result is a measurement of turbidity in nephelometric turbidity units.

The list is reviewed for approval by the U.S. Environmental Protection Agency. Within the Upper Sacramento IRWM region, the waters listed in Table 3.4, below, are included on the 2010 California 303(d) list of water quality limited segments under (California State Water Resources Board 2013).

Table 3.4: 303(d) listings in the USR*

Water body:	Listed for:	Size affected:	Identified source:
Pit River (from the confluence of the north and south forks to Shasta Lake Reservoir)	Nutrients, organic enrichment/low dissolved oxygen, water temperature	123 miles	Agriculture and grazing
West Squaw Creek (below Balaklala Mine)	Cadmium, copper, lead, and zinc	2 miles	Abandoned mines
Shasta Lake Reservoir (where West Squaw Creek enters)	Cadmium, copper, and zinc	20 acres	Resource extraction
Shasta Lake Reservoir	Mercury	27,335 acres	Resource extraction

** While Shasta Lake Reservoir is technically not recognized as being located in the USR, it is noted as a related concern here.*

Other Water Quality Concerns

Concerns have been expressed in regional stakeholder meetings about the potential for water and ground contamination from weather modification activities. This issue as it relates to precipitation enhancement and geoengineering is discussed further in Section 6.4.2 of Chapter 6, Issues, Interests, and Challenges.

Geoengineering can be practiced for many reasons. It includes activities ranging from encouraging the growth of algae with the goal of taking up carbon dioxide, to spraying chemical elements into the atmosphere with the objective of reducing solar radiation or changing weather patterns all together. The Intergovernmental Panel on Climate Change has noted that these strategies have limited, if any, success. One of the reasons this issue is relevant to the USR is the perceived water quality changes associated with what some residents believe is an increase in spraying. Some residents report an increase in aluminum content of the free-flowing rivers throughout the region. At this time, there are no available agency technical reports or peer-reviewed scientific articles addressing these claims.

Aside from the water quality issues, unintended climatic consequences could be numerous, such as changes to the hydrologic cycle, including droughts or floods, caused by the geoengineering techniques, but possibly not predicted by the models used to plan them. Such effects may be cumulative or chaotic in nature, making prediction and control very difficult.

3.7.3 Spring Water

(Note: Much of the following discussion about springs in this region is credited to the Mount Shasta Springs 2009 Summary Report, published in 2010 by California Trout. That report is discussed below.)

Mount Shasta's glacial meltwater, as well as meltwater from snowfields and rainfall in the higher elevations of the local watersheds and the Medicine Lake Highlands, percolate through the volcanic geology and emerge as hundreds of springs. Springs feed the McCloud River and the Upper Sacramento River and are substantial tributaries to the upper reaches of these streams. Spring-fed rivers have a constant input of cold water, as opposed to rivers fed primarily by surface runoff. The cold, clean spring waters provide ideal habitat for native trout and many other fish and aquatic populations.

Rainfall, snowmelt, and glacial meltwater filter through layers of volcanic rocks. There are few perennial streams flowing off the sides of Mount Shasta or from the Medicine Lake Highlands. Most of the water is absorbed into the ground and eventually flows to the surface as springs. Springs feed the base flow of stream headwaters and may be pumped by private and municipal water systems. Springs are fundamental sources of municipal water supplies for local communities such as McCloud and the cities of Dunsmuir and Mt. Shasta.

As summarized in the *Mount Shasta Springs 2009 Summary Report* (California Trout 2010), following are examples of some the most prominent springs in the region:

McCloud Big Springs
The Big Springs on the McCloud River is said to contribute from approximately 600 cubic feet per second (cfs) to 200 cfs, which is a considerable percentage of the total flow of the McCloud River at that location. It discharges directly into the McCloud River, emanating from a deeply eroded escarpment on the Hearst Property.

Muir Falls
Muir Falls also discharges directly into the McCloud River, located at an elevation of approximately 2,983 feet. It is a large spring that discharges along a wide area of riverbank at river surface.

Elk Springs
There are two discharges that are considered to be Elk Springs: Upper Elk and Lower Elk. Both of these springs are utilized by the McCloud Community Services District (CSD) to provide drinking water to the community of McCloud.

Intake Spring
Intake Spring is also a source of drinking water for the McCloud CSD. The springs are located at approximately 4,610 feet, with a calculated recharge elevation of 6,435 feet.

Mt. Shasta Big Springs
Mt. Shasta Big Springs is located in the Mt. Shasta City Park and is frequently publicized as the headwaters of the Upper Sacramento River. It has an average estimated discharge of 20 cfs. It is considered to be a non-thermal spring. The tritium sampling of this spring indicated the water to be greater than 50 years old.

Cold Springs
Cold Springs, also known as Howard Springs, is an important water source for the City of Mt. Shasta. The City of Mt. Shasta monitors the flow and usage rates of this spring. The average yearly spring production fluctuates from year to year, with its lowest monthly production of 1,317 gallons per minute at 2.9 cfs having been recorded in March 1992. It was also noted that maximum spring production generally occurs in the summer months; however this varies from year to year, where in 2006 production peaked in June (with usage peaking in July).

Mossbrae Springs
The City of Dunsmuir is supplied water through the diversion of 4 of 16 springs known collectively as Mossbrae Springs. The entire Mossbrae Springs system (i.e. all 16 springs) is estimated to have a total yield of approximately 15 cfs, or about 9.6 MGD. The water from the springs falls into the Upper Sacramento River as the scenic feature known as Mossbrae Falls.

Medicine Lake Highlands' Springs

In the Medicine Lake Highlands, despite an estimated 30 inches per year of precipitation at higher elevations, there is a lack of surface runoff due to the extreme permeability of the volcanic geology and infiltration of precipitation. Isolated springs are located in the area, often representing surface outflow of shallow groundwater flow from snowmelt and winter precipitation. Medicine Lake itself is fed primarily by emergent springs rather than from surface drainages. Outflow from the lake is believed to occur, in part, via Paynes Springs to the south of the caldera. Paynes Springs, which is a pair of springs, is the source of Paynes Creek. Other springs in the area include Schonchin Spring, Crystal Springs, and Tamarack Spring.

Groundwater elevations in the vicinity of Medicine Lake, including the Giant Crater Lava Field which extends southward from the southern flank of Medicine Lake Volcano, indicate radial flow away from the area and contribute to spring flows outside the area. The headwaters springs for the Fall River, which is a significant tributary to the upper Pit River, are located approximately 35 miles to the south-southeast of Medicine Lake (outside this IRWMP region). Those springs, which emerge from the distal end of the Giant Crater Lava Field, provide the Fall River with a high volume, near-constant water source. In fact, the Fall River is said to originate from what is considered California's largest network of cold-water springs. In total, the entire spring system generates approximately 1,200 to 2,000 cfs of water. By some calculations, 85% of the summer base flows in the Pit River actually originate in the Fall River. At approximately one million acre-feet per year, the Fall River is said to be responsible for supplying nearly 22% of the storage capacity of Shasta Lake Reservoir.

Mount Shasta Spring Waters Study

The *Mount Shasta Springs 2009 Summary Report*, published in 2010 by California Trout, reported the findings of an initial baseline study on general water quality and geochemical parameters, recharge area, age, and vulnerability of springs that originate around Mount Shasta mountain. The study focused on springs in three areas: the two watersheds of the McCloud River and the Upper Sacramento River, both of which are in this IRWMP region, and the watershed of the Shasta River (a tributary to the Klamath River). The Shasta River watershed is northwest of and outside this IRWMP region.

Recognizing that much of the water resources in the area depend on springs that are sourced from glaciers, snow pack, and rainfall that originates on Mount Shasta, the spring and groundwater study was initiated by California Trout to assist local governments in considering policies regarding related water resources of the greater Mount Shasta area. The study was conducted and evaluated by a collaboration of California Trout, AquaTerra Consulting, the UC Davis Center for Watershed Sciences, and other project partners. The spring waters study was conducted from 2007–2009, and the report was published in 2010. A related vulnerability rating report concerning the springs was published in 2011 as an addendum to the study.

The scope of the Mount Shasta Springs study included taking water samples from 22 springs on Mt. Shasta, beginning in fall of 2007. Springs at high, middle, and low elevations in each of the three watersheds were sampled. The water samples were analyzed for a suite of general water quality and geochemical parameters. A subset of the samples was also analyzed for oxygen, hydrogen and deuterium isotopes. The intent of the sampling was to determine where the water originates on the mountain, as well as to consider if certain springs may be related. This information was gathered to assist in determining if and how these springs may be impacted as the result of development and/or climate change. To further support the study, nine springs were monitored for flow to determine if seasonal and yearly fluctuations in flow are occurring.

Five of the spring samples were age-dated based on analysis of the tritium isotope. After the first year the study was refined and the 2009 report summarizes and analyzes the first two years of data. The information collected from the study informed the development of a vulnerability rating for the springs sampled. The rating analysis assumed that Mount Shasta spring waters could be vulnerable to land use (water quality), development (water use), and climate change (variability). The purpose of the vulnerability rating is to assist with water management decisions (California Trout 2010).

The springs that contribute to the McCloud watershed that were sampled as part of this study all seem to have reduced sulfate equivalent, which may be an indication of a shorter travel time. This coincides with the tritium isotope results obtained on Muir Falls on the McCloud River, which has been dated at approximately 14 years. This is a significant spring in the McCloud basin and, coupled with the dating results, data could indicate that the aquifer of this spring (and potentially McCloud Big Springs) is a very large one with limited storage. Some of the other springs do not have year-round flow or appear to fluctuate, indicating more relation to seasonal snow pack melting.

Most of the springs in the McCloud River drainage are considered to be non-thermal springs with low dissolved constituents, limited water-rock interaction, and inferred low residence time. Low residence times are most obvious in Intake, Widow, Bundora, and Esperanza springs, which all have local recharge areas. Due to this factor, the study concluded that they could all be considered more vulnerable to precipitation fluctuations. McCloud Soda Springs shows high dissolved constituents, low discharge rates, longer residence time, and slightly elevated temperatures, making it the only "slightly-thermal mineral spring" in the McCloud basin (California Trout 2010).

The springs that discharge into the Upper Sacramento River watershed are also mostly classified as non-thermal springs with low dissolved mineral constituents and low residence time. There are a few exceptions to this generalization. One exception is Mt. Shasta Big Springs, the water of which has been dated to be older than 50 years, indicating high recharge elevations and longer recharge paths. There are also a few slightly-thermal mineral springs located in the Dunsmuir area, which have slightly elevated temperatures and high dissolved mineral content. The Cities of Mt. Shasta and Dunsmuir depend upon spring water as their potable community water source and some data on spring production and water use in these cities was obtained and included in the study.

3.7.4 Geothermal Water

The Glass Mountain Known Geothermal Resource Area (KGRA) is situated within the Medicine Lake Highlands – a volcanic region consisting of a caldera and surrounding volcanic features. The United States Geological Survey (USGS) began exploring the Glass Mountain region in the 1960s. While there were no known hot springs in the area, when the USGS discovered evidence of geothermal resources, the area was designated as a KGRA. The Bureau of Land Management (BLM) assumed responsibility for subsurface resources and the US Forest Service (Modoc National Forest) manages surface assets in this area. The BLM and USFS conducted environmental assessments for exploratory drilling and offered geothermal leases to private developers beginning in the mid-1980s. To date, exploratory wells have been drilled but no geothermal energy has been produced.

Two geothermal development projects were proposed on federal leases in the Medicine Lake Highlands in 1997. The first of the two, Fourmile Hill, involved a proposed 49.9MW dual-flash geothermal power plant, well field, and 24-mile, 230-kilovolt (kV) transmission line. The Fourmile Hill leaseholds are outside the rim of the caldera and to the northwest. The second project, Telephone Flat, would also produce 49.9MW of power with similar support facilities requiring a 12-mile transmission line. Telephone Flat is located within the caldera, within a mile from Medicine Lake. The project sites are located within six miles of one another, but the projects were proposed independent of each other. A variety of environmental studies, including combinations of environmental impact statements pursuant to the National Environmental Policy Act and environmental impact reports pursuant to the California Environmental Quality Act, were prepared for both projects. By 2012, the geothermal developer had withdrawn both project approvals in favor of a new larger 480 MW geothermal development proposal. The new proposal is nearly 5 times larger than the two previous 49.9 MW projects.

The geothermal development projects proposed in the vicinity of Medicine Lake have been controversial and the subject of litigation. A lawsuit filed in May 2004 argued that the BLM renewed geothermal leases without taking previous reports into consideration or consulting adequately with affected Native American tribes. The proposed sites are on federal lands that are also the location of sacred grounds according to local Native American nations. The Medicine Lake Highlands have been identified as being sacred to the Pit River, Klamath, Modoc, Shasta, Karuk and Wintu tribes. A coalition of tribes petitioned the National Register of Historic Places to recognize the Medicine Lake Caldera (the oval crater within the highlands) as a Traditional Cultural District in August 1999, which was enlarged in 2005 to include 73,000 acres, covering a large portion of the Medicine Lake Highlands.

Concerning other related water resources, one reason for opposition to geothermal development in this area has been concern that geothermal drilling could have a significant adverse impact on groundwater quality. Hydrologic and geothermal resource assessments have evaluated the potential effects of projects on existing surface water and groundwater resources and the effects associated with geothermal heat extraction. Specific concerns were expressed during public scoping that the use of shallow groundwater for geothermal activities would adversely affect or compete with existing groundwater uses in the Medicine Lake basin; that blasting required during project construction could impact private wells in the area; and that spills or releases of either geothermal fluid or any potentially harmful substances used by the projects could impact surface water or groundwater in the area. On a regional basis, concern was expressed that production or injection of shallow groundwater or geothermal fluids could adversely affect the quality and/or quantity of flow to the Fall River Springs or would adversely impact thermal features in the area.

Geothermal water and hot springs are found within this IRWM region in the Big Bend area along the Lower Pit River. Hot springs have been given names including Indian Hot Springs and Crystal Hot Springs. Temperatures are reported to be as high as 170 to 180 degrees Fahrenheit. Much of the hot water flows from the riverbank into pools or otherwise directly into the Pit River. The Big Bend area has a history of resort operation and other uses of geothermal water.

3.7.5 Flooding

Flooding is generally a natural event and can provide many natural and beneficial functions to natural floodplains. Nonetheless, when human development in areas susceptible to flooding is factored in, flooding can impact the environment and community development in a variety of adverse and costly ways. In many areas as population growth expands, there is increased pressure to develop within floodplains. Such development limits the options available to flood managers and exacerbates flooding potential. Even with new requirements that require flood management to be incorporated in agency general plans, flood managers are sometimes not included in development decision-making.

While most communities in this region are located in topography that is not as conducive to general or major flooding (aside from localized flooding, e.g. blocked culverts) as communities in valley-type settings, there are communities in the region that have experienced and are vulnerable to flooding. For example, the Upper Sacramento River flows through the City of Dunsmuir and has caused flood damage on numerous occasions. Significant floods and damage in the city since 1911 are reported to have occurred in January 1997, January 1974, February 1940, January 1914, December 1964, March

1916, and December 1955 (FEMA 2011). Damage from the 1974 flood in Dunsmuir was estimated to have cost $4.2 million with 25 homes destroyed. The city has experienced substantial damage from flooding to its wastewater collection and treatment system on several occasions.

Flooding can damage water and sewer systems. Floodwaters can back up drainage systems and cause localized flooding. Culverts can be blocked by debris such as logs from flood events, also causing localized urban flooding. Floodwaters can get into drinking water supplies, causing contamination. Sewer systems can be backed up, causing wastewater to spill into homes, neighborhoods, and streams. Transportation systems are also subject to being damaged by flooding. Roads are typically closed due to varying degrees of erosion-related washout. Road shoulders may be compromised due to high levels of runoff and rill erosion from intense precipitation. At the most severe stages, entire roadways may be undercut and eroded due to high discharges where roads parallel flooding waterways.

The most problematic secondary hazard for flooding is bank erosion, which in some cases can be more harmful than actual flooding. This is especially true in the upper courses of rivers with steep gradients where floodwaters may scour the banks, edging properties and infrastructure improvements closer to the floodplain or causing properties to fall into the river. Flooding is also responsible for hazards such as landslides when high flows over-saturate soils on steep slopes, causing them to fail. During the “New Year’s” storm that extended through January 1, 1997, the Union Pacific Railroad main line north of Redding suffered damage from more than 40 slides and washouts, mostly between Lakehead and Castella, and was closed for several weeks.

A floodplain is the area adjacent to a river, creek or lake that becomes inundated during a flood event. Floodplains may be broad, as when a river crosses a flat landscape, or narrow, as when a river is confined in a canyon. The USR is located mostly within mountainous terrain with drainages that course through high-relief, deeply-cut river canyons with narrow floodplains. Large amounts of water move through these river canyons and flooding is predominantly confined within the canyons and riverine valleys. Occasionally, railroad, highway or canal embankments form barriers, resulting in ponding or diversion of flows. Some localized flooding not associated with stream overflow can occur where there are no drainage facilities to control flows, or when runoff volumes exceed the design capacity of culverts and other drainage facilities. In some areas, the lack of broad, floodplain topography reduces flood hazards and the scope of flood impact, yet this channeling of the water into a narrow confinement during peak events does result in significant demand on culverts, bridges and other structures that divert or channel water flows.

Flooding in this IRWM region can be caused by two types of flooding: flash floods and riverine floods. Flash floods occur suddenly after a brief but intense downpour. They move rapidly, terminate suddenly, and can occur in areas not generally associated with flooding. Although the duration of flash flood events is usually brief, the damage they cause can be severe. Riverine floods are typically described in terms of their extent (including the horizontal area affected and the vertical depth of floodwater) and the related probability of occurrence (expressed as the percentage chance that a flood of a specific extent will occur in any given year (e.g. a 100-year flood). The big winter floods of 1997 and 1974 were caused by these much longer duration events (e.g. extended series of large winter frontal storms, or “pineapple express” storms). In these instances the floods built very gradually over several days before peaking. The most widespread damage recorded to roads, bridges and other infrastructure on the Shasta-Trinity National Forest occurred in response to these types of floods.

Rain-on-snow events are a notable factor that contributes to flood hazards in the region. Rain-on-snow flooding develops when warm rains fall on accumulated snow, causing layers of snow to melt and run off in conjunction with the rain. The ground is often already saturated in such cases. Storm fronts with snow levels above 7,000 feet bring heavy rainfall over large areas where snow may have accumulated from previous storms with snowfall down to 3,000 feet or lower. These flood-producing storms typically occur between October and March.

The unincorporated community of McCloud is located in a small valley at an elevation of about 3,300 feet. Panther and Squaw Valley Creeks flow near and through the community. Panther Creek enters the valley from the northwest side and has formed a small alluvial fan where it exits an otherwise confined channel. This channel decreases in size to a small drainage ditch through the developed portion of the community. Squaw Valley Creek enters the valley and community from the northeast. A significant rain event that occurred between December 29, 1996 and January 1, 1997 resulted in flooding and damage in many places in Northern California, including the community of McCloud. Over 11 inches of precipitation fell on a deep snow pack in the area, triggering flooding of Panther and Squaw Valley Creeks. Anecdotal accounts, reported in the Flood Insurance Study for Siskiyou County (FEMA 2011), suggest that flooding was the worst to occur in the McCloud area in over 50 years.

It is expected that climate change will affect flood potential. Climate change is projected to cause increases in global temperatures that likely will lead to shifts in the timing and magnitude of precipitation and runoff. Increased temperatures might alter precipitation and runoff patterns, such as higher snowline elevations, earlier snowmelt, and less overall snowpack. The projected shift in the timing of reservoir inflows could pose significant challenges for management of flood storage capacity in major system reservoirs. This would result in potential increases to the number of people, property, and other assets exposed to flooding in the state.

Potential for Dam Failure

The Siskiyou County Flood Control and Water Conservation District Act created the Siskiyou County Flood Control and Water Conservation District in 1957. In the planning region, the primary operation of this district is management of Box Canyon Dam on the Upper Sacramento River, along with management of Lake Siskiyou reservoir behind the dam and the county-owned property surrounding the lake. As described in the water-related infrastructure section of this document, the dam has a height of 209 feet and a length of 1,100 feet. It has a maximum discharge capacity of 42,700 cubic feet per second. Lake Siskiyou has a storage capacity of 26,000 acre-feet with a normal surface area of approximately 430 acres. The facility is used for minor flood control, hydroelectric power and recreation.

While dams such as Box Canyon Dam provide some protection from flooding by impounding and regulating flows, they also present a potential for flooding consequences of their own related to the potential for structural failures. Hazard studies such as those referenced in the Siskiyou County Hazard Mitigation Plan (2012) calculate and evaluate inundation areas that might result from a structural failure of a dam. Box Canyon Dam is considered a high-risk dam for which flood inundation mapping is available.

There is often limited warning time for a dam failure. These events are frequently associated with other natural hazard events such as earthquakes, landslides or severe weather, which limits their predictability and compounds the hazard. The most significant issue associated with dam failure involves the properties and populations in the inundation zones. Flooding as a result of a dam failure would significantly impact these areas, where properties would experience a large, destructive surge of water.

Flood-Related Programs

Through its Flood Hazard Mapping Program, the Federal Emergency Management Agency (FEMA) identifies flood hazards, assesses flood risks, and partners with States and communities to provide flood hazard and risk data to guide mitigation measures and actions.

FEMA prepares Flood Insurance Studies for communities. There are Flood Insurance Studies for both Shasta and Siskiyou counties and selected incorporated areas within these counties. These Studies investigate the existence and severity of flood hazards in the study areas and aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Local and regional planners can use such studies in their efforts to promote flood plain management.

Existing FEMA maps for the Upper Sacramento basin are Dunsmuir FIRM panel 0603630001B and the FIRM panel that includes Lake Siskiyou (0603621375B). Panel 0603621400B includes the area east of Interstate 5 above the City of Dunsmuir and Panel 0603621600B includes the area east of Interstate 5 below the City of Dunsmuir. The City of Mt. Shasta is listed as an “area not included.”

There is a recently revised FEMA map in the McCloud basin that includes the Mud Creek drainage, which is prone to mud and debris flows primarily from Konwakiton glacier on Mount Shasta. Existing FEMA maps for the McCloud basin (including the McCloud River, Squaw Creek, Ash Creek, Dry Creek, and Edson Creek) is FIRM panel 0603621425B. There are no known FIRM maps for the Lower Pit River area or the Medicine Lake Highlands.

Counties and cities are also obligated under California planning law to address the potential for flooding in their general plans. They are directed to provide consistent policies concerning the recognition of flood hazards in their general plan safety elements, corresponding with appropriate land use designations and policies in their general plan land use elements. The safety elements of general plans establish standards and policies for the protection of the community from hazards. Flood-related policies in general plans are intended to help reduce the risk associated with flooding and potential dam failure hazards for future development.

In the Shasta County General Plan, for example, Chapter 5.0, Public Safety Group, (which serves as the general plan safety element) addresses flooding in Section 5.2, Flood Protection. This General Plan observes that damages resulting from the development of flood-prone areas can be minimized through floodplain management. This management concept encompasses a comprehensive program of corrective and preventive measures for reducing flood damage, including but not limited to emergency preparedness plans, flood control projects, and floodplain management regulations. Shasta County’s General Plan acknowledges that National Flood Insurance Program information should serve as the basis for land use and zoning designations in floodplain regions during the implementation phase of the planning process.

The Siskiyou County General Plan also addresses the potential for flooding and promotes appropriate development standards in flood hazard areas.

Both Shasta County and Siskiyou County have also adopted Hazard Mitigation Plans, which include consideration of flooding and the potential for inundation from the failure of dams. The Disaster Mitigation Act (DMA) is federal legislation enacted to promote proactive pre-disaster planning as a condition of receiving financial assistance under the Robert T. Stafford Act (1988). The DMA encourages state and local authorities to work together on pre-disaster planning.

Lastly, it is noted that, in addition to FEMA programs, the California Department of Water Resources has a program to identify flood hazard areas through its Awareness Floodplain Mapping program.

(Information about this program is available online at http://www.water.ca.gov/floodmgmt/lrafmo/fmb/fes/.) The intent of the Awareness Floodplain Mapping program is to identify all pertinent flood hazard areas by 2015 for areas that are not mapped under the National Flood Insurance Program and to provide communities and residents an additional tool in understanding potential flood hazards currently not mapped as a regulated floodplain. The awareness maps identify the 100-year flood hazard areas using approximate assessment procedures.

New Awareness Floodplain Maps will be added to the program as they become available. As of January 2013, maps were posted for areas of the region within Shasta County but not for Siskiyou County. DWR notes that their maps are not FEMA regulatory floodplain maps but that, at the request of a community, FEMA would include the data on their maps.

3.7.6 Other Water Resource Issues

Following is discussion related to some of the particular issues that have been raised during work on the Upper Sac IRWM plan.

3.7.6.1 Precipitation Enhancement

Note: This issue is also addressed in the Issues and Interests Chapter of this IRWMP.

According to the California Water Plan 2005, precipitation enhancement, commonly called cloud seeding, artificially stimulates clouds to produce more rainfall or snowfall than would naturally occur. The Department of Water Resources (DWR) states that precipitation enhancement in the form of cloud seeding has been practiced continuously in several California river basins since the early 1950s (DWR 2005). The projects mostly use silver iodide as the active cloud seeding agent, supplemented by dry ice if aerial seeding is done. The silver iodide can be applied from ground generators or from airplanes. Occasionally other agents such as liquid propane have been used. In recent years, some projects have also applied hygroscopic materials (substances that take up water from the air) as supplemental seeding agents. Operators engaged in cloud seeding have found it beneficial to seed rain bands along the coast and orographic clouds over the mountains. (DWR 2005)

In California, precipitation enhancement projects are intended to increase water supply or hydroelectric power. The amounts of water produced are difficult to determine, but estimates range from 2 to 15% increases in annual precipitation or runoff. DWR makes reference to a National Research Council 2003 report on weather modification, which had limited material on winter orographic cloud seeding such as practiced in California and other western states. However, DWR has found that the report concurs that there is considerable evidence that winter orographic weather modification can result in up to a 10% increase in precipitation.

In a draft section for the California Water Plan Update 2013, DWR reports that the Pacific Gas and Electric Company (PG&E) had planned a new precipitation enhancement project on the Pit and McCloud Rivers in Northern California on the headwaters of Shasta Lake Reservoir, but that this proposal has been suspended. That project was expected to have been one of the more productive in California because of the frequency of storms and being able to take advantage of natural storage by increasing precipitation recharge of the large volcanic aquifers that feed the Pit and McCloud Rivers year round (DWR 2013). The intended result would be increased hydroelectric power production. Much of the added precipitation would have gone into recharging the large volcanic aquifers that supply the springs in the region. Accepting a PG&E estimate for the formerly proposed Pit River cloud seeding project of 200,000 acre-feet of water for that region, DWR suggests that another 200,000 to 300,000 acre-feet of water per year might be generated by precipitation enhancement in other areas (DWR 2013 Draft).

In California, proposals have been made to the California Energy Commission's Public Interest Energy Research (PIER) program for additional research into cloud seeding to evaluate the effectiveness of existing programs in the state and optimize their effectiveness. Justification was stated as being the potential benefits to hydroelectric energy production. This approach would survey the latest scientific advances in cloud physics, remote sensing, atmospheric science, and seeding technologies, and would evaluate strategies and recommendations for the best course of action to maximize the contribution of operational cloud seeding programs to the state's water and energy supplies. Study could also include the potential effect of global warming and atmospheric pollution on seeding practices and capabilities. DWR has recommended that the PIER program include and fund research on cloud seeding in their activities.

Questions and controversy about potential unintended impacts from precipitation enhancement have been raised over the years. Common concerns relate to downwind effects (enhancing precipitation in one area at the expense of other areas downwind) and long-term toxic effects of silver iodide. The U.S. Bureau of Reclamation has studied these issues, and findings include those reported in its Project Skywater programmatic environmental statement in 1977 and in its Sierra Cooperative Pilot Project EIS in 1981.

According to DWR's summary of preliminary observations for the draft California Water Plan 2013, available studies indicate that silver and silver compounds have a rather low order of toxicity and there is little potential for eventual toxic effects of silver (DWR 2013 Draft). The report states that accumulations in the soil, vegetation and surface runoff have not been large enough to measure above natural background. A 2004 study done for Snowy Hydro Limited in Australia is said to confirm the earlier findings from the Bureau of Reclamation.

Draft material from DWR for the 2013 California Water Plan Update states that findings about silver accumulation testing by PG&E on the Mokelumne River and Lake Almanor watersheds were reported at the 2007 annual meeting of the Weather Modification Association. Both watersheds have been seeded for more than 50 years. Sampling at Upper Blue Lake and Salt Springs Reservoir showed very low to non-detectible concentrations of silver in water and sediment. Similar results were found at Lake Almanor in tested water, sediment and fish samples during the 2000 to 2003 period. Amounts were far below toxic levels and there was little to suggest bio-accumulation. DWR has concluded that continued operations should not result in any significant chronic effect on sensitive aquatic organisms. (DWR 2013 Draft)

State requirements for sponsors of weather modification projects consist of filing a Notice of Intention (NOI) initially and every five years for continuing projects, with record keeping by operators and annual or biennial reports to DWR. Sponsors also need to comply with the California Environmental Quality Act. Annual letter notices should also be sent to the Board of Supervisors of affected counties and to DWR. There are also activity reports to be sent to the National Oceanic and Atmospheric Administration, which give the number of days and hours of operation and the amounts of seeding material applied.

Draft recommendations to increase precipitation enhancement that are being considered by DWR for the California Water Plan Update 2013 (DWR 2013 Draft) include the following:

- The state should support the continuation of current projects as well as the development of new projects and help in seeking research funds for both old and new projects. Operational funding support for new projects may be available in the IWRM program.

- The state should support research on potential new seeding agents, particularly those that would work at higher temperatures. Global warming may limit the effectiveness of silver iodide, the most commonly used agent, which requires cloud temperatures well below freezing, around -5º C, to be effective. The increasing cost of silver is a detriment to some ongoing projects.
- DWR, in partnership with the Bureau of Reclamation, and seeking cooperation with PG&E, should produce an EIR/EIS on a Pit River project similar to the one proposed several years ago, since this is an area with one of the best potential yields which could benefit both the Central Valley Project and the State Water Project (which share in-basin use above and in the Delta) and there would appear to be multiple State benefits from augmenting recharge of the huge northeastern California volcanic aquifer.

The California Water Plan Update 2013 is still in draft form as of this writing and it is not known if and when the draft recommendations will be adopted and pursued.

3.7.6.2 Shasta Dam and Proposals to Raise the Lake Level

As described earlier in this Region Description, Shasta Dam and its impoundment, Shasta Lake Reservoir, are not included in the USR. The watersheds of this region and the region itself terminate at the reservoir's current high-water mark. Nevertheless, the completion of the dam in 1944 has had significant impacts and implications on the lower watersheds of the region, and any dam raise would back the reservoir further into the USR. A description of Shasta Dam is provided in Section 3.4, Water-Related Infrastructure. Issues concerning fish, especially as related to anadromous fish that have been blocked by the dam and related facilities, are discussed in Section 3.7, Biological Characteristics. The following discussion notes the issue of the proposed raising of Shasta Dam as related to the USR.

The USBR has initiated feasibility studies and environmental compliance documentation for the Shasta Lake Water Resources Investigation (SLWRI). A feasibility study was initiated in 2000 to analyze alternatives for raising the dam from 6.5 to 18.5 feet and corresponding increases of reservoir storage. In February 2012, the USBR released a Draft Feasibility Report and Preliminary Draft Environmental Impact Statement (EIS) to examine the potential for enlarging the dam. The primary study area is extensive, due to downstream concerns along the greater Sacramento River and nearly statewide considerations for the use of water stored in Shasta Lake Reservoir. The study area directly includes: Shasta Dam and Lake; land around the lake; lower reaches of primary tributaries flowing into Shasta Lake reservoir (Sacramento, McCloud, and Pit rivers and Squaw Creek); and all smaller tributaries flowing into the lake. The draft EIS documents address the potential impacts, costs and benefits of the No Action alternative and five action alternatives evaluated to date.

Federal, state and local stakeholders have identified several areas of concern during SLWRI meetings and workshops. Major concerns that have been raised, as identified in the Preliminary Draft EIS for the Shasta Investigation, include the following:

- Impacts to Cultural Resources — Sites of cultural significance exist in and around Shasta Lake reservoir, many related to historic activities and religious beliefs of Native Americans. The Winnemem Wintu Tribe continues to raise concerns about the culturally devastating impacts of enlarging Shasta Dam on their historic and culturally significant sites. The Winnemem Wintu have indicated that at least 118 archeological sites that are still used today for their ceremonies would be destroyed and/or rendered unusable by inundation, in addition to the many sites that were destroyed when Shasta Lake Reservoir was first developed. The USBR has claimed that the effects of the dam raise on Winnemem traditional cultural properties (TCPs) are unavoidable and has not offered any plan for mitigation or avoidance. The Winnemem Wintu Tribe contends that cultural concerns and laws are being deliberately and illegally ignored.

- Impacts to Recreation — Shasta Lake Reservoir is the principal recreation destination in Shasta County. Local interests are concerned about possible adverse effects on recreation at the lake. This ranges from impacts to the lake area concessionaires and their facilities to concerns about potential impacts on the regional economy. Shasta Lake Reservoir is within the Shasta-Trinity National Recreation Area (NRA). Accordingly, impacts to campgrounds and related facilities administered by the USFS under the NRA have been identified as a concern.
- McCloud River — Although the California Department of Water Resources (DWR) is the current non-Federal sponsor for the SLWRI, its participation and that of other state agencies are limited by California Public Resources Code 5093.542(c). (See discussion of special McCloud River legislation below.) The McCloud River CRMP and others have expressed concerns about impacts to the McCloud River resulting from enlarging Shasta Dam.
- Impacts to Reservoir Area Property Owners — Raising Shasta Dam by 18.5 feet would inundate about 2,500 additional acres around Shasta Lake Reservoir. This would affect at least 130 structures and require replacing seven bridges and about 115 segments of existing paved and non-paved roads.
- Impacts to the Environment — Enlarging Shasta Dam or modifying project operations would affect a broad range of environmental resources, some adversely and some beneficially. Significant concern has been expressed about potential impacts to reservoir rim wildlife habitat, fishery habitat on several inflowing creeks and streams, and fishery resources in affected watersheds.
- Reservoir Reoperation — Residents and businesses around Shasta Lake Reservoir have expressed interest in revising the operation of Shasta Dam to reduce the potential for extreme seasonal drawdown for flood control, such as occurred in early 2004.
- No studies have been done regarding alternate ways to meet water supply needs.

3.7.6.3 McCloud River Legislation

Unique provisions have been adopted by the State of California to protect the special qualities of the McCloud River. These provisions, as will be noted, have implications on the proposal to raise Shasta Dam and the lake level.

In 1994, the USFS evaluated the eligibility of the McCloud River for listing as a wild and scenic river under the Federal Wild and Scenic River Act during preparation of the Shasta-Trinity National Forest Land and Resource Management Plan (LRMP) (USDA 1994). Although the LRMP found the McCloud River eligible for listing, the direction was to not formally designate any reach of the river as wild and scenic. Instead, the direction was to manage the lower McCloud River under a Coordinated Resource Management Plan (USDA 1994). The Coordinated Resource Management Plan (CRMP) is a coordinated effort between landowners and stakeholders with a vested interest in the river. The CRMP requires its signatories to protect the values that make the river eligible for federal designation as wild and scenic and contains a provision stating that the USFS reserves the right to pursue designation if the CRMP is terminated or fails to protect these values. (More information about the McCloud River CRMP is included below.)

The California Resources Agency also evaluated the McCloud River in the late 1980s to determine whether the river was eligible for listing as a wild and scenic river under the State Public Resources Code (PRC). The Resources Agency study found it eligible, but the California legislature declined to formally add the river to the California wild and scenic river system. The legislature instead passed an amendment to the California Wild and Scenic Rivers Act in the PRC to protect the river below McCloud Dam. This Act was amended in 1989 to include portions of the McCloud River. Although the McCloud River is not formally designated as a state wild and scenic river, PRC Section 5093.542 specifies that the McCloud River should be maintained in its free-flowing condition, and its wild trout fishery protected. The amendment specifies that no new dams, reservoirs, diversions, or water impoundment facilities are to be constructed on the McCloud River from 0.25 miles downstream from the McCloud Dam to the McCloud River Bridge — a reach length of approximately 24 miles. Section 5093.542(c) states the following:

> Except for participation by the Department of Water Resources in studies involving the technical and economic feasibility of enlargement of Shasta Dam, no department or agency of the state shall assist or cooperate with, whether by loan, grant, license, or otherwise, any agency of the federal, state, or local government in the planning or construction of any dam, reservoir, diversion, or other water impoundment facility that could have an adverse effect on the free-flowing condition of the McCloud River, or on its wild trout fishery.

Section 5093.542(d) also states that all state agencies exercising powers under any other provision of law with respect to the protection and restoration of fishery resources shall continue to exercise those powers in a manner to protect and enhance the fishery [of the protected segments of the McCloud River].

As discussed above, raising Shasta Dam and the lake level as proposed in the Shasta Lake Water Resources Investigation (SLWRI) would inundate portions of the lower McCloud River. At gross pool, the existing reservoir can inundate just over a mile of river upstream from the McCloud Bridge. Raising Shasta Dam could extend this area by about 2/3 of a mile. The EIS for the SLWRI evaluates the related potential impacts of this increased length on the trout fishery of the McCloud River and the related legislation. PRC Section 5093.542(c), as noted, may limit participation from state departments or agencies in planning or constructing any water impoundment facility that could adversely affect this area of the McCloud River.

Acknowledging the provisions of the PRC relative to the McCloud River, the Bureau of Reclamation has expressed the intent to continue to coordinate with state and potential non-federal sponsors to develop strategies to support state agency participation in the SLWRI and necessary permitting processes, such as those related to water rights and CEQA.

3.7.6.4 McCloud River CRMP

The McCloud River Coordinated Resource Management Plan (CRMP) was adopted in July 1991 to maintain the values of the McCloud River. The management plan establishes guidelines to coordinate management activities with the principal landowners in the McCloud River drainage area and public agencies that administer programs in the area. The main objective of the plan is to improve management of the area's resources to allow for multiple uses while protecting the natural environment and private property rights. Signatories of the McCloud River Coordinated Resource Management Plan include McCloud River Club, Crane Mills, USFS, McCloud River Co-Tenants, PG&E, California Trout, Sierra Pacific Industries, DFG, Hearst Corporation, and The Nature Conservancy (McCloud River CRMP 1991). The Winnemem Wintu Tribe, with aboriginal claims to this territory, have made several requests to join the CRMP, but have not yet been invited.

The area addressed by the McCloud River CRMP is described as being divided into two segments: the Lower McCloud and Upper McCloud areas, with the area being essentially the area visible from the river and Squaw Valley Creek; that is, ridge top to ridge top. More specifically, the Lower

McCloud area covered by the plan is the segment that covers the McCloud River and Squaw Valley Creek drainages above Shasta Lake Reservoir north to Lake McCloud on the river, and up to Cabin Creek on Squaw Valley Creek. The east boundary extends up to approximately one mile on the east side of the river. The west boundary extends up to four miles from the river and Squaw Valley Creek. The Upper McCloud segment generally encompasses the inter-gorge area of the river from Lake McCloud up to Algoma Campground.

The CRMP is supported by an MOU that establishes a McCloud River coordinating group for the plan. As described in the MOU, the mission of the coordinating group is to coordinate, between agencies and landowner participants, the various land management activities in the plan in such a way as to achieve the following goals (CRMP 1991):

1. To maintain respect for the property rights of the participants;
2. To enhance and improve habitat for wildlife and fish by coordination with other resources and by specific habitat improvement projects;
3. To improve water quality for fisheries and other beneficial uses;
4. To improve and coordinate recreation resource opportunities and interpretation;
5. To maintain soil resources for beneficial uses;
6. To develop the timber resource to its reasonable attainable potential in harmony with other resources.

3.8 Biological Characteristics

3.8.1 General Biological Features

As noted in the Geology section (Section 3.6) of this chapter, the USR straddles two ecological provinces, the Klamath Mountain province and the Cascade province. In the Klamath Mountain province, the complexity of the geology and terrain has a strong influence on the structure, composition, and productivity of vegetation, producing floristic diversity and complexity in vegetative patterns. The diverse patterns of climate, topography, and parent materials in the Klamath Mountains create a mosaic of vegetation patterns that are found to be more complex than patterns typically found in the Cascade Range.

Generally speaking, the western and southern portions of this IRWM region are characterized by biotic communities typical of the Klamath province, while the northern and eastern portions of the region, including the Medicine Lake Highlands, are characterized by biotic communities typical of the California Cascades province. The Klamath Province is dominated by Douglas fir, Douglas fir/mixed hardwood, mixed conifer, mixed conifer/hardwoods, and Ponderosa/Jeffrey pine forests. The California Cascades Province is dominated by mixed conifer and/or ponderosa pine associations on relatively dry sites.

According to the Sacramento River Watershed Program, there are approximately 217 species of wildlife associated with the variety of habitats found in the watersheds of this IRWM region (Sacramento River Watershed Program 2012). For example, concerning the McCloud River watershed, this estimate of 217 species reportedly consists of 132 birds, 55 mammals, 19 reptiles, and 11 amphibians. Within the mixed conifer and oak forests of the region, wildlife includes mammals such as black bear, mountain lion, ringtail cat, gray fox and the rare wolverine. Otters are common along the rivers and major creeks of this region. As many as 17 species of bats inhabit the area.

The steady supply and volume of cold, clean water in the region supports a high quality wild trout fishery. The watershed also provides important habitat for a number of special-status plant and animal species including rough sculpin, Shasta salamander, and northern spotted owl.

3.8.1.1 Biotic Communities

This section describes some of the common biotic communities in the region and, on that basis, provides an overview of the region's wildlife and fishery resources and habitats of special concern. The primary source for this section is the *Upper Sacramento River Watershed Assessment* (June 2010). Much of this section incorporates related material directly from the *Upper Sacramento River Watershed Assessment*. That material has been adapted and expanded as applicable to discussion of the larger planning region, of which the Upper Sacramento River watershed is one of the four watershed areas along with the McCloud River watershed, the Lower Pit River watershed, and the Medicine Lake Highlands. Various watershed analyses prepared by the Shasta-Trinity National Forest have also been used in preparing this section.

Biotic communities are groups of plant, wildlife, and fish populations that interact with one another in the same environment. This region encompasses a wide diversity of biotic communities. This diversity results from the large size of the region in combination with the variety of landforms, soil types, topography, and microclimates. Human use and management have influenced some of these factors. The plant species present in a biotic community are generally a response to abiotic, or non-living, factors such as climate, topography, and soils. The plant assemblages, however, largely determine wildlife species. Therefore, biological communities are commonly defined in terms of their dominant plant species (e.g. oak woodland, mixed chaparral, annual grassland).

The planning region encompasses a wide diversity of biotic communities. This diversity is a result of the large size of the region in combination with the variety of factors including landforms, topography, microclimates, and soil types. Dominant plant species and species composition in these communities vary with dramatic changes occurring in relation to aspect, slope, geologic substrate, or juxtaposition with other communities. For example, it was projected in the *Upper Sacramento River Watershed Assessment* that, in that particular watershed, the Sierran mixed conifer biotic community was by far the most dominant community, covering approximately 46% of the 383,000-acre watershed. Mixed hardwood was the next most abundant community in the watershed (approximately 12%), followed by mixed chaparral, mixed hardwood-conifer, white fir, and lacustrine (primarily portions of Shasta Lake Reservoir). Other biotic communities covered no more than 3% of that watershed.

For the purposes of this region description, the biotic communities in the watershed have been divided into three general categories: aquatic, riparian, and terrestrial. These general communities are discussed below.

Aquatic Communities

The aquatic characteristics of the region include sub-alpine lakes, several man-made reservoirs, rivers and other perennial streams, and a complex of springs, intermittent streams, seasonal floodplains, wetlands, seeps, marshy fens, and wet meadows. These landforms provide habitat for a variety of aquatic species. While not typically covering large areas of land in the region, aquatic ecosystems are a significant type of biotic community. In addition to fish, aquatic environments provide habitat for a variety of other aquatic fauna including invertebrates and amphibians, as well as planktonic organisms.

The discussion of aquatic communities and their key species was sequenced hierarchically in the *Upper Sacramento Watershed Assessment*, beginning at the base of the food-web and progressing up to higher level consumers (i.e. microbes and planktonic organisms, invertebrates, amphibians and aquatic reptiles, and fish and fisheries). Of the special-status species present in the watershed, seven are aquatic. Of these seven, three are fish species (rough sculpin (*Cottus asperrimus*), hardhead (*Mylopharodon conocephalus*), and rainbow trout (*Oncorhynchus mykiss*)), three are amphibians (Cascades frog, foothill yellow-legged frog, and tailed frog), and one is an aquatic reptile (northwestern pond turtle). In addition to these, several other species are considered species of interest. This inclusion is generally based on the species' unique history in the region, importance as game species, or relationship to a specific habitat type of interest.

Aquatic macro-invertebrate species and communities, which include insects, snails, clams, crayfish, worms, and other invertebrates living in the aquatic environment, are a critical component of aquatic ecosystems and resources. Aquatic insects generally feed on algae, terrestrial and aquatic organic debris, and other macroinvertebrates. They provide a critical food source for fish and amphibian species, and certain aquatic insects with a terrestrial life phase have been shown to provide an important food source for riparian and upland reptile, bird, and bat species. In the upper headwater areas of the watersheds, Odonata (dragonflies and damselflies), caddisflies, mayflies, and Diptera (true flies) appear as the dominant taxa in most of the streams. In the central and lower portions of watersheds, mayfly, stonefly, caddisfly assemblage represents species groups that indicate high-quality aquatic conditions

Mollusks serve as primary herbivores and detrivores in benthic stream communities and are major food items for fish and other stream-dwelling or stream-related animals. The freshwater mollusk fauna of rivers and tributaries in the area has long been considered exceptionally diverse, including snails such as *Physella* as well as cold water–specific genera such as *Fluminicola* (pebble snails) and *Vorticifex*.

Non-native signal crayfish are present in the main river watersheds and appear anecdotally to be expanding because they are widely distributed in locations where they were not in the late 1970s when the streams were last surveyed.

Concerning amphibians and aquatic reptiles, in some areas of the planning region there is a high diversity of herpetofauna, which include 12 aquatic amphibian species and one aquatic reptile species. In 2002, surveys for terrestrial amphibians were conducted at 40 locations in the region north of Shasta Lake Reservoir (Nauman and Olson 2004). Three species of reptiles and nine species of amphibians were detected, including the federally listed Shasta salamander. Along the McCloud River canyon and arm of the reservoir, the Shasta salamander, which is not known to occur anywhere else on earth, can be found in limestone outcrops and caverns.

Amphibians and aquatic reptiles are integral and often abundant members of aquatic ecosystems and have often been found to constitute the highest fraction of vertebrate biomass in an ecosystem. Additionally, both amphibians and aquatic reptiles provide important links within and across aquatic and terrestrial food webs, consuming large amounts of invertebrate prey from both habitats and sustaining numerous predators at multiple trophic levels.

The California Golden Beaver, formerly native to the region, was extirpated (likely by fur trappers) before recorded history (Naiman, et al. 1988). The benefits of the presence of beaver include more persistent native tree numbers, groundwater recharge, and the development of more habitable stream refugia for fish (Benson-Ayers 1997; Gard 1961). There is some interest in the region in reintroducing the beaver to regional waterways, which has been successfully accomplished in other parts of California.

Fish

Fish are, of course, directly associated with aquatic communities. Due to the particular concern of fish relative to this IRWM plan, fish are discussed in this separate section, along with related management issues.

Historically, the fish population within the USR in general included large seasonal runs of anadromous salmonids (winter, spring and fall salmon and winter steelhead), and migratory populations of sturgeon (*Acipenser spp.*). However, anadromous fishes have not been found in the region since the completion of Shasta Dam in 1943, and sturgeon are limited to a white sturgeon (*Acipenser transmontanus*) population in Shasta Reservoir. The current fish assemblage in the area is composed primarily of native, introduced, and regularly stocked resident coldwater and warm water fish. The non-native trout in the basin are a result of hatchery introductions that began in the late 1800s and include coastal rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), and brook trout (*Salvelinus fontinalis*).

The fish assemblage in the watershed varies by sub-region. For example, the species in the headwaters portion of the Upper Sacramento Watershed consist primarily of introduced char and possibly a few remnant minnows and suckers in isolated locations. Exceptions to this include reservoirs such as Lake Siskiyou, which supports a diverse assemblage of primarily introduced warm and coldwater fishes. The fish assemblage in the central watershed sub-region is dominated by rainbow trout. In addition to trout, rivers in the region are home to Sacramento sucker, Sacramento squawfish, carp, riffle sculpin, smallmouth bass, blackfish, golden shiner, and hardhead minnow. These species are generally present in the main stem of the Sacramento River, but are largely absent from the tributaries, with the exception of the riffle sculpin. Several non-native warm water species are present in the main stem of the Sacramento River, with increasing presence in the southern end, close to Shasta Lake Reservoir. However, these species are also largely absent from the tributaries.

All three of the major rivers in this region have trout fisheries that are unique in number and size and are highly-prized by the sport-fishing community. The McCloud River, for one, is known as a premier trout stream with an abundance of large rainbow and brown trout. The abundance of large fish is a function of the excellent quality of the habitat, and benefits from special fishing regulations and limited access to the lower reaches of the river where large tracts of private ownership limit the take of fish. The Lower McCloud River from the McCloud Dam downstream to Shasta Lake Reservoir is designated as a 'Wild Trout Stream' by the California Department of Fish and Wildlife. The McCloud River historically had the southernmost and only bull trout (*Salvelinus confluentus*) population in the state of California until it was extirpated in 1975. Many of the streams in the upper McCloud River basin originate in terrain where soil is composed of porous volcanic ash. Consequently, many of the streams are isolated, beginning as springs and then soon sinking back into the ground a short distance downstream. Redband trout in these small stream populations reach a maximum size of around 12 inches with a lifespan of three to seven years. The Redband trout found in the larger waters of the McCloud River may reach sizes of 20 inches and weights of up to three pounds.

The Lower Pit River supports warm water fish species (e.g. bass, crappie, catfish, and bullhead), and an outstanding coldwater fishery for native rainbow trout in the lower reaches of the river. Native and non-native fish species are important prey items for the significant population of bald eagles.

Shasta Lake Reservoir and its tributaries provide very productive habitats for coldwater fish species, which typically prefer or require temperatures cooler than 70° F. During the cooler months, coldwater species such as rainbow trout, brown trout (*Salmo trutta*), and landlocked Chinook (*Oncorhynchus tshawytscha*) may be found rearing throughout the lake; however, these species do not spawn in the lake, preferring to spawn in tributary streams.

Native species such as white sturgeon, hardhead (*Mylopharodon conocephalus*), riffle sculpin, Sacramento sucker (*Catostomus occidentalis*), and Sacramento pikeminnow (*Ptychocheilus grandis*) tend to reside in cooler water strata in the reservoir and in and near tributary inflows. Trout may also congregate near the mouths of the reservoir's tributaries, including the Upper Sacramento River and the McCloud River, at various times of the year for various purposes including thermal refuge, foraging, and spawning, when conditions are favorable for these species.

The warm water fish habitats of Shasta Lake Reservoir occupy two ecological zones: the littoral shoreline/rocky/vegetated) and the pelagic (open water). The littoral zone lies along the reservoir shoreline down to the maximum depth of light penetration on the reservoir bottom and supports populations of spotted bass (*Micropterus punctulatus*), smallmouth bass (*Micropterus dolomieui*), largemouth bass (*Micropterus salmoides*), black crappie (*Pomoxis nigromaculatus*), bluegill (Lepomis *macrochirus*), channel catfish (*Ictalurus punctatus*), and other warm water species. Warm water species, such as largemouth bass, smallmouth bass, spotted bass, and other sunfishes, were introduced into the reservoir and have become well established with naturally sustaining populations.

Some waters, including the PG&E-owned/operated Pit 6 reservoir on the Pit River, support a population of hardhead, a California species of concern and a Forest Service sensitive species (FERC 2011).

Riparian Biotic Communities

The term "riparian" pertains to the moist soil zone immediately outside of aquatic wetlands, perennial and intermittent watercourses, and other freshwater bodies. These areas may be regarded as the interfaces between aquatic communities and adjacent terrestrial communities. Riparian vegetation is considered to be important in determining the structure and function of stream ecosystems. Streams are characteristically shaded and kept cool by overhanging riparian vegetation that moderates stream temperatures. While fish are not typically considered part of riparian communities, they interact directly with riparian habitat in a variety of ways, including feeding on terrestrial insects, supplying nutrients to terrestrial species, or using flooded vegetation for spawning.

Riparian woodlands form an important link between aquatic and terrestrial wildlife communities. Most aquatic insects are either directly or indirectly dependent on riparian vegetation at some stage in their life cycles. The predominant form of a riparian biotic community in the region is the montane riparian community.

Beavers were once integral to the riparian habitat along stream corridors throughout California. These mammals represent an integral link between aquatic and terrestrial habitats, in the riparian corridors.

Terrestrial Biotic Communities

The term terrestrial is applied to biotic communities that are generally upslope of the more water-defined characteristics of aquatic and riparian communities. As noted in the *Upper Sacramento River Watershed Assessment*, many natural processes in terrestrial communities, such as erosion, nutrient cycling, input of organic material, evaporative water loss, and movement of wildlife, result in direct interactions with neighboring aquatic and riparian communities. The conditions of upslope soil and vegetation can significantly affect the capability of a watershed to retain moisture and modulate surface and subsurface runoff into streams.

A wide variety of terrestrial biotic communities are found in this region. Following, in Table 3.5, is a brief list of some of these communities. Readers should refer to the *Upper Sacramento River Watershed Assessment*, as well as other relevant watershed analyses, for a more thorough account of these biotic communities and species that are characteristic of these areas. (Note: Although biotic communities comprise both animals and plants, communities typically are named on the basis of the dominant plant species or site characteristics.)

Table 3.5: Terrestrial Biotic Communities found in the USR	
Sierran Mixed Conifer	Jeffrey Pine
Montane Hardwood	Klamath Mixed Conifer
Alpine Dwarf-Shrub	Mixed Chaparral
Annual Grassland	Montane Chaparral
Barren	Mixed Hardwood-Conifer
Bitterbrush	Pasture
Blue Oak Gray Pine	Ponderosa Pine
Closed-Cone Pine-Cypress	Red Fir
Cropland	Sagebrush
Deciduous Orchard	Subalpine Conifer
Douglas-Fir	White Fir
Eastside Pine	Wet Meadow

Urban habitat is another component of terrestrial communities, and includes roadways, residential areas, and commercial areas. Urban areas are largely denuded of native vegetation; what vegetation does exist is predominantly non-native or ornamental. The wildlife species most often associated with urban areas are those that are most tolerant of periodic human disturbances, including several introduced species such as European starlings, rock doves, and house mice. Native species that are able to use these habitats include western fence lizards, American robins, Brewer's blackbirds, northern mockingbirds, mourning doves, house finches, black-tailed jackrabbits, and striped skunks. In addition, bats that forage in nearby habitats may make use of small cavities around the eaves of structures.

3.8.1.2 Special Status Designations

The designation of species as having "special status" can be applied to both plant and animal communities in California with slightly different criteria.

For the Upper Sacramento River Watershed the California Natural Diversity Database (CNDDB) indicates 42 special-status plants known to occur in the watershed. Information on the habitat requirements of these species was obtained from the California Native Plant Society (CNPS) online Inventory of Rare and Endangered Plants, which features information on the habitats and statewide distribution of special-status plants in California. The *Upper Sacramento River Watershed Assessment* should be consulted for more information.

Special-status fish and wildlife typically include:

- Species listed or proposed for listing as threatened or endangered under the Federal Endangered Species Act,
- Species listed or proposed for listing by the State of California as threatened or endangered under the California Endangered Species Act,
- Species designated as "species of special concern" by the California Department of Fish and Wildlife (CDFW),

- Species designated as "fully-protected" by CDFW,
- Species considered sensitive or endemic by the U.S. Forest Service, or
- Birds designated as "birds of conservation concern" by the U.S. Fish and Wildlife Service.

Plants

The distribution and abundance of rare plants in the watershed is governed by a combination of: availability of suitable habitat; connectivity of habitat for dispersal and colonization; and losses of local populations from human impacts, climatic fluctuations, and other environmental events such as floods, fires, and diseases.

Assessments of potentially occurring special-status plants typically include a search of the CNDDB. The CNDDB is a database consisting of historical observations of special-status plant species, wildlife species, and natural communities. It is limited to reported sightings and is not a comprehensive list of special-status species that may occur in a particular area. Therefore, additional special-status plants may occur in the watershed, and CNDDB information may be supplemented by other assessments. The Upper Sacramento River Watershed Assessment includes a list of USFS Sensitive and Endemic Plants potentially occurring in the region.

Insects and Wildlife

In the *Upper Sacramento River Watershed Assessment*, 36 special-status wildlife species that are known to occur or may occur in the watershed were listed. Their distribution, legal status, general habitat requirements, and known occurrences in the watershed were listed, based on CNDDB information, as well as information from the California Wildlife Habitat Relationships (CWHR) system maintained by the California Department of Fish and Wildlife. (Note: CWHR is an online information system for California's wildlife and contains life history, geographic range, habitat relationships, and management information on 694 species of amphibians, reptiles, birds, and mammals known to occur in the state.)

The list of federal- or state-listed threatened and endangered insect and wildlife species in the *Upper Sacramento River Watershed Assessment* includes special recognition of the following species (this list is not intended to indicate all threatened and endangered species that may be found in the region):

- Shasta Salamander (*Hydromantes shastae*): Known habitat consists primarily of limestone bluffs, cliffs, and outcrops near Shasta Lake Reservoir;
- American peregrine falcon (*Falco peregrines anatum*): Requires cliffs for nesting. Has been recorded nesting in the region;
- Bald Eagle (*Haliaeetus leucocephalus*): Although delisted as a threatened species, the bald eagle continues to be protected under the federal Bald and Golden Eagle Protection Act;
- Northern Spotted Owl (*Strix occidentalis caurina*): Associated with late-successional forest conditions. Critical habitat designation includes units within the region;
- Western Yellow-Billed Cuckoo (*Coccyzus americanus occidentalis*): Considered extremely rare in most areas and possibly extirpated from this region;
- Willow Flycatcher (*Empidonax traillii*): Nests in dense riparian thickets. Considered to be a rare spring and fall migrant in this area;

- Pacific Fisher (*Martes pennant pacifica*): This mammal has been recorded in numerous locations in the region; and
- Sierra Nevada Red Fox (*Vulpes vulpes nector*): Inhabits various habitats in alpine and subalpine zones. Sightings of this mammal have been recorded near Mount Shasta.

Other species that also warrant mention as special status species are: the Valley Elderberry Longhorn Beetle, golden eagle, northern goshawk, bank swallow, greater sandhill crane, American marten, California wolverine, ringtail, pallid bat, spotted bat, Townsend's big-eared bat, western red bat, western mastiff bat, tailed frog, foothill yellow-legged frog, northwestern pond turtle, and 10 species of terrestrial mollusks — six of which are considered Forest Service special status species.

McCloud Redband Trout

The McCloud Redband Trout is a former candidate species for protection under the federal Endangered Species Act. Due to the enactment of a Candidate Conservation Agreement, the McCloud Redband Trout (or McCloud Redband) was removed from candidate status in October 2000. A series of conservation actions implemented by the Upper McCloud River Redband Trout Core Group have been designed to help recover this fish and reduce the need for listing under the Endangered Species Act. Conservation of McCloud Redband Trout is ongoing under joint efforts of California Trout, the Shasta-Trinity National Forest, the California Department of Fish and Wildlife, and other partners in this effort. The forging of the Redband Trout Conservation Agreement in 2007 was an important step towards protecting these fish and their habitats. As noted in the purpose statement of the Redband Trout Conservation Agreement:

> "This Conservation Agreement has been prepared to provide for genetic integrity, secure populations and long-term viability of the upper McCloud redband while respecting existing land uses, resource uses, and private property rights and while providing for angling and other recreational opportunities. The purpose of this document is to provide specific direction that will conserve this species and reduce or remove the threats that could cause it to be listed as threatened or endangered. This will be done through an adaptive management process of implementing, monitoring and adjusting conservation measures by the Upper McCloud River Redband Trout Core Group (Redband Core Group)." (Shasta Trinity National Forest 1998)

The Conservation Agreement recommends several actions to protect the McCloud River redband trout, including establishing a McCloud redband refuge, maintaining and enhancing existing habitats, and protecting the genetic integrity of existing populations by eliminating planting of hatchery fish in streams of the upper McCloud Basin. Additional recommendations are to develop and enforce angling regulations for the protection of redbands, a complete genetic evaluation of all redband populations, and establishing a regular population-monitoring program. Actions to help conserve the McCloud River Redband Trout include a conservation easement from the Blue Heron/Whiskey Creek drainages downstream, held by The Pacific Forest Trust.

Anadromous Fish

Fish species in the region include several USFS-sensitive species as well as species listed as threatened and endangered under the Endangered Species Act (ESA). While the anadromous species are no longer present, they may be reintroduced per the NOAA Fisheries Recovery Plan as is discussed below. ESA-listed species include Sacramento River winter run Chinook, Central Valley spring- and fall-run Chinook, North Coast winter coho, Northern California steelhead, Great Basin Redband trout, and the Rough Sculpin. Most of these species are already at risk due to loss of habitat and habitat fragmentation. Additional stress to species is probable due to influences of warming on hydrologic processes. Periods of extended drought would also exacerbate the effects of drying on small aquatic habitats. Timing and volume of hydrographs are likely to shift. These increased stresses could result in loss of habitats and the species they support.

Concerning the presence of coho salmon, a U.S. Bureau of Reclamation report entitled "Coho Salmon (*Oncorhynchus kisutch*) Life History Patterns in the Pacific Northwest and California" (2007) also states:

> "In the Sacramento River, Behnke (2002) states that coho salmon were always extremely rare and says it is unclear why conditions are so ill-fitted for this species. Brown et al. (1994), however, suggests that coho may not have been entirely rare in the system historically. Moyle (2002), citing Leidy (1984), states that coho were never common in the Sacramento basin but small numbers probably once spawned in the McCloud and upper Sacramento rivers, in excess of 300 miles from the marine environment."

The Keswick and Shasta dams on the Sacramento River are existing barriers to upstream passage of anadromous salmonids including Chinook salmon and steelhead. Prior to construction of Shasta dam in 1942, Chinook salmon and other anadromous fishes were able to travel up the rivers of the region. On the McCloud River, prior to construction of the McCloud Dam, they could travel as far as the 20-foot-high Lower Falls (FERC 2011). In 1941 when Shasta Dam was under construction, it was estimated from studies of Chinook salmon runs that would be blocked by the dam that a total annual run of approximately 27,000 fish would be blocked when the dam was completed (Needham, et al. 1941).

Chinook salmon have been extirpated from the rivers in this region. In addition, the extirpation of Chinook populations had further impacts by affecting other species in the system, notably bull trout (originally identified as Dolly Varden) that fed on early life stages of the Chinook (FERC 2011).

Downstream of the region, the population of Chinook salmon in the Sacramento River has significantly declined over the past 40 years (DFG 2010). Numerous factors have contributed to this decline, including unstable water temperature, loss of historic spawning areas and suitable rearing habitat, water diversions from the Sacramento River, drought conditions, limited suitable spawning gravels, fluctuations in river flows, toxic acid mine drainage, high rates of predation, unsustainable fish harvests, and unsuitable ocean conditions. As a result, Sacramento River winter-run Chinook salmon have been listed as endangered under the Federal Endangered Species Act, and spring-run Chinook salmon have been listed as threatened, along with other anadromous fish species in the upper Sacramento River, including Central Valley steelhead and North American green sturgeon.

Proposals for Salmon Restoration

Note: This issue is also addressed in the Challenges section of Chapter 6, Issues and Interests.

The National Marine Fisheries Service (NMFS) has drafted a plan entitled the "Central Valley Salmon and Steelhead Recover Plan" (Recovery Plan). The goal of the Recovery Plan is to address the viability of endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, and threatened Central Valley steelhead. NMFS' Endangered and Threatened Species Recovery Planning Guidance describes the recovery planning goal as the long-term sustainability of an endangered or threatened species and, therefore, delisting of the species.

The Recovery Plan is an issue in the IRWM region because the Recovery Plan identifies particular diversity groups related to California's Central Valley, one of which, referred to as the Basalt and Porous Lava Diversity Group, is identified in connection with the Upper Sacramento watersheds (i.e. the Upper Sacramento, McCloud, and Pit rivers). Diversity groups are biogeographic regions of similar climatological, hydrological, and geological characteristics that historically supported, or in some cases continue to support, self-sustaining spawning populations. (It is interesting to note that the Recovery Plan uses the name “Little Sacramento River” for what is more commonly known as the “Upper Sacramento”. NMFS appears to apply the name “Upper Sacramento” to the reach of the Sacramento River between Keswick Dam and Red Bluff.) None of these listed fishes would be expected to have access to habitat in the upper waters until upstream migration is facilitated past Keswick and Shasta dams and through Shasta Lake Reservoir.

NMFS proposes that addressing the primary threats and risk factors for each species will require reintroducing populations to historic but currently unoccupied habitats. These areas include watersheds that are currently inaccessible because of existing dams (e.g. the “Little” Sacramento River and McCloud River). The recovery plan identifies candidate areas for re-introduction and proposes that primary watersheds have the highest potential to support spawning populations of anadromous fish, while secondary watersheds have less potential, or more information is needed to assess reintroduction potential. As identified in the Recovery Plan, priority areas for reintroduction include both the Little Sacramento River and the McCloud River for winter- and spring-run Chinook salmon and steelhead. Therefore, one of the Recovery Plan’s “Priority 1 Recovery Actions” is:

- Develop and implement a phased reintroduction plan to re-colonize winter-run, spring-run, and steelhead to the Little Sacramento and McCloud Rivers above Shasta and Keswick Dams.

The program, as outlined in the Recovery Plan, is only in the pilot stage and many aspects of the plan are still undetermined. Recovery plans are not regulatory documents. NMFS states that the successful implementation and recovery of listed species will require the support, efforts and resources of many entities, from federal and state agencies to individual members of the public.

For the Winnemem Wintu Tribe, there is a strong cultural perspective concerning the issue of restoring Chinook salmon (which they regard as the “Nur”) to the McCloud River in particular. Salmon were not only an important food source for the Winnemem people in the days before the Shasta Dam project cut off the passage of spawning anadromous fish, salmon were also a key element in their spiritual traditions. The Winnemem Wintu are proponents for recovery of salmon to the McCloud River, especially restoration of salmon from New Zealand where eggs from the McCloud River were long ago used to establish a stable fishery. The tribe has supported proposals with the National Oceanic and Atmospheric Administration and the Bureau of Reclamation to develop passageways or other means to enable returning spawning salmon and outgoing ocean bound fingerlings to move past barriers including Shasta Dam, and to otherwise support maintenance of a viable salmon population in the McCloud River.

One aspect of local concern that has been expressed is whether or not the NMFS recovery program will include provisions for “safe harbor”. Landowners often have various assurances prior to recovery efforts that involve habitat on or adjoining private property. As described by the U.S. Fish and Wildlife Service, the Safe Harbor Policy provides incentives for property owners to restore, enhance and maintain habitats for listed species. Because many endangered and threatened species occur exclusively, or to a large extent, on non-federally owned property, the involvement of non-federal property owners in the conservation and recovery of listed species is considered critical to the success of these efforts. Under the policy, the federal agencies can provide participating property owners with technical assistance to develop Safe Harbor Agreements that manage habitat for listed species, and provide assurances that additional land, water, and/or natural resource use restrictions will not be imposed as a result of their voluntary conservation actions to benefit covered species.

As part of IRWMP deliberations, the Winnemem Wintu tribe proposed and encouraged a project of coordination and cooperation between the tribe, landowners and regulatory agencies to facilitate reintroduction of salmon above Shasta Lake reservoir, particularly into the McCloud River. Such a project is proposed to address the feasibility of the proposal, as well as to consider the relevant mitigation measures, regulations and management agreements that could make the proposal possible.

Unique Ecological Communities
There are areas in the region that are considered to be unique ecological communities. These areas often receive special management consideration. Two examples are serpentine soils and Port-Orford-cedar.

Serpentine soils can occur in a number of the biotic communities discussed above. They have a high proportion of endemic plants (i.e. plants that are restricted to unique site characteristics; in this case, to serpentine soils). This is because of the harsh nature of serpentine soils, which stems from its special chemical and physical characteristics. Serpentine soils have high concentrations of heavy metals and magnesium, low calcium concentrations, and low concentrations of essential plant nutrients. Most communities occurring on serpentine soil consist of only a few small populations of dwarfs and xerophytes (plants designed to conserve water). In addition, some species have adapted so well to these harsh conditions that they are endemic and grow exclusively on serpentine soils. A number of plants that are known to occur, or potentially occur, in the region are generally found on serpentine soils, including special-status species such as serpentine Beegum onion (*Allium hoffmanii*), goldenbush (*Ericameria ophitidis*), Trinity buckwheat (*Eriogonum alpinum*), peanut sandwort (*Minuartia rosei*), and Red Mountain catchfly (*Silene campanulata ssp. campanulata*).

Port-Orford-cedar has a very limited range, occurring naturally (the species has been widely cultivated as an ornamental) only in northwestern California and southwestern Oregon. The species range is primarily along the Pacific coast; however, a major inland disjunction includes small populations along the upper Trinity and upper Sacramento River drainages. It is often described as a serpentine endemic, but it is also found on other soil types. With the exception of the northern part of its range, Port-Orford-cedar usually grows primarily along streams and in areas with year-round seepage. Port-Orford-cedar is the largest member of the cypress family (*Cupressaceae*), and has been a valuable commercial species, both for its use in landscaping and as a finished wood product. Management of Port-Orford-cedar has become difficult in much of its range because of the presence of *Phytophthora lateralis*, a fatal root rot.

3.8.1.3 Invasive Species
For over two centuries, people have imported animals and plants into California that are not native to the state. Whether brought here intentionally for food, sport, ornament, as pets, or by accident, many of these species have now been introduced into the wild (California Department of Fish and Game 2003). Although Californians have benefited from the introduction of plant and animal species necessary for food or other human pursuits, many introduced species can wreak havoc on the state's environment and economy. Those species that cause harm and, once established, spread quickly from their point of introduction are often called "invasive" or "nuisance" species.

Invasive species threaten the diversity or abundance of native species through competition for resources, predation, interbreeding with native populations, parasitism, transmitting diseases, or causing physical or chemical changes to the invaded habitat.

Through their impacts on natural ecosystems, agricultural and other developed lands, water delivery and flood protection systems, invasive species may also negatively affect human health and/or the economy. Examples of direct impacts to human activities include the clogging of navigable waterways and water delivery systems, weakening flood control structures, damaging crops, introducing diseases to animals that are raised or harvested commercially, and diminishing sport-fish populations (California Department of Fish and Game 2008a). A few of the more common introduced/invasive wildlife and plant species present in the watershed are discussed below.

In December 2007, the New Zealand mud snail was confirmed to live in Shasta Lake Reservoir. New Zealand mud snails can reproduce rapidly and can crowd out native insects that aquatic wildlife is dependent upon for survival. Snail colonies disrupt the base of the food chain by consuming algae and competing with native bottom-dwelling invertebrates. A population decline of invertebrates can follow the introduction of New Zealand mud snails, which reduces fish forage. With a decrease in food availability, fish populations can decline as well. New Zealand mud snails can grow as large as one-quarter inch but are often much smaller and are parthenogenic (i.e. able to start a new population with only one snail). They have the potential of extraordinary population densities — up to nearly one million snails per square meter and comprising up to 95% of the invertebrate biomass of a river. It is believed that populations in New Zealand are kept in check naturally by a native parasite. In North America, however, native stream communities can be altered because the snail has no natural predators or parasites and its populations have flourished where they have been introduced. It is not believed they can be eradicated once established.

The Shasta-Trinity National Forest has an ongoing alert posted on its website concerning Quagga and Zebra mussels for the area including Shasta Lake Reservoir. The alert notes that these mussels are a threat to the area and can alter fish and aquatic ecosystems and can cause extensive damage including damage to water intake facilities. According to the California Department of Fish and Wildlife, Zebra mussels arrived in North America from Europe in the 1980s, followed shortly thereafter by their close relative the Quagga mussel. Quagga mussels were discovered in Lake Mead in Nevada in January 2007 and later throughout Lake Mead's lower basin. It was the first discovery of either of these mussels west of the Continental Divide. Subsequent surveys found smaller numbers of Quagga mussels in Lakes Mohave and Havasu in the Colorado River and in the Colorado River Aqueduct System (Fish and Wildlife, 2013).

As prodigious water filterers, they remove substantial amounts of phytoplankton, zooplankton and suspended particulate from the water, which reduces the food sources for zooplankton and small fish, altering the food web. With the filtering out of suspended particulates and phytoplankton, water clarity increases allowing sunlight to penetrate the water deeper triggering increased vegetation growth that can affect oxygen levels resulting in fish die offs. The mussels have also been associated with outbreaks of botulism poisoning in wild birds. Quagga/Zebra mussels clog water intake structures, such as pipelines and screens, reducing pumping capabilities for power and water treatment facilities. Recreation-based industries and activities are also affected by the mussels, which take up residence on docks, break-walls, buoys, boats, and beaches.

The American bullfrog is native to the eastern and mid-western United States and southeast Canada. It has been accidentally and intentionally introduced (e.g. for food in the 1920s by commercial frog farmers due to its large meaty legs) throughout the world. The American bullfrog is now established throughout most of the western United States and southwestern Canada. Their large size, high mobility, generalized eating habits, and huge reproductive capabilities have made bullfrogs extremely successful invaders and a threat to biodiversity. Bullfrogs prey on native amphibians as well as young western pond turtles, ducklings, and other aquatic and riparian vertebrates.

"Invasive" and "naturalized" are terms used frequently in reference to both non-native plants in wildland areas and to garden plants. The term "naturalized" is used to describe a non-native plant that is capable of surviving and reproducing without human intervention for an indefinite period. Naturalized plants that do not spread away from where they were introduced are not generally a significant problem in a natural habitat. However, naturalized species that do spread and survive in new areas are called invasive plants.

"Noxious" is a legal term used by regulatory agencies, such as the California Department of Food and Agriculture (CDFA) and the U. S. Department of Agriculture Animal Plant Health Inspection Service (USDA-APHIS). To be considered noxious, a plant must be listed on a noxious weed list maintained by one or both of these agencies. Listing is typically based upon the threat of this weed to agriculture or non-crop areas and allows these agencies, along with the county agricultural commissioner, to ban, quarantine, or eradicate these plants.

The California Invasive Plant Inventory categorizes non-native invasive plants that threaten the state's wildlands. Categorization is based on an assessment of the ecological impacts of each plant. The Inventory represents the best available knowledge of invasive plant experts in the state. Non-native invasive plants may spread as a result of fire. In some local areas, for example, species with significant potential to spread and affect natural plant communities due to their ecological impacts and potential response to fire disturbance may include French broom (*Genista monspessulana*), Scotch broom (*Cytisus scoparius*), yellow starthistle (*Centaurea solstitialis*), Italian thistle (*Carduus pycnocephalus*), and bull thistle (*Cirsium vulgare*). Sweet pea (*Lathyrus latifolius*) is also a common invasive plant in this region. These and other species have potential for substantial negative ecological effects by expanding their distribution as a result of fire.

A few of the more common introduced/invasive species present in this IRWM region are discussed below:

- Black locust (*Robinia pseudoacacia*) is particularly invasive in some areas and favors disturbed sites. The Lower McCloud River Watershed Analysis (1998) discusses how locust was planted at the Ah-Di-Na homestead over a hundred years ago and has had a major impact. In some areas along the McCloud River near the Ah-Di-Na campground, this species has replaced much of the riparian vegetation.
- Introduced non-native blackberries, including Himalayan berry (*Rubus discolor*) and cut-leaved blackberry (*Rubus laciniatus*) have become established in thickets in many locations and may contribute to the permanent loss of fragile native riparian plant communities.
- Yellow star-thistle (*Centaurea solstitialis*) has the ability to grow aggressively and prevent native plant species from competing for site occupancy. Over time, this invasive plant can dominate sites.

3.8.2 Overview of Reference Conditions

The purpose of this section is to provide an overview of how the environmental conditions of watersheds in the Upper Sacramento Region have generally changed over time as a result of natural forces and human influences. This section is not a comprehensive description of reference conditions or an in-depth examination of the transition of natural conditions that has occurred as a result of various impacts. Rather, this discussion is intended to provide a general overview on the subject, and frames that overview by highlighting general characteristics and some noteworthy changes relative to selected topics including natural processes, vegetation and stream characteristics, and changes related to land use and development. It also provides some notes concerning ownership patterns and, due to the direct impact on water resources, impacts related to the development of dams in the region.

The following discussion is largely drawn from various watershed analyses that have been prepared by the Shasta-Trinity National Forest. In those analyses, reference conditions are described for comparison with current conditions and with the expected results of Forest Service management objectives. For more information about reference conditions in particular areas of the region, please refer to the applicable watershed analysis. A collection of watershed analyses has been available from the Shasta-Trinity National Forest at: http://www.fs.usda.gov/main/stnf/landmanagement/planning.

Various approaches have been taken in local watershed analyses to recognize time periods by which reference conditions can be described. Discussions of physical features, biological features and human uses can generally be considered in two historic periods:

- Pre-European Settlement: During this period, significant Anglo-American influences were absent. Indigenous peoples occupied and used the area; however, the ecosystem was functioning under essentially natural conditions during that time.
- Post-European Settlement: In some areas of this region the European or Anglo-American settlement period can be considered to have begun in the 1830s[8]. In some of the more remote parts of the region, European settlement and land use had little impact until 1880 and after (see Section 8.2.2 on vegetation and fire characteristics). During this period human influences began to affect natural processes in the watershed. The area experienced increased effects from settlement, mining, wildfire suppression, timber management and harvest, and construction activities.

It is also common for Forest Service watershed analyses prepared for areas in the lower watersheds of this region to further divide the post-European settlement period into two periods; pre-1945 and 1945-present. The year 1945 is primarily marked by completion of Shasta Dam and the consequences that it had on the watersheds of the Upper Sacramento, McCloud, and Pit rivers. The period since 1945 also encompasses the general expansion of community and infrastructure development in California that occurred following World War II.

3.8.2.1 Natural Processes

In terms of geology and climate, the region has experienced substantial changes over time. Topography and stream channels were fundamentally formed and altered as a result of the uplift of the Klamath Mountains and the periodic eruptions and lava flows of Mount Shasta and the Medicine Lake Highlands volcanoes. Natural processes that affected water resources have included climate, mass wasting activities, peak flows, and fire. Volcanic eruptions, ash fall, and pyroclastic flows had periodic impacts. Mudflows, including those that happened during the retractions of ice ages and glacial activity as well as related to volcanic activity, shaped the landscape and affected stream channel morphology.

Stream channels were not significantly affected by human use activities prior to European settlement, but were frequently impacted by natural disturbance processes. Streams fed by glacial melt have experienced multiple debris flows in the past 500 years. Large debris flows occur on Mt. Shasta at a rate of roughly four per century. The largest debris flow event to occur in the past 100 years in the region was the Mud Creek flow that occurred over several years in the 1920s and 30s. The rapid melting of the Koniwakiton Glacier triggered these debris flows. The flows transported large quantities of sediment down Mud Creek where debris was deposited onto the Mud Creek alluvial fan, the McCloud River, and ultimately into the lower Sacramento River.

[8] The malaria epidemic of the 1830s felt by indigenous people would have affected the ecosystem through the decimation of the populations of those communities — largely the ecosystem and natural resource managers of that day.

Natural processes that controlled peak and base flows in the region's watersheds prior to European settlement have not changed substantially from reference to current conditions. Peak and base flows within the watershed were controlled by the prevailing climate and variations in annual precipitation. Variations in the amounts and distribution of vegetation within the watershed also affected peak and base flows. Wetter periods brought increased rainfall that reduced wildfire activity and stimulated vegetative growth.

Primarily fluvial erosion processes and mass wasting activity have influenced channel morphologies. Prior to European settlement channel morphologies were controlled by peak flows and hill slope erosion processes. Frequent fires and mass wasting activity affected channel development and influenced channel stability. Swales, colluvial, bedrock and cascade channels located in upland areas that burned frequently probably exhibited unstable characteristics as a result of the high sediment inputs and the lack of large woody debris needed for channel stabilization. It is expected that these upland channel types hosted aquatic and terrestrial plant and wildlife species adapted to frequently burned, early seral habitats rather than those adapted to the forested riparian areas found throughout the region's watersheds today.

3.8.2.2 Vegetation Characteristics and Fire Regimes

At the beginning of the nineteenth century, vegetation in much of the region is believed to have been dominated by open stands of pine and mixed conifer forest with a chaparral understory in lower elevations. Species of conifer and chaparral were the same as presently exist. Pine was probably a more dominant species in the mixed conifer forest. Seral stage diversity was greater with more old growth and late successional stands. Generally, late successional forest probably made up 40-50% of the forestlands in the area. Mid-seral forest probably made up 20-30% of the forested lands and early seral forest the remaining 20-40% (STNF 2000). Natural disturbances such as lightning-caused fire, winds, and snow had the greatest influence on stand structure and composition, though Native American management likely had an effect on a smaller scale. Timber belts in the higher elevations, typically white fir and red fir, are largely dominated by these shade tolerant species. The white bark pine belt, which makes up the highest reaching extent of trees, has very few other trees existing in that belt and few changes have occurred since the late 1800s.

Wildfire was an important natural process that controlled fuels and the distribution and age of vegetative communities throughout the watershed. Wildfires kept most stands in open conditions with the riparian areas having the greatest stand densities. Fire was a common occurrence in local watersheds. Regular lightning storms along with the use of fire by native people promoted frequent surface fires of mostly low to moderate severity. Indigenous people utilized fire to promote food production and growth of basket material, improve hunting conditions, gather food, and for ceremonial purposes.

Long-term alterations of fire patterns in the region have occurred as a result of changes in climate and human interactions. Fire suppression in the area generally began around the 1880s in response to fires burning along railroad lines. Organized fire suppression efforts were further instituted after the establishment of the National Forest. Since the onset of fire suppression, and with the increased effectiveness of mechanized suppression techniques (fire engines, bulldozers, aircraft, etc.), the amount of area burned by fires has been greatly reduced and the intervals of time between reoccurring fires increased compared to historic levels.

Reducing and, in some areas, totally excluding fire from the landscape for over 100 years has resulted in ecosystem composition structures and functions that are significantly altered from earlier historical conditions. As a result of successful fire suppression, fuels and vegetation density has increased, expanding the potential for fires to become more intense and difficult to control. Under current fire suppression strategies, fire as an ecosystem process has been dramatically reduced. This has resulted in the development of more homogeneous vegetation patterns. Concerns over the effects of fire to resources (e.g. wildlife habitat, soils, human uses, hydrology, air quality, etc.) have also increased over time. A challenge for both public and private land managers is how to safely and effectively re-introduce fire into land management practices.

Timber Management

The character of vegetation in the region has also been altered over time by timber harvesting and management activity. Beginning in the mid-1800s, miners and settlers began to harvest timber in the watershed. The structure and composition of the forest changed as logging activities increased.

Plantations are now found on both National Forest and private lands within the region. Plantations vary greatly in acreage and age with some mid seral age pine plantations mostly representing large shrub conversion projects dating from the 1940s to 1970s. Early seral (seedling) plantations represent those established since the 1980s. Many of the plantations were planted as ponderosa pine, although neither National Forest nor private timber companies plant in monocultures any longer (since 1990/95). While natural monocultures do happen naturally, with an increased awareness of the importance of having species diversity in stands, plantations have increasingly been planted with a mix of conifer species. Species diversity helps in avoiding beetle infestation and other management challenges with monocultures (blue stain and black stain among them), especially as projected climate change effects include increased drought occurrence, which is a stressor on the trees and can make them vulnerable to black stain and pine beetles. In addition, many plantations retained some residual trees (typically white fir and incense cedar) that became seed sources to provide a greater diversity of species.

Invasive Species

Most of California's invasive plants originated from the Mediterranean area and have been spread by post-European settlement and subsequent human activity. Noxious weeds have competitive advantages that often allow them to colonize a site quickly (e.g. rapid growth rates and prolific seed crops, seeds that are spread easily by wind, water, and wildlife, etc.). Road building, logging, wild and prescribed fires, and grazing tend to expose bare mineral soils which may then be colonized by invasive plants due to a reduction in competition for space and resources.

3.8.2.3 Stream Characteristics, Morphology, and Native Fish Populations

The channel morphologies of step-pool and pool-riffle channels in the past were probably similar to those found in the watershed today. Because impacts from burning appear to have affected mid-slopes and ridge-tops more than inner gorge areas, it is believed that the larger channel types such as step-pool and pool-riffle channels probably were not impacted appreciably by wildfires or mass wasting activity. Gravel and fine sediment probably accumulated in step-pool and pool-riffle channels following large wildfires and floods, however the sediment deposited during these events was probably flushed from the channel network during smaller bank-full flows occurring over the following years. Large woody debris probably played a significant role in controlling the morphologies of smaller step-pool channels; however, most large wood was probably flushed through the larger step-pool and pool-riffle channels.

Historically, natural stream processes have provided excellent fish habitat. Bedload movement and large woody debris in balance with channel functions likely provided an abundance of deep pools and runs. Under these conditions, large fish would have been common. Stream systems were healthy enough to support large and consistent salmon runs. It is apparent that riparian habitats and tributaries underwent periodic changes, to which associated aquatic species adapted.

Large runs of Chinook salmon and steelhead once ascended the Sacramento River and its main tributaries. It is estimated that indigenous tribes harvested 8.5 million pounds, annually, from four distinct runs in the Sacramento River (Yoshiyama, et al. 1998). Anadromous fish ascended the Pit River, the Upper Sacramento River, and the McCloud River up to Lower Falls (about six miles above present McCloud Reservoir). Coho salmon were also present but in much smaller numbers. Bull trout and rainbow trout, as well as Sacramento sucker and riffle sculpin, were common inhabitants. Local Native Americans used native fish assemblages in the region as an important source of food, and salmon especially had important cultural significance.

Indigenous peoples of the region, because of their dependence on the return of salmon each year, took great care to honor these fish and the ecosystem that preserved their existence. They were careful not to take too much, and allowed the majority of the fish to pass and complete their lifecycle.

Changes to fish populations and aquatic habitat began taking place in the late 1800s and continued into the 1900s. Even prior to the construction of Shasta Dam, the growth of the population in the area and downstream along the Sacramento River impacted the fishery resources of the region. Miners and settlers capitalized on the fishery for both personal and commercial consumption. The runs of Chinook salmon were most impacted by this pressure. By the late 1800s, diminishing runs of salmon were already noticeable in the Sacramento River and its upper tributaries as a result of local consumption as well as downstream impacts including growing communities, commercial fishing and canneries, mining and smelting operations, railroad construction and operation, and other factors.

The Forest Service has noted that the increasing trend in land use activities, especially since 1945, generally correlates to an increase in effects to stream channel morphology and water quality. The impacts associated from timber harvest activities on Forest Service lands, for example, affect increased sedimentation in upland channels (STNF 2011). The Forest Service has reported in documents such as the Squaw Valley Creek Watershed Analysis that roads appear to have had a more chronic impact generally than timber harvest activities on the morphology of upland stream channels throughout the various watersheds, especially as a result of erosion and sedimentation from unmaintained road systems. Impacts have been generally concentrated at stream crossings and in areas where roads were constructed on unstable slopes within or adjacent to inner stream gorges. Impacts to step-pool and pool-riffle channels have mostly been in the form of increased sediment inputs, which have contributed to increased deposition in pools and impairment of fish habitat. Common impacts to stream channels from roads include channel degradation below stream crossings, gullying along poorly drained roads, and channel aggradation above plugged or partially plugged culverts.

3.8.2.4 Land Use and Development Effects

The impact of indigenous cultures on the landscape of local watersheds appears to have been slight. Native American groups inhabited the watershed for thousands of years prior to European settlement. (Note: The Ethnographies section of the Region Description contains more information about some of the indigenous people of this area and their relationship with water features.) Archaeological information from sites at lower elevations in the area indicates that people have probably occupied the watersheds of this region continuously for the last 8,000 years, although the presence of earlier sites in other parts of northeastern California suggests that people may have occupied local watersheds as early as 10,000-12,500 before the present.

The local prehistoric material culture evolved over time, reflecting adaptations to changing physical and cultural landscapes. Villages were generally located on terraces lining rivers and major streams. The rivers in the region were a bountiful source of salmon and other fish, and tributary creeks were rich with suckers. The indigenous people traveled to the upland, forested areas of the watershed to collect acorns, gray pine nuts, buckeye, and other food and non-food materials. They also visited upland sites such as Panther Meadows and Medicine Lake for spiritual purposes. Approximately 10 archaeological sites have been identified on the forested mid-slopes around Mount Shasta, mostly on the southeast side of the mountain (STNF 2012).

Early populations are assumed to have been organized in mobile small groups that focused on large game hunting. Later, large semi-sedentary village sites in the valleys and an abundance of temporary camps and hunting features in the uplands appears to have been the prevailing pattern. This site distribution pattern suggests that people followed a foraging strategy in which small hunting parties left residential camps for prolonged periods of time to hunt. The availability of resources dictated the carrying capacity of different locations relative to the population of the villages.

Indigenous peoples who occupied parts of the region at the beginning of the European settlement period and after included people (in various bands) of the Modoc Tribe, the Pit River Tribe, the Shasta Tribe, and the Wintu Tribe, particularly the Winnemem Wintu.

The past 150 years of the post-European Settlement period brought many changes to the physical, biological, and human elements of the region. Hudson Bay trappers first explored the Sacramento River trail in 1830. The trail came to be known as the west branch of the California-Oregon trail. During the gold rush episodes in Northern California and Oregon, the route became a major mule trail and later a wagon road connecting the Redding area with Yreka and points north.

During the 1841 Wilkes Expedition (United States Exploring Expedition), it was noted in journals that the Mt. Shasta Region was populated entirely by indigenous people (STNF 2012). It is tragic to note that one of the first major impacts in the region caused by the influx of Europeans was the decimation of the indigenous peoples by introduced diseases, murder, and seizure of territory and resources. In one incident in the early 1830s, as much as 75% of the native population in one area died in a malaria epidemic brought in by trappers. Other tribes in the area experienced similar impacts and virtual annihilation of their population. By some estimates, during the two decades after 1848 when California became part of the United States, the native population in the state plummeted by 90%. The indigenous population in this region suffered a similar catastrophic fate.

European Settlement and Community Growth

Settlement of the area by non-indigenous people (primarily Europeans or Anglo-Americans) began after 1850. Modification of natural drainages occurred in order to drain wetland areas and facilitate European-style agriculture, settlement, and community growth. Examples of landscape modifications occurring in the lower watersheds included mining activity, establishment of log ponds associated with mill locations, draining of wetlands, and development of springs for crop irrigation and other domestic uses. Livestock grazing and homesteading began to change the native landscape. Attempts to extirpate wildlife species that were considered threats, such as the grizzly bear and wolf, continued. Elk were also extirpated, probably due to overhunting (though efforts were made beginning in 1911 to reintroduce Elk in the area).

Settlement of the Mt. Shasta area began after 1850. The first effects to springs and wet meadow habitats occurred on the lower slopes of the mountain in the areas now occupied by McCloud and Mount Shasta City and were associated with the development of water sources for human uses. Early settlers established homesteads, small farms, saw mills, and eventually stage stations and hotels. This area was first known as Strawberry Valley and then later as Berryvale. With the coming of the Central Pacific Railroad in 1886 the town grew around the railroad route and was incorporated in 1905 as Sisson. It was renamed Mount Shasta in 1924.

As the Central Pacific Railroad was extended northward from Redding, settlements sprang up along many of the railroad stops such as Morley, Elmore, Pollack, Antlers and Delta, many of which are now under the waters of Shasta Reservoir. The completion of the railroad along the line of the Siskiyou Trail in 1887 led to the creation of the community that was to become Dunsmuir. Dunsmuir was incorporated as a city in 1909.

In 1916 the California-Oregon trail was modernized by the Division of Highways and renamed the Pacific Highway and later regarded as Highway 99. Highway 99 was eventually improved and, in some areas, relocated to become Interstate 5, as it is known today.

The town of McCloud was first established as a lumber company town. The McCloud River Lumber Company built the town in 1897 to house and provide services for the families of millworkers. The company built a standard gauge railroad from Mt. Shasta to McCloud over the southeast slope of Mt. Shasta. The company owned the buildings until 1963, when the mill was sold to U.S. Plywood. The houses were sold to individuals living in them. The McCloud Community Services District was formed to operate community services.

The establishment and growth of communities in the region and the urban character of development and land uses in and around these communities directly altered the conditions of the landscape in those areas with grading, paving, construction of buildings, and other alterations of the natural setting. Management of storm water runoff, especially from the impervious surfaces of roads, highways and developed areas, became necessary to reduce erosion and impacts on water quality.

Mining

Concerning changes to the landscape and general environment, mining was one of the first human activities to result in major impacts to the land and water in the region. Although some gold mining was conducted in the region as early as 1850 at places such as Kennett and Dogtown (Delta), the area did not play a major role in the mining industry until the 1890s when the copper boom began. The areas of the region in which copper mining activities took place include what was known as the West Shasta Mining District. For about 20 years, copper and zinc ore was produced from numerous underground mines.

The impacts of mining, especially impacts related to copper mining and processing, took a toll on the natural conditions of the area. The forests surrounding the mines were cut down for the timber needed in mine tunnels and for building fires under the mountainous piles of ore for open-air roasting. The toxic smoke released from the chimneys of copper smelters created an overwhelming environmental disaster as toxic fumes killed vegetation for miles around. Farmers and other citizens, with some success, brought damage suits against the mining companies. By 1919 the smelters had been shut down by a combination of legal action and changing market conditions following the end of World War I. However, the closure of the smelters did not bring a complete end to the pollution. To this day toxic water from acid mine drainage continues to seep into Shasta Lake Reservoir and the Sacramento River, adversely impacting water quality and wildlife.

Land Ownership and Management Patterns

Please see Section 3.8.2 for a review of pre-history and the land ownership traditions and patterns affecting aboriginal people.

Nothing in the natural history of the pre-European settlement period could have anticipated the checkerboard ownership and land management pattern that was stamped over much of the landscape as a result of railroad land grants. These grants were primarily the result of the Pacific Railroad Act of 1862, which was intended to encourage construction of the transcontinental railroad. Through that act, the federal government deeded large parcels (up to 640 acres each), mostly in a checkerboard pattern, to railroad companies such as Union Pacific Railroad. Nation wide, the land deeded to the railroads amounted to millions of acres. Many of those parcels located in what is now recognized as the Upper Sac IRWM region were eventually sold by the railroad companies and are now (largely) owned and managed by private timber companies.

Following the railroad grants, a major historic event to affect the landscape and management of resources in the region was the creation of the Shasta National Forest in 1905 from the remaining public domain lands. The multiple-use management mandate of the Forest Service, which considers recreation uses and other resource objectives in addition to timber management, has had a significant influence over time on the regional landscape and resources.

Landscape and resource management efforts continue to be affected by the checkerboard ownership pattern because the pattern interferes with what would otherwise be more consolidated ownership and management by either private land owners or the Shasta-Trinity National Forest. The geometric pattern, having virtually no relation to the natural character of the landscape, imposes a variety of challenges for property and resource management (such as fire management, timber production, and roads). Land exchanges between the Forest Service and private land owners have been proposed and implemented to some extent in an effort to consolidate federally-managed land, and thereby address and help resolve some of the challenges created by this land ownership pattern.

Land-use activities that have generated changes in the landscape and watersheds of the region include development of the urban interface, local infrastructure, and transportation systems, primarily along the Upper Sacramento River corridor. Also, over the past 70 years, numerous recreation facilities have been developed around Shasta Lake reservoir (including facilities related to the National Recreation Area designation) and in other areas of the region, including trails, campgrounds, and boat ramps. Land use pressures, including demand for expanded infrastructure, have increased as a result of growing population and recreation use.

3.8.2.5 Water Management Infrastructure

As noted in several places of this Region Description, the construction of Shasta Dam and filling of Shasta Lake Reservoir had a tremendous impact on the surrounding natural environment. Hydrologic conditions of the lower portions of watersheds in the region were dramatically altered following completion of the dam in 1945. Large areas of these watersheds were inundated with creation of the reservoir. For example, approximately 30 miles of the Pit River and 13 miles of the McCloud River were inundated. The dam blocked the historic runs of salmon and steelhead from accessing the watersheds, thereby removing an important human food source and cultural element for indigenous people in the region. The elimination of anadromous fish runs also changed the ecology of the streams by altering the fish community structure, disrupting the flow of nutrients that large runs of anadromous fish contribute to the food web, and genetically isolating native rainbow trout.

It is noted that much of the traditional land of the Winnemem Wintu Tribe was inundated by development of the Shasta dam and reservoir. Many village sites, burial sites and other sacred locations are now below the surface of Shasta reservoir. This is especially noteworthy in that proposals to increase the height of Shasta Dam and the reservoir level would result in the inundation of many of the remaining sites that are culturally significant to the Winnemem Wintu Tribe along the

McCloud River in this IRWM region. More information on this topic is available in Section 5.7, Dams, Reservoirs and Hydroelectric Infrastructure.

Other dams and diversions in this region, including those that make up PG&E's hydroelectric facilities on the McCloud River and the Pit River, and Box Canyon Dam and Lake Siskiyou reservoir on the Upper Sacramento River, have resulted in a variety of changes to the natural conditions of those streams. The full range and significance of changes caused to local streams by dams in the region are beyond the scope of this overview, but it is acknowledged that such facilities have altered the reference conditions of the watersheds to achieve particular objectives (e.g. water storage, power production, flood control, public recreation) and have necessitated measures intended to mitigate or compensate for various impacts. McCloud Dam, for example, by 1965 had blocked bull trout in the lower reaches of the McCloud River from swimming upstream to spawn and flooded six miles of prime bull trout habitat. That project contributed to the demise of the bull trout that, in the 1970s, was considered to be extirpated from California. The diversion of approximately 80% of the flow of the McCloud River to the Pit River for hydroelectric production also resulted in reduced flows in the lower McCloud and disrupted sediment regimes and increased water temperatures. These influences further altered the aquatic habitat of the lower McCloud and its tributaries.

3.8.3 Vegetation Management Issues

While vegetation management issues can take many forms, the risk of catastrophic fire is the primary concern in the USR. Similar to many source water areas, these watersheds are composed of a variety of complex and dynamic relationships, and many factors are relevant to an understanding of the current conditions of a watershed and how the conditions may change in the future. Fire is one of the most important factors in this context, and will become even more of a concern as climate change alters historic hydrology and the dry season extends earlier into the spring and later into the fall.

The occurrence of past wildfires has been an important factor affecting current vegetation conditions in the region, including the amount of late-successional habitat. Changes brought about by fire suppression alter the forest structure, stand density, and species composition in many areas, and have had a direct effect on forest health. Patterns of fire severity are important in determining the structural diversity of forests. Soils, air, water, and site biology are all affected by fire and, in some important ways, by the lack of fire.

Fire regime refers to the patterns of fire that occur over periods of time, and the effects that fire can have in the environment in which it occurs. While there are a variety of ways to define a fire regime, it can be said to be a function of the frequency of fire occurrence, fire intensity, and the amount of fuel consumed. Fire suppression has been applied widely throughout the planning region, and has generally changed the fire regime in many areas from frequent low-intensity surface fires to infrequent but relatively high-intensity fires. Long intervals between fires allow for a greater accumulation of fuels that result in hotter, more severe fires when ignited.

Forests in areas that have not experienced low-intensity fires become more closed and multi-storied. Tree species composition has succeeded towards more shade tolerant, fire sensitive species such as white fir, and away from more shade intolerant, fire-resistant species such as ponderosa pine. Pure stands of oak along with the oak component of mixed conifer forests have been encroached upon by conifers and have become less vigorous and more decadent.

Due to the lack of periodic fires, knobcone pines have colonized some areas such as in the vicinities of McCloud and the City of Mt. Shasta. Many of these stands became established following wildfires that occurred over 60 years ago. These stands are now beyond maturity and most of the trees have already died in some areas. In decadent knobcone stands, large numbers of dead and dying trees have increased the potential threat of wildfire to public and private lands. As these dead trees fall down, hazardous levels of surface fuel accumulates. Past reforestation projects on knobcone pine stands have been largely successful in converting those areas to healthier and less fire-prone stands of ponderosa pine and other conifer species. (STNF 2005)

Changes in vegetation composition and successional stages related to the lack of periodic fires of low and moderate intensity have, in-turn, influenced the wildlife species present in those environments.

Large fires present a substantial risk to water quality as a result of causing a cascading sequence of accelerated erosion, flooding, channel scour, and increased sedimentation that can destroy productive habitats over large area for decades. When wildfire occurs in watersheds, the severity of the fire combined with the slope conditions (e.g. steepness, aspect) will determine the susceptibility of the burn area to soil erosion, which may have a direct impact of sedimentation in waterways. The erosion potential following wildfire can be significant.

Predictably, this largely forested IRWM region is susceptible to large fires. As a fairly recent example, in August 2012, the Bagley fire started near Big Bend. Burning generally northward around Iron Canyon Reservoir and toward McCloud Reservoir, the fire ultimately charred an estimated 46,011 acres. As another example, in 1992, the Fountain Fire burned 300 homes and 64,000 acres, much of it in the southeastern portion of this IRWM region.

It is expected, due in part to the trend of changes in the climate, that there will be an increase in the potential for catastrophic fires. Climate change models predict hotter, drier conditions in the west. While future climate scenarios differ in the expected changes to California's climate, there is general agreement that increases in temperature are likely to result in significant changes in the composition of forests and rangelands throughout the state. In some cases, environmental effects from climate change have already been observed in California forests and rangelands. The effects from climate change and expected long periods of drought are likely to include shifts in vegetation types, changes in snowpack with earlier snowmelt, changes in the frequency of wildfire, and greater mortality of trees due to changes in pest disturbance.

As in many areas of the western United States, suburban development in the wildland-urban interface areas of the region has complicated fire management strategies and practices. Vegetation types that naturally burn with high intensity and rapid spread are increasingly being interspersed with new homes, increasing the number of people and amount of property at risk. The use of controlled burns to reduce fuel loads becomes more problematic as the presence and resulting risks increase to homes and other structures. In some communities, community volunteers have organized local Fire Safe Councils such as the councils in the areas of Dunsmuir, Lakehead, McCloud and Mount Shasta. There is also a Shasta County Fire Safe Council and a Fire Safe Council of Siskiyou County. Some fire safe councils have prepared Community Wildfire Protection Plans. The intent of these community-based fire protection plans is to identify and take measures to reduce the risk of wildfires.

The Shasta-Trinity National Forest engages in the use of prescribed burning with the understanding that the removal of accumulated vegetation is an important part of maintaining healthy and resilient forests. Managing prescribed fires is a tool to restore and enhance forest ecosystems. Prescribed fires are used to re-introduce fire to its natural role in the ecosystem and to treat hazardous accumulations of forest debris and other fuels, reducing the future risk of severe wildland fire. Techniques included burning piled slash and broadcast burning, in which fuel on the forest floor is ignited directly.

The use of prescribed fires can be complicated by complex ownership patterns and property configurations. Checkerboard property configurations, which originated as a result of railroad land grants, are common in many areas of the region, often interspersing privately owned sections of land with sections of land managed by the Forest Service.

4. Relation to Local Water Use Planning

Pursuant to the IRWM Guidelines, each IRWM Plan is to document the local water planning documents on which it is based. The Guidelines ask for:

A list of local water plans used in the IRWM Plan;
A discussion of how the IRWM Plan relates to planning documents and programs established by local agencies; and
A description of the dynamics between the IRWM Plan and local planning documents.

As emphasized in the Guidelines, regional planning does not replace or supersede local planning; rather, regional planning should appropriately incorporate local planning elements. Per California Water Code §10540(b), the IRWM plan must describe how the RWMG has or will coordinate its water management planning activities to address a variety of local water management topics.

There are no groundwater management plans applicable to the IRWMP for the Upper Sacramento/McCloud/Lower Pit Region. While most communities are reliant upon springs for municipal water supply, no communities in the region draw extensively from a defined and regulated groundwater aquifer. While the water code requires groundwater management plans for identified basins, of which there are two in the USR, these basins have not yet been monitored.[9] Because of the identified lack of groundwater knowledge in the USR, there are several projects identified in Chapter 10, Project Review Process and Implementation, that deal with this topic.

Due to the limited extent of agricultural activity in this mountainous region, there is no agricultural water management planning activity as in many IRWM regions, pursuant in part to Senate Bill X7-7.[10]

Concerning the subject of urban water management, none of the cities or communities in this region fall under the applicable definition of "Urban". Pursuant to Division 6 Part 2.6 of the Water Code §10610 - 10656[11], Urban Water Management Plans (UWMP) are prepared by urban water suppliers in California to support long-term resource planning and to ensure that adequate water supplies will be available to meet future water demands.

Concerning the subject of water supply assessments, given the relatively small size of communities in this IRWM region and relatively slow rate of growth, it is unlikely that a development project large enough to trigger the requirements of SB 221 and SB 610 will be proposed. Senate Bills 610 (Chapter 643, Statutes of 2001) and 221 (Chapter 642, Statutes of 2001) amended state law, effective January 1, 2002, to improve the link between information on water supply availability and certain land use decisions made by cities and counties. Both statutes require detailed information regarding water availability to be provided to the city and county decision-makers prior to approval of specified large development projects. Both SB 221 and SB 610 apply to projects generally equivalent to a 500 unit residential development, an industrial development of roughly equivalent projected use, or a project that would increase the number of the public water system's existing service connections by 10%. No

[9] While the Shasta County Water Agency has prepared a Coordinated AB 3030 Groundwater Management Plan for the Redding Groundwater Basin, this IRWMP region is outside the area addressed by that groundwater plan, except for the extent that the watershed of the Sacramento River as a whole relates to that groundwater basin.
[10] SBx7-7, signed into law in 2009, contains water resource management provisions that require water suppliers that provide water to 25,000 irrigated acres or more to implement various monitoring and conservation measures, including preparation of Agricultural Water Management Plans.
[11] Available at: http://www.water.ca.gov/urbanwatermanagement/docs/water_code-10610-10656.pdf.

water supply assessments in that context were available for consideration in preparation of this IRWM plan.

The RWMG for this region includes representatives from agencies that have local water supply responsibilities. These agencies typically have master plans or other management plans concerning the operation, maintenance and expansion, as needed, of their water systems. Cities periodically prepare and update such master plans. For example, the City of Mt. Shasta Master Water Plan was prepared in 1986. It contains the results of investigation of the water system including supply, storage, and distribution facilities. A Master Water Plan identifies a number of the primary recommendations for improvement of the system. During preparation of this IRWMP, the RWMG was receptive to concerns and information from local agencies regarding water use planning issues as reflected in their master water plans and related planning studies.

As discussed in Chapter 5, Relation to Local Land Use Planning, counties and cities have prepared and maintain general plans pursuant to state planning law. These general plans contain various policies and proposals that represent various levels of local water planning and practitioners must coordinate with local water providers where appropriate. The following discussion addresses local water use planning policies in Shasta and Siskiyou Counties, as well as policies in the cities of Dunsmuir and Mt. Shasta.

Below is a list of water management plans considered in the development of the USR IRWMP, organized by the entity overseeing their development and implementation.

Table 4.1: Local water plans used in the development of the USR IRWMP.

Jurisdictional Type	*Plan Name*
County	Shasta County General Plan
	Shasta County Water Agency: plans for County Service Areas
	Siskiyou County General Plan
	Siskiyou County Strategic Plan
	Siskiyou County Groundwater Management Ordinance
Community Services District	McCloud Community Services District Master Plan
City	Dunsmuir General Plan
	Dunsmuir Water and Wastewater Operational Plans
	City of Mt. Shasta General Plan
	City of Mt. Shasta Master Water Plan Sewer System Management Plan
	City of Mt. Shasta Master Sewer Plan for the Sewage Collection and Treatment Facilities
	City of Mt. Shasta Sewer System Management Plan
Other Local Plans	McCloud River Coordinated Resource Management Plan (CRMP)
	Upper Sacramento River Watershed Assessment and Management Strategy
	Local watershed planning (USFS)
Statewide Plans with Local Significance	Sacramento River and San Joaquin River Basin Plan
	State Water Plan

4.1 Shasta County

Shasta County's General Plan includes Section 6.0, Resources Group. The Resources Group section, which fulfills many of the requirements of a general plan conservation element as required by the State General Plan Guidelines, addresses the preservation, management, and utilization of the county's natural resources. Included in that section are subsections addressing water resources and water quality, as well as other natural resources including: agricultural lands; timber lands; minerals; energy; air quality; fish and wildlife habitat, and other subjects related to natural resources.

The Resources Group section of the General Plan includes a subsection entitled Section 6.6, Water Resources. This subsection contains objectives and policies concerning water resources. Many of the provisions of that section specifically address the Redding Basin, which is Shasta County's primary population center. Several policies of that general plan section are applicable to water management planning in the Upper Sacramento IRWMP region. For example:

> W-c. All proposed land divisions and developments in Shasta County shall have an adequate water supply of a quantity and a quality for the planned uses. Project proponents shall submit sufficient data and reports, when requested, which demonstrate that potential adverse impacts on the existing water users will not be significant. The reports for land divisions shall be submitted to the County for review and acceptance prior to a completeness determination of a tentative map. This policy will not apply to developments in special districts that have committed and documented, in writing, the ability to provide the needed water supply.
>
> W-e. The Shasta County Water Agency should encourage and promote interagency water planning efforts within the County, particularly in the Redding Basin.
>
> W-f. The County shall encourage and participate in interagency planning efforts, such as the Redding Area Water Council, to protect and enhance the quality of all groundwater and surface water resources.

Within this IRWM region, the County of Shasta maintains three county service areas (CSAs) that provide water service to rural unincorporated communities in the county. These three CSAs are: CSA No. 2 – Sugarloaf; CSA No. 3 – Castella; and CSA No. 23 – Crag View. The County manages these CSAs and has related plans for water use in these areas.

The Shasta County Water Agency was formed to develop water supplies in Shasta County. It wholesales 1,022 acre-feet of CVP water-to-water districts and other parties. The Water Agency acts as staff to the Redding Area Water Council, which has developed the Redding Basin Water Resources Management Plan to ensure adequate water supply in future droughts.

4.2 Siskiyou County

In the Siskiyou County General Plan Conservation Element (1973), the County expresses the following objectives:

> Objective #1: To conserve and protect the land resources of Siskiyou County.
>
> Objective #2: To protect and conserve the lakes, streams and reservoirs of the county of potable and agricultural water for recreation areas but more important as wildlife habitat which will be beneficial to the residents, present and future, of Siskiyou County and the State.

Under Section H. Watershed and Water Recharge Lands, the Conservation Element includes the objective:

> To preserve the quality of the existing water supply in Siskiyou County and adequately plan for the expansion and retention of valuable water supplies for future generations and to provide for a comprehensive program for sustained multiple use of watershed lands through reduction of fire hazards, erosion control and type conversion of vegetation where desirable and feasible.

Following that objective, the element lists the following as recommendations:

1. Provide for the safety and welfare of the residents of the county by flood control efforts on a regional scale.
2. Continue to assure the high quality of water within the county with management programs for agriculture waters and emphasizing programs that stop intrusion of agricultural waste into the water supply.
3. Every precaution must be maintained to eliminate the danger of any pollution to the streams and lakes as well as recharge areas through human and industrial waste and agricultural runoff.
4. Continue a program [of] research into the future water demands of Siskiyou County to establish the need for any future facilities.
5. Promote a plan for future expansion of water storage reservoirs to be utilized as water supply as well as recreation.
6. Utilize latest scientific techniques towards reclamation and recycling of wastewater.
7. Use of watershed or recharge lands for urban or second homes purposes should be permitted only under rigid controls.

Aside from the county general plan, the Siskiyou County Board of Supervisors also adopted a Strategic Plan in November 2008 to outline various policy statements and intended actions. Under the category of F. Natural Resources, the county expressed the need for a strategy (F-4) to: "Develop overarching policy and network for Siskiyou County water resources."

Siskiyou County maintains a Groundwater Management Ordinance as County Code Title 3, Chapter 13. This ordinance requires that a discretionary permit is required from the county for the extraction of groundwater from any groundwater basin underlying the county for use outside the basin from which it was extracted, with exceptions specified in the ordinance for water bottling facilities (detailed below). In adopting this ordinance, the Board of Supervisors cited findings including declarations that the groundwater basins underlying the county form significant water resources that must be managed in trust, and must be conserved so that they may be placed to the reasonable and beneficial uses of potential users, while avoiding waste and unreasonable use of these resources. The county also found that it is essential for information gathering and monitoring purposes, and for the protection of the county's groundwater resources, that the county should adopt a permit process to address excessive extraction of groundwater for use outside the basin from which it would be extracted. Issuance of a permit is subject to approval by the Board of Supervisors following review by and recommendations from the Planning Commission.

Among the exceptions from the permitting requirements are bottling and transporting bottled water by a commercial bottling water enterprise. However, the exemption for commercial bottled water is not applicable to water that is extracted and exported in bulk for bottling at a location outside Siskiyou County.

Siskiyou County's Groundwater Management Ordinance expresses the county's intent to, as resources permit, undertake development of "a County water plan to more specifically address water availability, needs and usages in an attempt to foster prudent water management practices to avoid significant adverse overdraft-related environmental, social, and economic impacts." Such a water plan has yet to be developed.

While the community of McCloud is unincorporated and therefore under Siskiyou County's jurisdiction, the McCloud Community Services District maintains a management plan for the water system it maintains and the services it provides to the unincorporated community of McCloud.

4.3 City of Dunsmuir

The City of Dunsmuir adopted a comprehensive update of its general plan in 2006. The Open Space Element and the Conservation Element for the City of Dunsmuir have been combined into a single element that addresses both subjects. The city's General Plan states that the Open Space and Conservation Elements are closely linked in Dunsmuir due to the proximity of the Sacramento River, the steepness of forested canyon walls on either side of the city, and the role open space and natural resources play in supporting Dunsmuir's economy. The Dunsmuir General Plan includes an important objective under Goal OC-3, Protection of the city's water resources.

> Objective: The city's water supply and the Sacramento River running through the city are vital to the community. The city must protect the watershed in order to maintain the quality and quantity of the municipal water supply, as well as sustain fishing, recreation and scenic benefits related to water resources.

In addition to general plan provisions that represent a general form of local water planning, the city also maintains detailed plans for operation and improvement of its municipal water and wastewater systems. Cities may also adopt standards for particular issues relating to water resources. For example, the City of Dunsmuir adopted its Water Efficient Landscaping Ordinance (Ordinance No. 532) in March 2011. The ordinance was codified as Chapter 15.52 of the Dunsmuir Municipal Code.

4.4 City of Mt. Shasta

The General Plan for the City of Mt. Shasta addresses the city's local plans for water use. Since water use is directly related to land use, some of the planning policies are contained in the General Plan Land Use Element. For example:

> Goal LU-18: Maintain a water supply and distribution system that meets drinking water standards and that serves the domestic and fire protection needs of the community.
>
> Policy LU-18.1: Ensure that the growth of the community does not outstrip the water supply and distribution system of the City.

As noted above, the City of Mt. Shasta has a Master Water Plan that was prepared in 1986 and updated in 2010, which identifies the primary proposals for improvement of the city's water system and the use of water within the city. There is also a City of Mt. Shasta Master Sewer Plan for the Sewage Collection and Treatment Facilities (1992), as well as a 2010 Sewer System Management Plan. In the context of the IRWM plan, the City of Mt. Shasta has been especially interested in pursuing improvements of the wastewater treatment plant to implement the master plan and to comply with new wastewater discharge requirements.

4.5 Other Local Plans

Various local plans have been prepared which merit mention in this section due to the relation of those plans to water resources in this IRWMP region. In other cases, proposed strategies with planning recommendations have resulted from planning efforts, but such recommended strategies may not necessarily be considered as local plans if they have not been adopted by a local jurisdiction with the authority to implement such recommendations.

The McCloud CRMP

One notable resource plan within the planning area is the McCloud River Coordinated Resource Management Plan (CRMP). The McCloud River CRMP was adopted in July 1991. Its purpose was to define the organizational structure and establish guidelines to coordinate management activities in an identified area of the McCloud River Drainage area with principle landowners and public agencies that administer programs in that area. The signatories of the memorandum of understanding (MOU) that adopted the plan agreed that the mission of the CRMP is to, among other objectives, coordinate various land management activities to improve management of resources while promoting cooperation between agencies, groups, and individuals responsible for resource management and land use planning and implementation within the CRMP area boundaries.

Another important objective was, "To allow a sustained flow of wood, fiber, recreation use, and other services and benefits from such lands while at the same time protecting and enhancing the area's natural environmental qualities and fully recognizing and protecting the rights of private participants in their property." (McCloud River CRMP 1991) It is also evident that the CRMP was intended to be used as an alternative to a then-proposed effort to designate the McCloud River as a "Wild and Scenic River" under the California Wild and Scenic River Act. The CRMP includes a number of specific management practices to help achieve its objectives, including recognition of types of project proposals that should, if proposed, be subject to study by the CRMP coordinating group.

Watershed Assessments and Analyses

Various watershed assessments have been prepared for several specific areas within the region. Watershed assessments provide an evaluation of resources and management issues in an identified study area. In some cases, the watershed assessments include recommendations (in the form of a "strategy" or otherwise) concerning planning and management of resources including water.

For example, a project that should be acknowledged as having been considered in preparation of the IRWMP for this region is the Upper Sacramento River Watershed Assessment and Management Strategy (2010). The preparation of that document was managed by The River Exchange and was funded by a grant through Proposition 50 (via the CALFED Watershed Program), as administered by the California Department of Water Resources. The project consultant was North State Resources, Inc., with assistance from ICF International and Lee Benda and Associates, Inc.

With assistance from a broad-based public advisory group and steering committee, the project included an assessment of resources and issues in the watershed of the Upper Sacramento River (from its headwaters to Shasta Lake). The assessment of these resources has contributed substantially to the Region Description portion of this IRWMP. The watershed assessment also provided recommendations for, as the name of the document implies, a management strategy. One of the expressed objectives of the assessment process and document was to, "Produce a document that can be incorporated into future watershed planning and management decisions."

The local planning conducted by the Shasta-Trinity National Forest (STNF) is applicable to the subject of water use and resource planning in the Upper Sac IRWM region. The STNF Land and Resource Management Plan (1995) was prepared to guide the management of the Shasta-Trinity National Forest. The primary goals of that plan are to integrate a mix of management activities that allow use and protection of forest resources, meet the needs of guiding legislation, and address local, regional, and national issues. This federal land and resource-planning program is described in more detail in the Land Use section of the Region Description. As part of this planning program, the STNF has produced a series of watershed analyses that warrant mention in this context. Following is a list of watershed analyses (WA) or basically equivalent ecosystem analyses that have been prepared by the STNF covering areas that are located completely or partially within the Upper Sac IRWM region:

1. Mount Shasta WA
2. Lower McCloud WA
3. Squaw Valley Creek WA

4. Edson WA
5. Pit Arm Shasta Lake WA
6. Porcupine WA
7. Headwaters Sacramento River Ecosystem Analysis
8. Shasta Lake West WA
9. Squaw Creek WA
10. McCloud Arm WA
11. Bartle WA
12. Shotgun-Slate WA
13. Iron Canyon WA
14. McCloud Flats Ecosystem Analysis
15. Upper Sacramento River (Castle/Soda Creek area – not on website)

A watershed analysis was also prepared for the Medicine Lake Highlands by the Modoc National Forest.

4.6 Statewide Plans with Local Significance

While not specific to the USR, both the Central Valley Water Quality Control Board's Basin Plan and the Department of Water Resources' State Water Plan are central to water planning throughout the state and, thus, in the Region.

Sacramento River and San Joaquin River Basin Plan

Basin Plans consist of a designation or establishment for the waters within a specified area of beneficial uses to be protected, water quality objectives to protect those uses, and a program of implementation needed for achieving the objectives. State law also requires that Basin Plans conform to the policies set forth in the Water Code beginning with Section 13000 and any state policy for water quality control. This Basin Plan doesn't specifically mention the Upper Sacramento or Lower Pit Rivers as far as policy is concerned, but does identify beneficial use goals for:

The McCloud River (Municipal Domestic, Power, Recreation (contact and non-contact), cold freshwater and spawning habitat, and wildlife habitat);

The mouth of Hat Creek as it enters Shasta Lake Reservoir (Municipal Domestic, Irrigation, Stock Watering, Power, Recreation (contact, non-contact, and canoeing and rafting), cold freshwater and spawning habitat, warm spawning habitat, and wildlife habitat);

The Upper Sacramento River to Box Canyon Dam (Irrigation, Stock Watering, Recreation (contact, non-contact), cold freshwater habitat, and wildlife habitat);

The Upper Sacramento River from Box Canyon Dam to Shasta Lake Reservoir (Irrigation, Stock Watering, Recreation (contact, non-contact, and canoeing and rafting), cold freshwater and spawning habitat, and wildlife habitat); and

Lake Siskiyou (contact and non-contact recreation, warm and cold freshwater habitat, and wildlife habitat).

Each of these bodies has specific management objectives for the beneficial uses assigned to it. USR stakeholders are aware of this and have structured proposed projects — in this IRWMP and outside of this planning process — in coordination with these management goals. Coordination with the Central Valley Water Quality Control Board will continue into the future.

An issue that has risen in level of importance on a statewide basis for the State Board is that of salts and nutrient management. This issue is linked to the increase in recycled water implementation and use throughout the state. Salts and nutrient inputs are not currently an issue in the USR, and are not expected to be in the near future. However, if recycled water is pursued as an implementation project, the Central Valley Board will be contacted to coordinate salt and nutrient management.

State Water Plan

Volume 1 of the State Water Plan identifies general vulnerabilities and opportunities for water management in California as a whole. Chapter 7 of this volume discusses implementation of the Plan, and identifies 13 objectives for implementation. Several of those, which are more relevant to the USR, are discussed in the list below.

- Objective 1: Expand Integrated Regional Water Management — USR stakeholders are vested in the success of the IRWM program in the region and in the state. Investment of the state in the IRWM program is essential for many rural and/or disadvantaged parts of California due to the low population levels and extensive human and natural infrastructure. In addition, these (largely) source water areas provide millions of dollars of benefit to the rest of the state, and should be part of taxpayer investment in water resources. IRWM is a good way to funnel these funds because of the balanced nature of participation and project review.
- Objective 4: Protect Surface Water and Groundwater Quality — Water quality is generally quite good in the USR, but climate change projections indicate possible threats to these resources. Most regional inhabitants not served by municipal water providers depend on groundwater resources through private groundwater wells. Those residents who do receive municipal supply are also, indirectly, dependent upon groundwater through the use of springs for most municipal supply. As mentioned throughout this IRWMP, groundwater quality and quantity is largely unknown throughout the USR; increasing regional understanding of this resource will add to regional resiliency as the region experiences the hydrology change projected as a result of climate change. In addition, some of the wastewater treatment infrastructure in the region affects the water quality of receiving waters. Decreased flow because of changing precipitation patterns may create a more challenging situation when it comes to compliance with designated beneficial uses. It is essential that stakeholders address these issues now, when they have the flexibility and adaptive advantage of time.
- Objective 5: Expand Environmental Stewardship — Reliable water supplies and resilient flood protection require environmental stewardship and resource and ecosystem sustainability to be a primary goal and foundational action for water resources management. Stakeholders in the USR are invested in the health of the watersheds around them and will continue to work together to promote, improve (where needed), and maintain the functionality and value of these resources.
- Objective 7: Manage a Sustainable California Delta — While the California Bay-Delta is outside of the USR planning region, the repercussions of Delta management are felt throughout the system. It is clear that water resources, planning, management, and policy in California will not be addressed without a solution to the Delta challenges. In that spirit, several USR stakeholder entities are involved in the process of developing and identifying options and strategies for the Delta, and in the process are ardently defending the resources of northern California interests. A solution for the Delta, while necessary, cannot be developed on the backs of northern California water users.
- Objective 10: Improve Data and Analysis for Decision-making — While the technology for increased and improved water information and monitoring is available, new technology has not been implemented in a meaningful, universal way throughout the state for many years. The CIMIS (California Irrigation Management Information System) station network has not been updated since implementation, and the real-time monitoring now available for snowpack, runoff, and temperature is not available in enough watersheds. In addition, this information could be useful to inform reservoir management rule curves, which could result in both significant water savings (through resource conservation in the spring) as well as the avoidance of significant flooding disasters (through water releases using real-time data on storm temperature and capacity). The gap in knowledge regarding groundwater resources has

been noted throughout this IRWMP, and a real need for increased data — and the coordination and sharing of that data — is apparent.

- Objective 12: Improve Tribal Water and Natural Resources — Four tribes (and two bands of one tribe) have been active in the USR IRWM planning process. It is clear from conversations — both public and individual — that water issues are at the forefront of many tribes' and aboriginal nations' concerns. Improvements that DWR is able to make as far as communication and coordination with tribes will only serve to strengthen the coordination and communication with and integration of tribes and nations into the IRWM planning process, thereby funneling a greater percent of statewide benefits to and through tribes.
- Objective 13: Ensure Equitable Distribution of Benefits — Through this USR planning process, and building on experiences of other IRWM planning regions, it was noted that both tribes and disadvantaged communities share an inhibitor to process participation. Limited budgets, an excessive workload-to-staffing ratio, and a difficulty in identifying the importance of the IRWM planning and implementation process is a set of challenges identified throughout California's rural and (often) source water area regions. The distribution of public benefits to these communities and planning areas goes beyond adequate funding for projects, to the heart of the question of participation. It is important that, as DWR promotes Objective 1, to expand and promote the IRWM process, that they keep in mind those real hurdles to participation by stakeholders in some of the key watersheds making up and contributing to California's water system and resources.

The Resource Management Strategies (RMS) make up a significant portion of the State Water Plan, and all of Volume 2. The relevance of these strategies are discussed in the RMS Chapter (Chapter 8).

Volume 3 of the State Water Plan identifies region-specific issues through twelve regional reports. That report which includes the Upper Sacramento, McCloud, and Lower Pit Rivers is the Sacramento River Regional Report. Within the report, DWR states that "[t]he Pit and McCloud Rivers contribute major volumes of water from the mountains above Shasta Lake." Aside from mentioning the hydrologic connectivity of the McCloud and Pit Rivers to Shasta Lake Reservoir, the report makes no mention of USR resources. It does include some generalities regarding Native American concerns with resources in the region, and identifies the USR IRWM planning effort, but doesn't recognize the uniqueness of the USR with relation to environmental and water (specifically, springs) resources. This is a possible activity for USR stakeholders with the 2013 update of the California Water Plan: to ensure the accuracy and completeness of the way the Sacramento Hydrologic Region is described in the Regional Report.

4.7 Future IRWM Collaboration Concerning Local Water Use Planning

The RWMG will continue to invite and be receptive to local agencies that wish to share and discuss their water use plans with others in the region. The RWMG will encourage and help local agencies consider the regional opportunities and ramifications of their local plans, and will welcome suggestions for how those local plans and related project proposals might be supported by regional planning. As noted above, almost all local water-service agencies in the region have been active members of the RWMG, and this participation facilitates consideration of local water use plans. Participation with the RWMG will also facilitate review of periodic updates of local plans, if and when the local agencies would like to present their updates to the RWMG for discussion.

When updates of local water use plans are presented to the RWMG for discussion, review will include consideration of any notable or potential inconsistencies between a local plan and the regional plan. The RWMG will consider whether and when the regional plan should be updated, if warranted, to accommodate or support a change in a local plan.

Since a major tenet of the IRWM program is that regional planning does not supersede local planning, but rather works to appropriately incorporate local planning, it is expected that local plans and their updates will be accommodated within the scope of the IRWM plan. That is, the Upper Sac IRWM plan is broad enough in scope to complement and support local plans.

5. Relation to Local Land Use Planning

This section examines the relationship of local land use planning to the management of water resources in the Upper Sacramento, McCloud, and Lower Pit Region (USR). Integrated Regional Water Management (IRWM) plans are encouraged and intended to foster expanded communication between regional water management groups and land use planners to effectively integrate water management strategies with land use planning.

There are four local agencies in this Integrated Regional Water Management Plan (IRWMP) region that have land use planning jurisdiction directly relating to water management: Shasta County, Siskiyou County, the City of Dunsmuir, and the City of Mt. Shasta. Approximately 55% of the total area of the region (including state and federal lands) consists of land within Shasta County and 45% within Siskiyou County. The local jurisdiction of these counties pertaining to land use planning does not directly apply to state and federal land, although county policies may address the need for coordination with state and federal land use and resource management planning.

Both Dunsmuir and Mt. Shasta are located in Siskiyou County. As incorporated cities, they each are responsible for land use planning within their municipal limits. Both cities also have what is called a "sphere of influence" around their service areas, as designated by the Local Agency Formation Commission (described below). One aspect of a sphere of influence is that a city (or a special district when applicable) may have concerns about proposed land use within their sphere (i.e. outside but near their service areas), thereby having land use concerns which overlap with the land use jurisdiction of the county in which the city is located.

The unincorporated town of McCloud is the only community in the region with a full community services district (CSD). The town of McCloud is under the land use planning jurisdiction of Siskiyou County. All of the communities in Shasta County's portion of the region (e.g. Castella, Lakehead, and Montgomery Creek) are unincorporated and are subject to the county's land use planning jurisdiction. The County of Shasta has established eight county service areas (CSAs) that provide water service to several rural unincorporated communities in the county. Three of these CSAs are located in the USR: CSA No. 2 – Sugarloaf; CSA No. 3 – Castella; and CSA No. 23 – Crag View. The County of Shasta manages these CSAs and, since the communities served by these service areas are in unincorporated territory, they are also under the land use planning jurisdiction of the county.

The primary policy document for every county and incorporated city in California concerning planning for land use and related resource management is the jurisdiction's general plan. Under California Planning Law (codified in the California Government Code, primarily § 65300 et seq.), the land use element of a general plan has the broadest scope of all general plan elements. The land use element indicates the intended future uses of land, the proposed density and intensity of development, and may also include policies and measures concerning water, wastewater, and stormwater infrastructure needed to serve existing and planned land uses. The function of a General Plan is to provide a policy framework that must be reflected in the jurisdiction's zoning codes and ordinances, specific plans, and other development guidelines.

The land use element must be closely correlated with the other elements of the general plan, such as the housing element. Conservation elements also typically contain goals and policies for the protection of the jurisdiction's water resources. The open space element (sometimes combined with the conservation element) may address protection of watersheds, recharge areas and other land around water sources. A safety element in the general plan is required to address public safety and hazard issues including hazards related to flooding.

Although all general plan elements need to be internally consistent, the general plan housing element has a special relationship with the land use element. Among the many content requirements for housing elements (outlined in California Government Code Section 65583) is an inventory of land suitable for residential development, including vacant sites and sites having potential for redevelopment. Housing elements must also include an analysis of the relationship of zoning and public facilities and services (e.g. water and wastewater) to identified housing development areas.

Concerning the general plan conservation element, the state legislature has required that that element address provisions of bills SB 221 and SB 610. These two bills were enacted to require greater coordination and exchange of information between local land use agencies and water suppliers concerning large development projects and related plans. As described in the demographics of this IRWMP region, local communities are small in population and have experienced very slow growth. Growth of a subdivision by 20 or 30 homes in any of the local communities would be considered by many as substantial. SB 221 requires a water supply assessment for any development of 500 units or more, the equivalent in industrial development, or a development that would increase a water purveyor's customer demand by at least 10%. Depending on the location of particular new development projects, community systems may have significant physical challenges to provide adequate water and/or wastewater services to accommodate new development. Therefore, the need for coordination between land use planning and sound resource management, as addressed in general plan conservation elements, is critically important.

In addition to what is commonly considered to be land use planning, counties and cities administer local ordinances, regulations, and standards for land use development within their jurisdictions. These ordinances and development standards guide consideration and permitting of development proposals. Development standards address requirements for improvements and infrastructure, including water service and wastewater management, necessary to accommodate and support proposed development.

Use of surface or ground water for agriculture in this mountainous region is minimal. Extensive areas of this IRWMP region are designated in the general plans of both Shasta and Siskiyou counties for land uses that are predominately forest management and natural resource production in character. Land use issues in these areas typically include consideration for the protection of watersheds and the condition of streams in areas that may be affected by resource management and production. While counties provide land use designations in their general plans to support timber production on private lands, actual timber management land use and practices are regulated by administration of the California Forest Practices Act by the California Department of Forestry and Fire Protection.

Within and in closer proximity to established communities, land use planning related to water resources becomes more focused on community services and the need to protect, maintain and, in many cases, expand infrastructure to adequately provide those services relative to land uses. Small cities and community systems struggle to maintain their water systems and improve those systems to accommodate planned growth with water for domestic use, including the provision of adequate storage and flow capacity for fire protection. These jurisdictions must also maintain and, in some cases, improve and expand their wastewater systems to protect surrounding groundwater and streams, and comply with related water quality standards and regulations administered by the Regional Water Quality Control Board.

An important planning issue around some communities in the region has involved management of land uses in the vicinity of water sources. Potential contamination of springs and wells by septic tank systems or from industrial uses has been of concern in some areas such as up-gradient from Dunsmuir and Mt. Shasta. Proposals and practices related to the commercial water bottling and other industries, and the potential impacts such operations could have on community water and/or wastewater systems, have also been issues in the region. This concern was exemplified several years ago by the controversy over a proposal to bottle water acquired from the McCloud CSD. Water bottling facilities have been sited in the City of Dunsmuir, near the City of Mt. Shasta, and in the City of Weed (north of this IRWM region).

Concerning land use planning and opportunities for collaboration with water managers, this section notes the existence and related roles of Local Agency Formation Commissions (LAFCO). Both Shasta County and Siskiyou County have a LAFCO. A LAFCO is one of several decision-making governmental entities in California with the responsibility to decide boundary issues pertaining to city and county lands, including spheres of influence, and issues relating to annexations of land into a city or special district. The Local Agency Formation Commissions' current legal authority and mandate are defined by the Cortese-Knox-Hertzberg Local Government Act of 2000 (Government Code Section 56000 et seq.), with subsequent amendments. As a regulatory agency, LAFCO is charged with discouraging urban sprawl and encouraging the orderly formation and development of local agencies based on local circumstances and conditions, including the availability of water and other infrastructure. The Local Agency Formation Commissions' regulatory responsibilities include reviewing, approving or denying proposals to annex land to cities or special districts.

As a planning agency, LAFCO is charged to determine and update, at least every five years, the sphere of influence of each city and special district. In updating spheres of influence, LAFCO must prepare Municipal Service Reviews of relevant local agencies and services. As part of its review of municipal services, LAFCO is required to prepare a written statement of its determination with respect to a list of specific issues, including infrastructure needs or deficiencies. Such infrastructure includes the provision of water as well as wastewater collection and treatment.

The following notes cite some of the primary local land use planning documents and development regulations related to water resources that were considered in preparation of this IRWM Plan.

5.1 Shasta County

Shasta County's principal land use policy document is the Land Use Element of its General Plan. The core of Shasta County's General Plan was last updated comprehensively in 2004. Shasta County applies land use controls through its General Plan, along with the Zoning Plan and Subdivision Ordinance. The General Plan is a generalized, long-term statement relating to land use and associated topics. The function of a General Plan is to provide a policy framework that must be reflected in the zoning ordinance, specific plans, and other development guidelines. The General Plan and Zoning Plan establish the amount and distribution of land allocated for different uses. The Subdivision Ordinance governs the process of creating new parcels and converting undeveloped land to building sites.

While the General Plan land use element contains most of the policies applicable to land use, other elements of the general plan include policies that directly pertain to the relationship between land use and water resource management. For example, in Shasta County's General Plan Section 6.6, Water Resources, there is the following policy:

> W-c. All proposed land divisions and developments in Shasta County shall have an adequate water supply of a quantity and a quality for the planned uses. Project proponents shall submit sufficient data and reports, when requested, which demonstrate that potential adverse impacts on the existing water users will not be significant. The reports for land divisions shall be submitted to the County for review and acceptance prior to a completeness determination of a

tentative map. This policy will not apply to developments in special districts that have committed and documented, in writing, the ability to provide the needed water supply. (Shasta County 2004)

In Shasta County, the Environmental Health Division of the Department of Resource Management is responsible for ensuring that each new subdivision and residential permit application verifies an adequate supply of potable water and a sewage disposal site capable of handling and processing effluent generated from development projects. These standards are consistent with uniform state standards adopted by the Regional Water Quality Board and the State Integrated Waste Management Board as specified by the State Health and Safety Code. In a majority of residential permit applications, these standards govern the location and development of individual on-site wells, septic tanks and drain fields.

Shasta County's Zoning Code, as in all local jurisdictions, is one of the primary tools to implement the general plan. The Zoning Plan specifies development standards for development projects such as setbacks, parking requirements, height limits, and lot coverage for individual zoning districts. The Zoning Plan is periodically reviewed to ensure consistency with the policies of the general plan as required by Government Code Section 65860. Amendments are considered when needed to enhance the value of the Zoning Plan to accommodate new development.

The County's Subdivision Ordinance includes the county's official requirements governing the division of land into separate parcels for future development. The Subdivision Ordinance adheres to the requirements of the State Subdivision Map Act. The requirement for adequate roads, lot size dimensions, provisions for water supply and sewage disposal and drainage improvements are among the key factors addressed in the Subdivision Ordinance.

5.2 Siskiyou County

Siskiyou County also maintains a General Plan as required by state planning law, and the Land Use Element of Siskiyou County's General Plan contains policies pertaining to land development. The main body of the Land Use and Circulation Element was adopted in 1980, and other general plan elements were adopted at various times (e.g. Conservation Element in 1973).

The current Land Use Element does not emphasize specific land use designations (e.g. rural residential, resource management, etc.). Instead, the general approach taken by the county for land use planning is that the Land Use Element has a series of overlay maps that identify development constraint areas. The introduction to the county's Land Use Element states: "By identifying an absence of physical constraints, it also indicates where urban development may proceed without encountering known physical problems." The Land Use Element also contains various goals, objectives and policies pertaining to the development of land uses in the context of recognized development constraints.

In Siskiyou County, almost all private land in this IRWMP region is indicated as having "Woodland Productivity" constraints according to the county's General Plan Land Use Element Map 11. Some areas are indicated as having "High Suitability" for woodland productivity (site classes I and II) and some areas are indicated as "Moderate Suitability" (site classes III and IV). Siskiyou County has approved residential development in areas designated with woodland productivity constraints, indicating that such areas may accommodate development. Depending on the proposed density of development, Siskiyou County applies various local development standards to determine the necessary water and wastewater improvements.

As in Shasta County, Siskiyou County's General Plan and related development policies are implemented by various zoning codes and development regulations. Siskiyou County's Zoning Ordinance is codified as County Code Title 10, Chapter 6. The county's Subdivision Ordinance is under County Code Title 10, Chapter 4.

A community planning project has been underway for several years in and around the unincorporated community of McCloud to formulate and propose General Plan amendments in the form of an area plan. Area plans are sometimes adopted by counties as components of their General Plans to help focus policies and land use designations on communities and geographical subareas that might not otherwise receive detailed consideration in countywide General Plan elements. A local group entitled the McCloud Area Plan Committee is working with other members of the public to discuss and propose planning policies concerning land use and resource management in the vicinity of McCloud. When completed by the committee, the recommendations for the area plan will be submitted to the Siskiyou County Board of Supervisors for consideration. Before an area plan and related General Plan amendments could be considered for adoption by the Board of Supervisors, the proposed action will require public hearings and further processing by the county including review by the county planning commission and evaluation under the California Environmental Quality Act.

As noted, the core of Siskiyou County's General Plan Land Use Element dates back to 1980. The county has expressed the intent to update its General Plan, including the land use element, when it has the resources to initiate such an update. It is expected that issues concerning water resources will be an important consideration when the update is undertaken. It is not known at this time whether or to what extent the County might wish to consult or collaborate with the regional water management group (RWMG) concerning the relationship between land use planning and the regional water resources plan. During the course of preparing the IRWMP for this region, the Board of Supervisors of Siskiyou County emphasized that it objected to and would oppose any effort that might be made by the RWMG to propose policies or other provisions that could interfere, directly or inadvertently, with the county's land use and related jurisdictional authority. In preparing the IRWM plan, the RWMG has worked with the county to address such concerns by evaluating how the developing provisions of the regional plan, in draft form, may relate to the land use concerns expressed by the Board of Supervisors and help to promote mutually agreeable goals between the Siskiyou County Board of Supervisors and the USR RWMG.

5.3 City of Dunsmuir

The City of Dunsmuir General Plan Open Space and Conservation Element notes:

> Dunsmuir's watershed is a valuable asset in that it provides an important economic resource (tourism) as well as the City's drinking water. Dunsmuir's drinking water is so pure that it does not require treatment, and it is a valued resource in the community. Protection and conservation of watershed resources, both groundwater and surface water, are essential. (Page 39)

As noted in the city's General Plan, development in the City of Dunsmuir is significantly constrained by topography. Being located in a river canyon with steep canyon walls, opportunities for further development and city expansion are limited. Little undeveloped land remains in the city with slopes of less than 30%. Lack of water pressure in some areas (another consequence of steep topography) is a significant development constraint. The city's General Plan clearly states concern for its water resources. It notes:

> *GOAL OC-3: Protection of the City's water resources.*
>
> Objective: The City's water supply and the Sacramento River running through the City are vital to the community. The City must protect the watershed in order to maintain the quality and quantity of the municipal water supply, as well as sustain fishing, recreation and scenic benefits related to water resources.

The City of Dunsmuir is concerned about land uses and potential development above its springs that could result in contamination of the city's water supply, whether or not the development is in the city limits. If such development is proposed outside the city limits, the general plan cites the need for the city to advocate its concerns and needs to Siskiyou County.

The city has been an active member of the RWMG. It is expected that the city may request RWMG assistance in addressing the relationship of local land use planning to protection of water resources in these areas.

5.4 City of Mt. Shasta

The City of Mt. Shasta's General Plan outlines the city's land use designations and the standards for building intensity and population density that are associated with each designation. The land use element also addresses related water supply issues.

> Goal LU-18: Maintain a water supply and distribution system that meets drinking water standards and that serves the domestic and fire protection needs of the community.
>
> Policy LU-18.1: Ensure that the growth of the community does not outstrip the water supply and distribution system of the City.

Concerning protection of its spring-fed water sources, especially since they are located in areas outside the city, the city's general plan includes related implementation measures:

> LU-18.2(a): The City shall encourage the enforcement of all federal, state, regional and county regulations and shall enforce local regulations regarding the preservation and enhancement of water quality as it relates to the City's water sources.
>
> LU-18.2(b): The City shall strive to protect its spring water sources by means such as preventing development (especially the use of septic tanks) within adequate buffer areas in the vicinity of its spring water sources, and/or facilitating the purchase or dedication of land or development rights in those areas.

There may be opportunities for the IRWM plan and the RWMG to assist in addressing these and similar relationships between local land use planning and water resource protection and management concerning the City of Mt. Shasta. The City of Mt. Shasta has been and is expected to continue to be an active member of the RWMG.

5.5 Shasta-Trinity National Forest

While land and resource management plans for national forests might not typically be referred to as local plans, in rural areas such as this IRWM region, land use planning practices for public lands are important and influential factors related to regional water management. The planning conducted by the Shasta-Trinity National Forest (STNF) is applicable to the subject of local land use planning in the USR. The STNF Land and Resource Management Plan (adopted in 1995) was prepared to guide the planning and management of land use and resources on the Shasta-Trinity National Forest. The primary goals of that plan are to integrate a mix of management activities that allow use and protection of forest resources, meet the needs of guiding legislation, and address local, regional, and national issues. This federal land and resource planning program is described in more detail in the Land Use section of the Region Description.

5.6 Collaboration between Land Use Planners and Water Managers

5.6.1 Current Relationships and Overlap

The IRWM Guidelines call for each IRWM plan to document future plans to further a collaborative, proactive relationship between land use planners and water managers. In this IRWMP region, as noted above, the jurisdictions that provide water service and/or wastewater management are typically the same jurisdictions that have land use authority. Therefore, the participation of those jurisdictions with the RWMG facilitates direct collaboration. The Cities of Dunsmuir and Mt. Shasta provide water services to developments within their jurisdictions, and those cities are also responsible for land use planning and development approval within their jurisdictions. The McCloud CSD, which provides water to the unincorporated community of McCloud, works with the Siskiyou County, which has land use planning jurisdiction over that community. The county also manages the Flood Control and Water Management District. These agencies participate with the RWMG.

In Shasta County, as noted, the three CSAs are located in the unincorporated jurisdiction of the county. Since the CSAs are managed by the county, there is close coordination with related land use planning.

There are no groundwater management or irrigation districts in the region. Compared to regions having more intricate patterns of water districts and other local jurisdictions, the patterns of jurisdictional boundaries are fairly simple in the USR. There are few instances where the responsibilities of one local jurisdiction relative to water management or land use planning overlay the boundaries of another jurisdiction. One case, as pointed out, is that the boundaries of the McCloud CSD service area are within the land use jurisdiction of Siskiyou County and within the Siskiyou County Flood Control and Water Management District.

5.6.2 Future Opportunities

Opportunities for expanded collaboration may be presented by coordination of these agencies with or through the RWMG, but that particular function for the RWMG hasn't emerged in the IRWMP process as a high priority. The reason for that is that there are other forums and systems for these agencies to dialog and work together to address planning related issues, such as the LAFCO, described above. Given that LAFCO may have an important role relative to local land use planning and the water and wastewater treatment infrastructure and services needed to accommodate expansion of communities and development, the functions of these agencies should be noted and regarded by this USR IRWMP and the RWMG. Therefore, this IRWM plan considers the objective that the RWMG will coordinate and collaborate with the Shasta County LAFCO and the Siskiyou County LAFCO, as warranted and appropriate, when land use planning matters involve water management issues of mutual concern.

The RWMG, in considering water resource issues and related proposed projects, will continue to collaborate with land use planning jurisdictions by virtue of the organizational structure of and entities participating in the RWMG. In this way, the RWMG can have a better understanding of the interrelationships and implications of water resource proposals concerning the local land use planning framework. It is also expected that the RWMG will be prepared to serve as a forum to help address planning issues related to regional water management when any of its participating agencies or organizations call attention to particular land use planning concerns. However, respecting as it does the local land use authority that is vested in particular agencies, the RWMG has not expressed an interest or intent to become involved in general land use planning concerns.

6. Issues and Interests: Introduction

Characterization of the Upper Sacramento, McCloud, and Lower Pit Integrated Regional Water Management (USR IRWM) planning region includes identifying key issues related to water resource management. Key issues are topics relevant to the IRWM process both during its development and during ongoing implementation. The issues presented in this document have been developed through interaction with stakeholder participants.

Management of water resources in the USR presents additional challenges that affect stakeholders in the region but may not be able to be fully addressed by this IRWM document. These challenges are also presented in this section along with current perspectives from regional stakeholders. The perspectives presented here are not intended to resolve these challenges but provide a background that helps in understanding particular issues and interests in the region that are addressed in this document.

6.1 Process and Issues Identified

Issues were identified through a process of stakeholder interviews conducted between March and September 2012. This process included at least two presentations to and follow-up discussions with the regional water management group (RWMG) as a whole, and other plenary discussions regarding the nuances and interests behind the issues.

Issues identified in the USR include:

- Basin Characterization
- Building Relationships of Trust, Understanding, and Respect
- Establishing Common Language
- Ecological Health
- Sustainable Economic Development
- Education and Outreach
- Fuels and Fire Management
- Forest Management
- Funding
- Governance
- Regulatory Compliance
- Tribal Water Resources Interests, Jurisdiction, and Issues
- Water Supply
- Water Quality
- Municipal Water Supply & Wastewater Infrastructure
- Adaptation to Climate Change

These issues provide a basis for development of plan objectives, resource management strategies and other relevant plan sections.

6.2 Discussion of Issues

The following discussion presents the issues listed above along with a summary of the interests in these issues expressed by stakeholders. For the purposes of this document, interests are defined as the reasons why an issue is of interest to a particular stakeholder.

6.2.1 Basin Characterization

Basin characterization was identified as an important issue to a number of RWMG members. While current knowledge is adequate for water and resource managers to address some needs in the region, stakeholders understand that a more complete characterization of the hydrologic cycle in the region, ground, spring and surface water interactions, and climatological patterns will aid in the development of more effective and integrated implementation projects for upstream and downstream interests alike in an uncertain future. The knowledge gained from basin characterization will allow for basin regional water management based on a more sound and accurate understanding of existing conditions, laws, and ordinances. RWMG members expressed the following particular interests in basin characterization.

Hydrology and hydrogeology around and under Mount Shasta

Knowledge and published data regarding hydrology and hydrogeology around and under Mount Shasta is limited at this time. Some limited investigations are underway by various groups. The desire to build on this knowledge by additional investigations and development of additional data is of particular interest to certain RWMG members.

Investigate water quality impacts in Upper Sacramento River

The overall quality of water in the Upper Sacramento River is of particular interest to the RWMG. Water quality of the Sacramento River effects ecological and human health, local fisheries, and other beneficial uses. In addition, water quality affects aesthetics and recreation related to the Sacramento River. Water quality standards for the Upper Sacramento River are of prime interest to the city of Mount Shasta and Dunsmuir who utilize it as receiving waters for municipal wastewater discharge. Additional characterization of the Upper Sacramento River related to Total Maximum Daily Load (TMDLs), as well as its capacity to assimilate various point and non-point sources will be important in developing water management strategies that focus limited resources to efforts that will produce the most beneficial outcomes.

6.2.2 Building Relationships of Trust, Understanding, and Respect

Water in the USR basins is critical to a variety of interests in the region. The perspectives of these interests often come from different directions. With this understanding, members of the RWMG have identified building relationships of trust, understanding, and respect as a key issue in this IRWMP. Building these relationships of trust between RWMG members will strengthen the IRWM process and assist in effective collaboration and cooperation in development of regional water management strategies that will be more representative of the interests of the overall RWMG membership.

Specific interests based on discussions with RWMG members include the following:

- Collaboration
- Resolve lack of trust by identifying and prioritizing common interests
- Respecting private property rights

The RWMG has expressed concern regarding the governmental process associated with these efforts. As this issue is addressed, this concern will need to be considered.

Water rights and the potential for them to be impacted through the IRWM process and otherwise have been expressed by several RWMG members. It is important to note that this IRWM process does not have the ability to affect or change water rights. However, respecting water users and their rights is important to RWMG members and is an important consideration regarding water resource management in the USR.

6.2.3 Establishing Common Language

The common language used in this IRWMP is a key issue for the RWMG. Establishing a common language that clarifies terms, acknowledges perspectives, and provides clear definitions regarding the IRWM process will be invaluable in facilitating progress and assuring that outcomes are as expected by RWMG members. This effort will also significantly assist with the process of building relationships of trust.

6.2.4 Ecological Health and Restoration

The USR basins have been and still are subject to timber harvesting, railroads, mining, and localized development while supporting an ecologically rich environment. This environment includes natural water features, wildlife, and a variety of natural resources that provide environmental and economic benefits. Protection, preservation, and where necessary, restoration of these features and resources in conjunction with maintaining and enhancing the economic environment and uses are key issues for RWMG members. Particular interests of some RWMG members related to intact ecological systems and processes include the following:

- Protect, preserve, and restore natural water features
- Quantification and availability of information on sedimentation, herbicide, and pesticide applications
- Sustainable yield of groundwater and surface water supplies
- Wildlife protection and management
- Protect, preserve, and restore habitat for native fisheries
- Natural resource conservation
- Maintenance and, where necessary, restoration of ecological health
- Invasive species management – terrestrial and aquatic
- Bioremediation of organic and volatile wastes

6.2.5 Sustainable Economic Development

Rural communities' characteristic of the USR can be particularly sensitive to economic variability. Smaller populations can have limited economic resources, making adaptation to economic change particularly difficult. Historic changes in local industry as well as recent economic challenges and changes in the management of federal lands have required these communities to reconsider effective economic strategies in the region. These strategies often are dependent on adequate water supply and water quality. Particular RWMG interests are discussed below.

Economical water service to jurisdictional constituents

Costs related to providing adequate water supply and wastewater treatment meeting regulatory requirements and local water quality expectations are continually increasing. In a region made up primarily of disadvantaged communities, this is a serious concern. Local jurisdictions face unique challenges in providing services to small, and often poor, populations and must be creative in project development to ensure local water service is provided economically.

Projects benefiting local community

In development of the IRWMP care will need to be taken to ensure that the projects developed consider both benefit to the local community and protection of watershed integrity as top priorities. Benefits may be defined broadly, including watershed restoration and ecological health, economic, water quality, cultural resource protection, eco-tourism, recreation, public health or other benefits. Benefits to a broader region may be desirable as long as the local priorities are met.

Encourage and support sustainable economic development in the basin

A major interest for RWMG members is to encourage projects and regional water planning that support healthy watersheds; protects water quantity; encourages environmental stewardship and considers these areas when planning for economic development within the Upper Sacramento, McCloud, and Lower Pit River basins. Efforts should keep the benefits of economic and resource development as local as possible.

Encourage sustainable industry

Industry in the Upper Sacramento, McCloud, and Lower Pit River basins has long been and still is an important part of the local economy. History in the region has shown the importance of encouraging economic growth that coincides with watershed protections to provide benefits within the basins for a sustained period of time. Water management projects that stabilize the region's natural resources will be more likely to gain support from RWMG members.

Encourage sustainable tourism

Tourism in the Upper Sacramento, McCloud, and Lower Pit River basins has long been a part of the local economy, and includes hiking and camping, fishing, hunting, snow play of all types, mountain climbing and biking, and many other recreational uses of the resources. In turn recreation and other forms of tourism, like all human activities, can have significant impacts on water quality, ecological health, and cultural resources in the region. The IRWMP process should encourage, support, and maintain this part of the region's livelihood.

Utilization of local professional and service-industry resources

As much as possible utilization of local resources, including resource expertise, tribal entities, and local professionals, will be encouraged and promoted as part of the IRWMP process. This will ensure that tribal communities and local interests will receive the greatest benefit possible from the outcomes of the IRWMP and will increase regional capacity.

Encourage green infrastructure

Some RWMG members have expressed particular interest in promoting infrastructure that is geared toward the greatest possible environmental benefit. This includes promoting conservation of natural watershed infrastructure such as forests, meadows, and riparian habitat that help store and filter water naturally. As different infrastructure alternatives are considered, those providing the greatest value to the basin taking into account environmental benefit will be given preference.

Internalize Externalities

The watersheds in the Upper Sacramento IRWM region provide a significant benefit to water users and resources outside the region. However, the costs to maintain the quality of this resource is often disproportionately distributed with the higher costs relative to received benefit being borne by the Upper Sacramento region. The RWMG is interested in working toward seeing that these costs are equitably distributed between the Upper Sacramento region and other regions benefiting from protection of these water resources.

6.2.6 Education and Outreach

RWMG members have expressed interest in supporting and encouraging education in the region related to water management issues and opportunities. Projects that allow for and provide education and outreach will assist in ongoing success of effective regional water management efforts. Specific education and outreach interests of RWMG members include the following:

- Increased awareness of interests among stakeholders
- Supporting and expanding watershed education

- Increase public awareness of factors that impact water quality (e.g. improperly working septic systems, erosion following some logging activities and high intensity wildfire) within the basin and strategies that are, or can be implemented to reduce these impacts; Community engagement regarding climate change
- Accurate valuation of ecosystem services

6.2.7 Fuels and Fire Management

Fire management in the Upper Sacramento, McCloud, and Lower Pit River basins is a tool, but also has the potential to significantly impact water quality and water resource management in the region. The RWMG members recognize fire management as a key issue requiring consideration in development an integrated regional management plan. Particular interests of RWMG members are listed below.

Fire protection and emergency planning

There are many considerations and many agencies active in fire management and planning. This includes everything from fire protection and fuels management to response activities and clean-up crews. It should consider effects on wildlife, communities, transportation corridors, hydrologic effects, and snowpack response. Planning for catastrophic fire is an essential component as communities look into the future; higher temperatures and more frequent summer lightning storms could exacerbate the natural fire regime, necessitating additional, more active (and expensive) management strategies.

Impacts of fire regimes

Historical changes in natural fire regimes have had an effect on, plant succession, composition, and diversity of native plant species. Traditional use of fire by California Indians is an important tool for future watershed restoration planning activities that incorporate Traditional Ecological Knowledge and seasonal burning activities. Fire as a tool is key to reducing fuel loads and can over time reduce the cost of fire suppression activities. These changes may also affect habitat suitability for certain species of plants and wildlife.

Development impacts

Additional development in the region will most certainly be in the wildland-urban-interface (WUI), the most expensive and dangerous area to defend against catastrophic wildfire. It is important that these development efforts be guided through fire education activities that include outreach to property owners on how to create fuel breaks and manage vegetation during the fire season.

Fuel reduction

Lack of density control on timberlands, combined with decades of fire suppression, can lead to increased fire intensity. Also, stressed trees in overstocked forests are vulnerable to bark beetle attacks, which may lead to infestation of entire stands. Under appropriate conditions, annual controlled burns, use of TEK and historic fire regime data, careful timely stocking control, and re-vegetation of herbaceous understory species can reduce the fuel loading and the occurrence of high-intensity fire. Forests managed in these ways may be more fire-resistant and more similar to forests that were present prior to European contact. In some cases, such management may also pay for itself through sale of forest products, along with providing family wage jobs for the local community.

Extensive areas of burned and beetle-killed forests present difficult management issues, and there are many points of view among stakeholders. Recent research has shown that snags remaining in burned forest and in beetle-killed forest support uncommon wildlife species that are highly dependent on that unique habitat type for foraging, breeding, and other life history needs. Where snags are retained, they also provide opportunities for woodpeckers to excavate cavities that are important to many other species as well. However, retention of extensive stands of dead timber can also contribute to spread of future fires, and can delay or prevent re-stocking of young forest where that is a management priority. Complete salvage of burned or beetle-killed timber is allowed on private land under the CA Forest Practice Rules, and in some cases has also been carried out on Federal lands. In some areas within the USR, heavy rain falling on both salvaged and un-salvaged burned areas has resulted in substantial watershed impacts. Additional scientific evaluation of such cases could provide valuable information. Management of dead timber should carefully evaluate the local and regional context in balancing various resource objectives, including long-term watershed health.

6.2.8 Forest Management

Forestry in the Upper Sacramento, McCloud, and Lower Pit River basins is a major industry that is key to the local economy and way of life in the region. Some stakeholders feel that forest management activities must include a restoration plan framework that balances timber extraction with watershed health, and provides for employment opportunities in ecological restoration. That approach is not required by state or federal laws, and other stakeholders feel that existing regulations are sufficient to mitigate potential impacts of timber management. Decisions regarding regional water management can have significant impacts on this industry. In turn forest management like all human activities can have significant positive and negative impacts on water quality and ecological health in the region. The IRWMP process should balance forest management (timber extraction methodologies) and watershed health to protect valuable natural resources.

Healthy forests

Healthy forests are key to providing habitat for wildlife; clean water for rivers; family wage jobs; economic output; agriculture, and human use and consumption; and provide for a buffer as climate change alters regional hydrology and temperature regimes. Forest health also includes fuels management to control catastrophic wildfire and insect infestations.

Regulatory impact to existing operations

Proper regulations that are enforced can help to protect resources and are very important to maintain environmental protections for cultural and environmental resources, endangered species and water resources. However, some stakeholders maintain that. Excessive regulations, or onerous and overzealous enforcement, can also negatively affect business as well as municipal operations. As has been noted by the U.S. Department of Agriculture, loss of a local viable forest products industry can make it cost prohibitive to conduct management activities that are necessary to achieve environmental goals or forest restoration activities. It is important to this region that assessment of regulatory implications to both resources and economics be considered during IRWM planning and implementation.

Maintain water drafting sites

There are sites where forest management operations draft water from local waterways to filltanker trucks. This water is an important resource for these operations to aid in dust and sediment control on natural surfaced roads. These drafting sites are also critical for supplying water during wildfire suppression efforts. Some RWMG members are interested in potential development of off-stream water storage facilities for dust and fire control.

Maintain working forests

For the Upper Sacramento, McCloud, and Lower Pit River IRWM Region, the term “working forests” includes forests that are managed to primarily provide economic benefit, while also providing water quality, wildlife habitat, spiritual and recreational refuges, aesthetics, and other benefits. This IRWMP recognizes that maintaining working forests is a foundational principle for some stakeholders in the USR region, and that other stakeholders believe that economic interest should not be prioritized above resource benefits such as water quality.

6.2.9 Funding

Project funding has been identified as a key issue for this IRWMP. A significant level of effort will be directed toward identifying and pursuing a variety of funding sources and opportunities. Strategies for obtaining funding for infrastructure projects will be developed and implemented to assist local communities and stakeholders in development of funding packages that have the greatest benefit to local interests.

Obtain funding for water-related infrastructure improvements

Obtaining grant funding for local water infrastructure improvement is a competitive process. The IRWMP will provide guidance to local communities and tribes in developing projects that are more likely to be funded by having the elements that satisfy the requirements of various funding sources.

Leverage funding to make more projects feasible

A key to funding success is leveraging funding from various sources, including local, state, federal, and private funds, to maximize potential funding assistance. The RWMG has particular interest in leveraging funding to the greatest extent possible.

6.2.10 Governance

The governance structure developed and utilized in the Upper Sacramento, McCloud, and Lower Pit River IRWMP has been a key issue from the beginning of the effort. Significant thought, effort, and collaboration have been utilized in the development of the governance structure being used by the RWMG. Particular interests of various RWMG members include the following:

- Stakeholder representation in IRWM process
- Tribal sovereignty over relevant jurisdictions and resources
- Diversity, balance, communication in governance
- Political accountability
- Collaboration
- Appropriate representation of non-jurisdictional interests

The governance structure identified and implemented was developed with each of the interests listed above being given in depth consideration. The current governance structure is being utilized to facilitate ongoing IRWM planning and implementation. More information regarding the governance structure can be found in Chapter 16, Governance.

6.2.11 Regulatory Compliance

Compliance with state and federal water quality standards as well as other environmental regulations is a key issue for development of the IRWMP. Regulatory compliance is of primary influence during the development of water resource management projects and efforts. Particular interests expressed by RWMG members related to this issue are discussed below.

Water quality standards in the Upper Sacramento River

Water quality standards in the Upper Sacramento River are becoming increasingly stringent. These increasing standards result in an ever-increasing challenge and higher cost for compliance. Identifying cost effective ways to meet the increasing standards is of particular interest to various RWMG members.

Wastewater discharge limit substantiation

A specific interest expressed by RWMG members is substantiation of municipal wastewater discharge limits in the Upper Sacramento River to determine the appropriateness of the limits. Local efforts to confirm the basis for development of water quality standards will allow local interests to feel confident those more stringent limits are appropriate and that limited resources for water quality improvements are being used most beneficially.

Local participation in development of regulatory standards

A primary interest of RWMG members is to maintain and, where appropriate, restore ecological integrity. Regulatory compliance should facilitate ecological integrity as long as it is based on sound science and reflective of the local conditions. In addition, there are circumstances where ecological integrity may need to be balanced with other considerations, such as recreational access and/or use, economic benefit, or emergency preparedness. In these circumstances a compromise will likely be pursued that results in the greatest benefit to the greatest number of interests.

Provide guidance to private landowners to meet regulatory requirements

It is in the interest of the RWMG to assist local landowners in their efforts to comply with existing federal, state and local regulations affecting the management of water in the region. This assistance includes educational programs and workshops with local landowners and providing landowners on the ground technical assistance and tools. These efforts will help implement projects that restore or improve conditions and protect cultural and environmental resources to meet regulatory requirements and improve the health of the entire watershed.

Identify alternatives to regulatory processes

Where possible, identify collaborative opportunities during the development of regulatory requirements through local participation to address multiple objectives. This could more likely allow all parties a positive part in the process, reduce need for costly litigation, and result in multi-benefit projects.

6.2.12 Tribal Water Resources Interests

This section will be developed upon further discussion with participating tribes and with the help of an ethnographer. Initial interests include:

- Study and restore historical watershed conditions as practical
- Preserve and protect historic sacred sites and traditional cultural properties
- Protect, preserve, and restore native fisheries and valuable native plant species

6.2.13 Water Quality

Water quality in the Upper Sacramento, McCloud, and Pit River basins is a key issue affecting RWMG members in a variety of ways. Water quality is recognized as generally good throughout the region and is integral to its ecological, public, and economic health. Maintaining this quality is important to stakeholders because it supports residents and native species including fisheries. Interests of RWMG members expressed during this IRWMP process include the following:

- Maintaining water quality that supports the local economy and native fish populations
- Mitigation of activities that can negatively impact water quality including organic and volatile wastes, aquatic invasive species, aging septic systems, resource extraction, construction and maintenance of dirt roads, and recreational use
- Understanding potential geo-thermal development impacts to water quality

6.2.14 Municipal Water Supply & Wastewater Infrastructure

The RWMG members have expressed the condition, capacity, and limitations of water-related infrastructure in the region as a key issue. This infrastructure represents a huge investment on the part of municipalities, agencies, and the ratepayers themselves. It is imperative that these investments be protected and maintained.

Water supply and storage

Domestic water supply, storage, and distribution limitations and needs have been recognized by each of the major municipalities in this IRWM region. There is particular interest in utilizing this planning effort to facilitate development and implementation of projects to address these current needs as well as anticipated future needs.

Storm water and flood control

Developing projects to address limitations in storm water infrastructure and flood control is also of interest to local municipalities. Storm water should be thought of as a resource rather than a liability, and innovations in development strategies and best management practices can allow communities to manage this resource while protecting infrastructure.

Wastewater treatment

Development of innovative wastewater treatment approaches that meet water quality standards but are consistent with available funding and consider local economic conditions is of primary interest to local municipalities. Development of wastewater treatment approaches that maximize potential environmental and community benefits, such as reuse, is also of particular interest.

6.2.15 Mitigation and Adaptation to Climate Change

Any management of water resources that contemplates future projections will require consideration of the effects of climate change on water quantity and quality. Changes in precipitation, snowfall, and climate conditions affect both water supply availability and water demand. These considerations will need to be incorporated in water resource management project development and any ongoing water management efforts.

6.3 Upper Sacramento IRWM Regional Challenges

This section presents issues and processes that impact management of and planning for water resources within the Region but are primarily controlled by interests outside this region. While stakeholders have a voice individually in these processes, it is conceivable that the RWMG could speak as a representative regional group on many of these topics. This would enable the region to be more actively involved in many of these topics and have the power of true regional representation behind it, but would require coordination and integration on a scale beyond what is contemplated in the planning phase of this IRWM process. The challenges are described here to present the perspective of local stakeholders regarding these issues, and so that opportunities for local participation and input into these processes may be identified. Further work on these topics — individually or as a group — is at the discretion of participating stakeholders and will be discussed in the chapter describing the RWMG's next steps.

6.3.1 FERC Relicensing

The hydropower dams on the McCloud and Pit Rivers were licensed almost 50 years ago and are being or have been relicensed between 2005 and 2020. Hydropower relicensing is a once-in-lifetime opportunity to address the diverse interests of power generation, ecosystem health, water reliability, and recreational opportunities in river stretches impacted by hydropower facilities. While this is an opportunity for collaboration and increasing knowledge of the IRWM watersheds, relicensing can also be a challenge to regional relationships. Hydropower licensees, regulatory agencies, tribes, recreation interests, and non-governmental organizations all advance objectives in relicensing negotiations and sometimes these objectives conflict with each other. Particularly controversial issues include: in-stream flow quantity, variability, and temperature; recreational flows; impacts to cultural resources; and maintenance of Forest Service lands where much of the hydropower facilities are situated. The challenge is to find common ground and solutions that everyone can live with in order to reach a settlement among all parties.

In the USR region, PG&E (Pacific Gas & Electric) is the only licensee. They manage projects on the Pit River watershed (both within the Region and upstream, but with effects in the Region) and in the McCloud River watershed. The PG&E hydropower projects on the Upper Pit completed relicensing in 2007. The McCloud-Pit project, which includes transfers from the McCloud to the Pit River by way of McCloud Iron Canyon Reservoir, is scheduled to be completed by 2015. The results of the relicensing process will dictate operation conditions for these hydropower facilities and will impact the health of the river ecosystems for the life of their licenses, which can extend from 20 to 50 years.

Opportunities for Local Engagement or Action
The IRWMP will not directly address the Federal Energy Regulatory (FERC) relicensing challenge; however, it will provide valuable resource data through the implementation of projects such as water quality monitoring, sediment transport, mercury impacts and habitat needs. The IRWMP will also provide tools for data management, dissemination and climate change analysis, as well as a forum for discussion and relationship/partnership development.

6.3.2 Weather Modification and Precipitation Enhancement

Weather modification

Weather modification is the act of intentionally manipulating or altering the weather. The most common form of weather modification is cloud seeding to increase rain or snow, usually for the purpose of increasing the local water supply and hydropower generation.

Weather modification can also have the goal of preventing damaging weather, such as hail or hurricanes, from occurring; of causing or ameliorating a drought by “steering” rain to specific portions of the globe. While there are no entities in the USR region that have come forward with this as a strategy, stakeholders are aware of this practice throughout the region and the western coast of North America. Unintended climatic consequences could be numerous, such as changes to the hydrological cycle, including droughts or floods, caused by the geoengineering techniques, but possibly not predicted by the models used to plan them. Such effects may be cumulative or chaotic in nature, making prediction and control very difficult. In the interest of full public and scientific understanding of potential impacts and outcomes, any effort to engage in weather modification practices in the USR should be subject to “public disclosure”.

Opportunities for Local Engagement or Action
The IRWMP will not investigate this issue in depth. However, it is a practice that stakeholders should be aware of as they consider projects that could be impacted by weather modification. It is also a topic that could be included in any educational and/or advocacy efforts to be pursued by the RWMG.

Precipitation enhancement

Cloud seeding artificially stimulates clouds to produce more rainfall or snowfall than they would naturally, and has been practiced in California since the early 1950s. This process injects special substances (usually silver iodide but occasionally liquid propane) into the clouds either through ground generation or by plane deposition, which then encourages the formation of snowflakes and raindrops.

Since December 2005, PG&E has placed about 20 cloud-seeding units in Shasta and Siskiyou Counties, in the McCloud and Pit River areas. Using silver iodide generators, PG&E proposed that each unit be run about 20 days maximum per year. According to Department of Water Resources (DWR) staff, no permits were needed from the county air quality districts because silver iodide is not classified as a hazardous or toxic air pollutant. Public notification requirements for such projects consist of a Notice of Intent (NOI) to be filed with DWR, and a notice in the newspaper.

According to PG&E calculations, "the silver concentrations measured in snow, water, soils and lake sediments are far below thresholds of concern for humans, animals, fish, insects and plants. … Also, emission rates of primary pollutants (NO_x, CO, etc.) from the seeding generators' chimneys are far below regulated rates." (e-mail from Wayne E. Yeager, Sr. Environmental Engineer, PG&E, to Siskiyou County, December 7, 2005).

PG&E also proposed a cloud-seeding project in the Upper Pit watershed in the 2009 Update of the State Water Plan, where the company acknowledged several cloud-seeding projects in the state. According to DWR records, PG&E withdrew that most recent cloud-seeding proposal, as the process remains a subject of high controversy.

Opportunities for Local Engagement or Action
Stakeholders suggest more open communication regarding these efforts and the data and analyses on their outcomes. Most stakeholders are not supportive of these techniques, and would rather see a natural cycle with more active management on the ground. This topic requires additional communication and outreach.

6.3.3 Salmon Reintroduction

Chinook salmon and steelhead have been absent from the Upper Sacramento and McCloud rivers for over 70 years. National Oceanic and Atmospheric Administration (NOAA) Fisheries and the Bureau of Reclamation are considering the concept of reintroducing salmon above Shasta Dam. This is due to uncertainty about the viability of currently listed populations of federally threatened fall-run and endangered winter run Chinook in the Sacramento basin below Shasta Dam. NOAA is currently re-writing opinions related to reintroduction of these species. The Bureau of Reclamation (BOR) is also preparing an Environmental Impact Statement (EIS) for a pilot project that will introduce adult salmon from one or both of the listed runs into the rivers above Shasta Dam to determine whether these runs can viably spawn in these waters. Shasta Dam is the primary barrier to passage of salmon to these streams. A reintroduction effort would be complicated and would need coordination from a variety of agencies, stakeholders, and other interested groups.

Reintroduction of native salmon to the Upper Sacramento and/or McCloud watersheds is of great interest to many stakeholders in the USR. Some are supportive of the process, while others are wary of potential challenges:

- Many tribal groups are supportive of restoring populations of a species that is an important part of their cultural heritage and lifeways.
- Restoring native species could renew a valuable economic resource for the region, restore a vital indigenous cultural resource, and provide a model for other restoration projects.
- Many landowners are concerned about additional regulatory requirements associated with managing land around waterways where endangered species are present.

- Similarly, municipal agencies are concerned about additional water quality limits that might be required to protect reintroduced endangered species.
- The McCloud and Upper Sacramento are both popular recreational fisheries. There is concern about the impacts of reintroducing an endangered species on existing recreational fishing opportunities in these rivers, and how changes could impact the local economy.

Opportunities for Local Engagement or Action
Stakeholders will continue to track the salmon reintroduction process with great interest, and this group may seek to identify strategies that inform the process and minimize resultant conflicts. Prior collaboration and planning among stakeholders could guide the development of regulations affecting all private landowners with land adjacent to waterways that historically supported anadromous fish habitat. It's possible that the IRWM process will result in collaborative actions that will improve habitat as well as minimize regulatory enforcement and impact on regional economics.

6.3.4 Raising Shasta Dam
In the 1990s, with increasing water shortages in the Central Valley, the Bureau of Reclamation suggested expansion of Shasta Dam. Options for raising the dam consider additional heights ranging from less than 20 feet to 200 feet. The proposed raising would have significant impacts to the Pit, Sacramento, and McCloud rivers as well as inhabitants, fishermen, Native Americans, and recreationalists. The McCloud River is an area of particular interest because of the quality of the local trout fishery.

This challenge particularly affects the Winnemem Wintu Tribe as the land inundated by the construction of Shasta Dam held the largest of the historic Wintu villages in the area, along with many sacred and ceremonial sites. Any expansion would inundate additional land and many remaining sacred tribal sites. Complicating that, the tribe is not federally recognized, and so their input is not assessed on the level of "government-to-government" communication that federally recognized tribes' input would be.

Some concerns voiced by in-region stakeholders include the following:

- There have been no alternative water sources identified that could be developed in place of raising Shasta Dam – this has been identified as the single possible project for its purpose.
- Raising Shasta Dam has been seen by some regional stakeholders as being tied to the building of the peripheral canal, or through-Delta conveyance structures to get more water to the southern portion of California. This diversion could have devastating effects to the surrounding Delta ecosystems, and would change forever how water is distributed in California.
- About 60% of the cost of the dam raise is attributed largely to salmon habitat improvement below Shasta Dam; some stakeholders feel as though this is a disingenuous attribution.

The IRWM will not directly address this challenge, however, information collected and data provided through the IRWM process will be available to consider as this challenge is addressed in the future.

Opportunities for Local Engagement or Action

Recognizing that the process and decision-making regarding whether to raise Shasta Dam is a process managed by the U.S. Bureau of Reclamation, and is beyond the scope of the Upper Sac IRWM plan, some stakeholders within the Region nevertheless feel it is important to include their interests as they relate to the possibility of raising Shasta dam and expanding Lake Shasta into areas within the Upper Sacramento, McCloud, Lower Pit Rivers IRWMP:

- Protecting ancestral lands and cultural sites of indigenous people
- Protecting riparian and in-stream habitat for native fish and wildlife
- Inundation of the wild and scenic stretch of the McCloud River.
- Protecting Area-of-Origin water rights

6.3.5 Potential Industrial-scale Geothermal Energy Development

Leases issued in the 1980s for industrial-scale geothermal development encompass 60 square miles in the Medicine Lake Highlands (MLH). While leasing applications on Mount Shasta were refused by the USFS in 2008, because of the Mountain's cultural and spiritual significance to Native American Tribes and Nations, industrial geothermal energy development remains a potential threat on Mount Shasta as well. The Programmatic Environmental Impact Statement for Geothermal Leasing projects capacities of 480 megawatts in the MLH and 240 megawatts on Mount Shasta. Geothermal extraction in MLH would involve drilling up to 9,000 feet below the surface through 800–1,000 feet of the fresh water aquifer. Risks of contamination and cross-contamination can occur from spills, toxic emissions, well-casing failures, blowouts, earthquakes, and subsidence. Geothermal development would involve hydro fracturing, which employs the same technology and similar practices as the hydrological fracturing, or fracking, by the oil and gas industry. Both processes inject millions of gallons of water laced with an array of chemicals, including acids, or proprietary formulae deep into wells in an attempt to release trapped resources. Geothermal hydro fracturing includes use of hydrofluoric acid (toxic at even a few parts per million) and hydrochloric acid, both of which are on the Environmental Protection Agency's (EPA) toxic substances list.

For the past 15 years, the first two geothermal proposals (totaling 98 megawatts) have been a source of conflict between federal and county agencies on the one hand, with tribes and environmental organizations on the other, resulting in administrative appeals, lawsuits and, thus-far, fruitless attempts at negotiations. With Calpine Corporation's latest proposal representing a fivefold increase to 480 megawatts, it is likely that the process will extend into a new environmental review activities during which increased hydrological information could contribute to sound science-based decisions.

Opportunities for Local Engagement or Action

It is hoped that the IRWM implementation process will result in further gathering of baseline hydrologic data on the Medicine Lake Volcano and the Fall River Springs (FRS). Because the recharge area is located in the USR and the discharge is in the Upper Pit IRWM Region, projects would be inter-regional in their implementation and results. Along with data already available, this will more clearly demonstrate the connection between MLH and FRS, and the vulnerability of this hydrologic system that delivers gravity-fed pristine waters to Shasta Reservoir, an integral water source for California.

6.3.6 Aboriginal Sovereignty

One of the tribes in the USR, the Shasta Nation, sees the IRWM planning process as a distinct threat to tribal sovereignty and has made repeated requests to halt the planning process completely by order of the Tribe as a sovereign nation, identifying most of the USR area as ancestral tribal lands. This statement excludes other tribes holding ancestral claims to lands within the USR. (Note: The statements and opinions of leaders of the Shasta Nation in this regard are not shared by the Shasta

Indian Nation, which also represents the people of the greater Shasta culture, nor do other tribes in the region concur with those opinions.) The challenge in addressing this statement is complicated by the fact that the treaties for many — if not most — of the tribes in California have never been formally ratified, or even rejected, by the federal government. This leaves tribes' status undetermined and complicates the relationships between tribes, local governments, private landholders, and the federal and state government. Further complicating matters, the issue of sovereignty has not been found to be a stumbling block by other tribes. One of the other tribes in the USR distinctly has stated that sovereignty is not an issue for IRWM planning, nor is it the venue to voice these concerns or develop a case for federal recognition. The Impacts and Benefits section of this document (Chapter 11) has more information on this topic.

Opportunities for Local Engagement or Action
The choice made by the USR stakeholders is to acknowledge this as an issue for the region. Stakeholders expect that this discussion will be ongoing throughout the implementation of the IRWMP.

7. Objectives

This chapter presents objectives developed by stakeholders in the Upper Sacramento Integrated Regional Water Management (IRWM) region to address water resource management issues. The development of these objectives, how they relate to other sections in the plan, and how they will be used for development of water resource management projects is also described. The objectives establish the intent of the IRWM plan (IRWMP) and clarify desired outcomes of implementing water management projects identified by stakeholders in this plan.

7.1 Objectives Identification and Development

Objectives were developed through a collaborative process including all stakeholders participating in the IRWM planning. The first step involved a collection of issues and objectives from other sources in the region. Stakeholders had invested significant effort in other planning and objectives-setting processes over the last decade and wanted to ensure that this work was captured in the planning process. The project team collected this information and presented a draft set of objectives, based on the issues identified and objectives developed through other processes, to the stakeholder group. These suggestions were discussed and the group decided that, because of the broader scope of the Integrated Regional Water Management Plan (IRWMP), a workgroup was necessary to invest more effort and time into the development of more specific objectives. The individuals participating in this workgroup were partially self-identified and partially nominated by stakeholders. They met soon after the plenary meeting to review those draft objectives. Present in the workgroup were a diverse array of interests, including water purveyors, cities, environmental groups, Native American tribes, Siskiyou County, and local business (timber) interests. They considered the measurability of each objective and the comprehensiveness of meeting stated issues and challenges in other developed sections. Following this meeting, their work was sent out to the entire list of interested parties and participants for review and acceptance. Some significant edits emerged at this point, including the addition of the overarching goals regarding climate change and Native American values. The active participation of four tribes in the Upper Sacramento, McCloud, and Lower Pit Region (USR) planning process is reflected in the addition of the latter overarching goal. The support of the other participants in the planning process for the addition of these two goals represents the integrated, tolerant, and respectful nature with which the planning process details were discussed and negotiated.

In the development of these objectives, pertinent information included those references used to develop the region description and issues section, including federal and state planning and implementation documents (such as the Central Valley Water Quality Control Board's Basin Plan, Bureau of Reclamation's Shasta Lake Water Resources Investigation documents, the disadvantaged community mapping tool provided by DWR, and various Forest Service planning and assessment documents), and local documents (including the Upper Sacramento Watershed Assessment, California Trout's Mount Shasta Springs Study, city and county general planning and master planning documents, FEMA information, and juried studies and reports on the Native American history and presence in the region). These primary and secondary sources provided invaluable and objective fact-checking information in the development of the objectives, especially for the measurable components that subsequently will feed into the region's performance evaluation (see Chapter 12, Plan Performance and Monitoring).

The nine regional objectives presented below were developed to address the issues and interests identified by the regional water management group (RWMG). Each objective integrates multiple issues of interest to the stakeholders. The objectives refined by the workgroup were further reviewed and edited by all interested and participating stakeholders. The final document represents the work of many interested parties and many hours of negotiation and refinement.

7.2 Objectives Organization and Prioritization

The objectives are not organized through any particular priority; however they are grouped based on similar issues (this can be seen in Table 7.1, below). This can be seen in the title of each objective, allowing a quick reference for each objective's core topic. Stakeholders reviewed the prioritization and decided against it in this initial round of planning. While shared priorities have consistently included efforts to characterize groundwater resources and disadvantaged communities' infrastructure needs, stakeholders felt that the prioritization of objectives in an outright manner would create a challenge for targeting funding opportunities and could also be detrimental to relationship-building within the region.

The objectives will be implemented with consideration of the overarching goals identified below. These will be used to guide water resource project management development in the Upper Sacramento IRWM region. Each project developed must consider how it will address at least one of these objectives and satisfy the considerations outlined in the overarching goals. Projects that address or meet multiple objectives will have a higher likelihood of being supported by the RWMG. Each objective is provided with measurement approaches. These measurements are critical to assessing effectiveness of the implementation of the IRWMP in meeting the desired outcomes of the plan. More information about how these will be tracked is available in Chapter 12, Plan Performance and Monitoring.

7.3 Overarching Goals

In addition to the specific objectives listed below, the RWMG has identified overarching goals for this IRWM planning and implementation process. These goals are applicable to each of the specific objectives outlined later in this chapter. As projects are developed and prioritized for implementation, these goals will be considered as overarching, priority values to the USR RWMG.

7.3.1 Climate Change Adaptation

The Department of Water Resources' (DWR) Guidelines require that contributions of a project to adapt to and/or mitigate climate change effects be evaluated and considered as projects are being developed to implement the IRWM plan objectives. Project planning, design, and ongoing implementation should consider both regional resiliency to projected climate change impacts as well as the potential impact on climate change the project itself may have. Because adaptation to climate change and mitigation of contributing factors involves a broad suite of strategies, the impact of a project or strategy is better described by measurements related to more general objectives.

In the objectives below, adaptation to climate change is identified as an issue related to several of the objectives, specifically regarding gaining a better understanding on potential impacts from climate change and increasing resiliency and efficiency of the water supply and water-related infrastructure.

7.3.2 Native American Values

Water is sacred to Native Americans, the traditional indigenous peoples in this region, and is central to their living cultures. Indigenous peoples use water to quench thirst, carry prayers, and cleanse body and spirit. Large populations (greater than today) have lived for thousands of years in this region with the intent to keep the water as pristine as it was given to them and to preserve the natural carrying capacity of the streams, lakes and springs. Today, Native Americans continue to protect their traditional waterways and restore their indigenous cultural practices within their historic territories.

The USR contains Native American sites that are directly impacted by water resource management decisions, including infrastructure placement and management, recreational activities, commercial endeavors, and forest and land management planning and implementation. Preserving these sites of cultural significance is the responsibility of those communities to which the resources are significant, and is also the responsibility of all stakeholders, inhabitants, and visitors of and to the USR.

It is the goal of the RWMG, through this IRWM plan, to embody both the letter and spirit of the laws protecting the dignity, rights, sites and cultures of our region's indigenous peoples, and recognize that clean, pure water is much more than a commodity, but rather a vital necessity for everyone within this region and on downstream. This goal will be fulfilled through coordination with local Native American Tribes and Nations — federally recognized and unrecognized — in the identification of, planning for, and ultimate implementation of all types of projects through the IRWM process. Where applicable, projects will be identified to restore and/or protect sites and water resources that have significance to this region's indigenous peoples.

7.4 USR Objectives

Objectives for the Upper Sacramento IRWM Region are presented and described in the following sections. As described above, each objective addresses water resource management issues and interests identified by the RWMG in Chapter 6. Table 7.1 provides a look at the issues each objective addresses, and is followed by each objective and the measurements identified by USR stakeholders.

Table 7.1 – Objectives / Issues Summary

RWMG Issues	Obj. 1 - Basin Characterization	Obj. 2 - Cooperation and Trust	Obj. 3 - Ecological Health	Obj. 4 - Forest Management	Obj. 5 - Water Management for DACs and Tribes	Obj. 6 - Water Quality	Obj. 7 - Regulatory Compliance	Obj. 8 - Infrastructure	Obj. 9 - Flood Management
Basin Characterization	X	X				X			X
Building Relationships of Trust, Understanding, and Respect	X	X					X		
Establishing Common Language	X	X							
Ecological Health	X		X	X		X	X	X	X
Sustainable Economic Development			X	X	X		X	X	X
Education and Outreach	X	X	X						
Fuels and Fire Management				X					X
Forest Management			X	X		X			X
Funding					X				
Governance		X							
Regulatory Compliance	X	X		X	X	X	X	X	
Tribal Water Resource Interests,	X	X	X	X	X				X

Table 7.1 – Objectives / Issues Summary

RWMG Issues	**Obj. 1 - Basin Characterization**	**Obj. 2 - Cooperation and Trust**	**Obj. 3 - Ecological Health**	**Obj. 4 - Forest Management**	**Obj. 5 - Water Management for DACs and Tribes**	**Obj. 6 - Water Quality**	**Obj. 7 - Regulatory Compliance**	**Obj. 8 - Infrastructure**	**Obj. 9 - Flood Management**
Jurisdiction, and Issues									
Water Supply			X	X	X				X
Water Quality			X	X	X	X	X	X	X
Municipal Water Supply and Wastewater Infrastructure			X		X	X	X	X	X
Adaptation to Climate Change	X	X	X	X	X	X		X	X
Issues met by each objective:	*8*	*8*	*9*	*9*	*8*	*7*	*6*	*6*	*10*

7.4.1 Objective 1 — Basin Characterization

Increase knowledge of basin characteristics and raise public awareness and understanding of fractured rock aquifers, watershed dynamics, existing water rights, water resource allocation, and existing management authorities to inform and develop support for IRWM planning and projects.

This objective addresses issues related to basin characterization and regional education regarding water management issues. An anticipated outcome of achieving this objective will be to understand how best to focus water resource management efforts and ensure that projects will be as productive as possible. In addition, familiarity with regional resources is an essential component for effective and efficient project development. Projects aimed at achieving this objective will also provide a foundation for adaptation to impacts from climate change.

Measurements for Objective 1

1. Mapping all groundwater basins by 2018
2. Understanding the dynamics of groundwater in the Medicine Lake Highlands as well as on, and around, Mount Shasta by 2025
3. Understand indigenous perspectives on values associated with Mount Shasta and Medicine Lake Highlands that would be affected by exploration and exploitation of ground and surface water
4. Support, expand, coordinate and measure success of existing public education and outreach campaigns on watershed conditions and management by 2014; Measure success through products developed, event attendance, and additional strategies

5. Develop better understanding of implications of climate change on this region; create a strategy for this by the end of 2014
6. Develop and support a basin hydrologic inventory including water sources, uses, features, and critical management areas for ground, spring and surface waters

7.4.2 Objective 2 — Cooperation and Trust

Encourage, improve and maintain an environment that fosters cooperation, facilitates collaboration, and builds relationships of trust and respect among water resource stakeholders and community members with respect to water management efforts within the region.

Cooperation and trust among stakeholders is critical to successful water resource management. Under this objective, stakeholders will work to encourage an environment of mutual trust and respect that will help all management efforts to proceed effectively. Developing a common language through definition of terms, operating under an agreed upon governance structure, being educated regarding the interests of other stakeholders, including tribal water resource interests will be goals of this objective.

Measurements for Objective 2

- Continue to meet as a RWMG through the life of the IRWMP (over the next 20 years — at least twice a year)
- Continue outreach to both current and potential members on an annual basis
- Continue ethnographic collaboration to build trust with local tribes
- Make two public presentations and/or write newspaper articles about regional water management issues in the Upper Sacramento Region annually
- Develop and maintain a glossary of terms specific to the USR IRWMP
- Track implementation success
- Track success and number of projects involving more than one entity
- Include stakeholder survey indicating level of support by stakeholders in project review criteria (five-star collaborative project)
- Implement video project
- Implement equitable governance structure

7.4.3 Objective 3 — Ecological Health

Maintain and enhance the ecological health of the basin to:
1. *Support the local economy*
2. *Ensure public health and safety*
3. *Respect and support indigenous cultures*
4. *Improve recreational infrastructure and opportunities for both tourism and the local economy*
5. *Prepare for potential reintroduction of native species to the region*

Achieving this objective will result in 1) maintaining the current high quality of the local environment, and 2) making improvements where warranted, all while 3) supporting development and enhancement of the local economy. In addition, ongoing responsibilities of stakeholders to provide for public health and safety will be met. Meeting this objective will also allow local stakeholders to collaboratively develop local mitigation and habitat restoration plans related to potential reintroduction of native species focused on minimizing stakeholder burdens and being proactive rather than reactive. The RWMG recognizes the important influence of local indigenous cultures. Meeting this objective will ensure these cultures are respected and conserved.

Measurements for Objective 3

- Implement at least three projects by 2020 that improve/protect ecological health and the local economy
- Document the economic costs and benefits of restoration projects
- Track and document economic costs and benefits that can be linked to water infrastructure improvements
- Document beneficial ecological results of projects (habitat improvements, water storage/infiltration, etc.)
- Develop regional plans acceptable to stakeholders prior to implementation of federal, state or local mandates related to potential native species reintroduction
- Prepare stakeholder developed plans for mitigation and improvements for potential native species reintroduction

7.4.4 Objective 4 — Forest Management

Support and improve ongoing forest management efforts with regard to local water quality and supply including fire management within existing regulatory frameworks.

Forest management is an important part of the USR. Supporting these management efforts as they relate to water resources in the region will support not only ecological health, but also the local economy.

Measurements for Objective 4

7. Fuel reduction on at least 5,000 acres on an annual basis through 2020
8. Document the number of projects implemented by forest management entities
9. Document number of integrated projects/joint collaboration projects among stakeholders (such as ecological restoration on public and private lands)
10. Preservation of pre-historic/historic indigenous sites using traditional fire treatment methods

7.4.5 Objective 5 — Water Management for Disadvantaged Communities and Tribes

Ensure support for and foster success of water management efforts for disadvantaged and Native American communities while respecting the cultural values of existing communities.

Nearly all of the Upper Sacramento IRWM region can be considered disadvantaged. These communities, including indigenous tribes and nations have particular challenges and objectives when it comes to water resource management. Funding needed improvements while supporting economic development in these communities requires creativity and innovation. This objective will support the efforts of these communities and work to secure needed economic resources to see that these challenges are met.

Measurements for Objective 5

- Document support for the participation of DAC in the IRWM process
- Implement at least three projects with a DAC project proponent by 2020

7.4.6 Objective 6 — Water Quality

Support local participation in development and implementation of water quality standards that reflect local conditions and implementation of projects that maintain and enhance the basin's existing water quality.

The Upper Sacramento IRWM region has specific characteristics with regard to its water resources, water quality, and economical resources. Achieving this objective will assist in developing solutions to local water quality and supply needs in the most effective successful way. Regulatory compliance with respect to water quality is important to local stakeholders. Local participation in the development of regulatory requirements will ensure that efforts to achieve compliance will produce the most benefit for the region both from an economic and environmental quality perspective.

Measurements for Objective 6

1. Locally track and document conditions on an annual basis
2. Develop a locally managed water quality data base for critical streams by 2015
3. Complete a local water quality assessment of the Sacramento River by 2017
4. Identify point source pollution and problem areas

7.4.7 Objective 7 — Regulatory Compliance

Ensure adequate water supply and quality while maintaining regulatory compliance, minimizing conflict, and recognizing and respecting existing water rights and users.

Adequate supply of water for stakeholder interests is a key issue in the Upper Sacramento IRWM region. This objective considers achievement of adequate water supply for local users while balancing the need to meet regulatory requirements while recognizing and respecting existing water rights. Projects requiring large water supply (surface or groundwater) will meet this objective if existing water supply of adjacent users is respected and preserved. Cooperation among stakeholders through this objective will minimize conflict as much as possible. Meeting this objective will also take into account potential changes in available water quantity and quality due to anticipated climate change.

Measurements for Objective 7

- Identification and quantification of water rights in the region by 2017
- Projections of water needs into the next 30 years by 2018
- Assessment of adequate area-of-origin water rights projections for the region by 2020
- Develop a regional capital improvement plan that identifies key deficiencies with proposed actions by 2016
- Better coordination and communication of land use planners and those regulating or managing water
- Identification and protection of long term water users who do not have deeded water rights

7.4.8 Objective 8 — Infrastructure

Facilitate development of sustainable water/wastewater infrastructure to ensure public health, protect ecological integrity, and support economic stability.

The health of the community in this region will be greatly dependent on adequate water supply and wastewater treatment infrastructure for local residents, business, and industry. The adequacy and quality of this infrastructure will have significant effect on ecological health and sustainable economic development, and efficient and effective infrastructure for water management will help the region to prepare for climate change effects by increasing regional response flexibility as far as resource management activities. Achieving this objective will also ensure local water purveyors are in compliance with regulatory requirements.

Measurements for Objective 8

- Implementation of at least three projects protecting and/or improving water/wastewater infrastructure by 2020
- Identify and develop a strategy to address supply and quality concerns related to non-municipal water supply (such as individual wells) and wastewater treatment (septic systems)
- Projections of water needs into the next 30 years by 2018
- Understanding connections between spring water and groundwater
- Provide information to interested people to support measurement/monitoring of their wells
- Research, facilitate and support alternative water and waste water treatment technology that also protects public health, ecological integrity, and economic stability

7.4.9 Objective 9 — Flood Management

Address flooding concerns through infrastructure improvements and support ongoing local flood management efforts.

Local communities have had significant challenges with flooding in the region. Floods can have significant negative impacts economically as well as ecologically. This objective will work toward addressing as much as possible flood hazards in specific locations within the region.

Measurements for Objective 9

1. Identify flood control and management deficiencies and develop an infrastructure improvement plan by 2015
2. Protect and preserve historic, spiritual and ceremonial sites in any flood control project.
3. Address critical flooding threats to communities by 2020
4. Use information from historical research of area to begin discussion of appropriate restoration of natural conditions that will decrease flooding

8. Resource Management Strategies Introduction

Resource Management Strategies (RMS) were first introduced by the California Department of Water Resources (DWR) in the 2005 California Water Plan (CWP).[12] They were updated in the 2009 CWP. This list includes the 29 RMS found in the 2012 Integrated Regional Water Management (IRWM) Guidelines as well as one additional strategy identified by the regional water management group (RWMG). These RMS enhance the tools stakeholders can utilize to address water resource management and planning challenges. A strategy, as defined in the 2009 CWP, is "a project, program, or policy that helps local agencies and governments manage their water and related resources." Stakeholders have considered this list a tool for water management. Not all parts of this tool are useful or appropriate for the Upper Sacramento, McCloud, and Lower Pit IRWM Region (USR), but all projects identified through the USR process will make use of at least one of these RMS. The combination of RMS utilized will depend on multiple variables, including the project type, climate and population projections, existing infrastructure, environmental and social conditions, and the USR's objectives.

This chapter lays out potential strategies stakeholders have identified for the USR. It also identifies strategies that may be in practice, but that the group feels should be watched closely for outcomes and possible adaptive management. It is important to note that the identification or use of any particular strategy does not represent any individual stakeholder nor the USR RWMG's collective dismissal or absolution of rights or responsibilities regarding resource management and/or allocation.

8.1 Selected Mix of Management Strategies

The mix of water management strategies displayed below demonstrates the breadth of potential tools available to USR stakeholders. These strategies present a variety of ways to address water management challenges and those that are applicable within the USR Region will likely be used by at least one implementation project. Most projects use more than one strategy, providing several different approaches to a specific challenge and allowing for integration throughout the project. Stakeholders defined the strategy mix and these same stakeholders will be using the strategies to implement projects in the next 30 years. The list below is organized by type of strategy, using the following headers: Operational and Management Efficiency, Using Less Water, Land and Water Stewardship, Water Quality Management and Protection, Other Applicable Strategies, and Strategies Considered Not Applicable to the USR. Each strategy is presented with a description and following actions for how and where it may be applicable within the USR.

8.1.1 Operational and Management Efficiency

Using water more efficiently indicates a regional commitment to increasing the work produced — or economy or habitat supported — by each drop. An example of this can be seen in the conveyance strategy: perhaps a canal works just fine for delivering water to a single city, but there may be other needs between the diversion point and the delivery point, such as habitat needs, other withdrawal points or pipes, or a need for the water to provide dilution to preserve water quality. If the region is using that water more efficiently, it may choose to keep the water in the stream so that the base flow is maintained and divert the water directly to the city at a different point lower in the river. Likewise, as climate change alters the region's hydrology and more precipitation falls as rain rather than snow, it may be important to replace those former "snow reservoirs" with restored meadows or engineered reservoirs to retain the supply that formerly remained in the region through the snowpack. The

[12] This is a document produced every five years by the California Department of Water Resources for reporting on statewide water resource use and planning water resources management.

strategies listed below are possible approaches to increasing the region's operational and management efficiency.

a. Conveyance — Regional/Local

Conveyance provides for the movement of water, and infrastructure for this activity can include natural watercourses as well as constructed facilities like canals, pipelines, and ditches. Analyses for conveyance changes and additions usually must be made at project-specific regional or inter-regional conveyance options rather than at a larger regional level. Addressing conveyance can be beneficial as it can improve regional efficiency through the use of cooperatively managed canals or pipes; can increase the reliability of water systems through the installation of interties; and can help a region to address resource management in a more holistic manner that meets infrastructure needs and requirements while minimizing cost and negative environmental effects. Some of the actions that may be appropriate in the USR include the following:

- Increase the reliability of canals and ditches by lining and/or piping, recognizing and adapting to recreational and environmental needs as appropriate
- Recognize systems vulnerable to catastrophic failure (mass wasting, infrastructure failure, etcetera) and identify potential interties with other systems and/or with other water sources to enable a quicker response in the event of an emergency
- Improve flow measurement and conduct system loss monitoring

b. System Reoperation[13]

System reoperation is applicable in the region. There are many small systems for which this may represent an option for increased water supply. On a larger scale, potential actions could include diversion consolidation (moving multiple diversion points to a single point and withdrawal facility), where appropriate and feasible, in order to increase efficiency on a financial and resource basis. Federal Energy Regulatory (FERC) relicensing can include significant system reoperation, benefiting the environment, regional water agencies, the recreating public, and many other user groups. While this is a separate activity from the IRWM development and adoption process, it does affect regional water management and should be tracked for potential changes.

c. Water Transfers[14]

Water transfers are traditionally defined as a voluntary change in the way water is distributed among water users in response to water scarcity. These transfers can occur within a basin or between two or more basins. Water transfers are used by water rights holders in some regions to generate revenue when there is adequate supply to sell and infrastructure to get it to its destination. However, in some cases, water transfers can negatively affect water users who have limited legal standing in the transfer.

[13] System reoperation means changing existing operation and management procedures for existing reservoirs and conveyance facilities to increase water related benefits from these facilities. System reoperation may improve the efficiency of existing water uses or it may increase the emphasis of one use over another. Although reoperation is generally regarded as an alternative to construction of major new water facilities, physical modifications to existing facilities may be needed in some cases to expand the reoperation capability.

[14] Water transfers are a voluntary change in the way water is distributed among water users in response to water scarcity. The California Water Code defines a water transfer as a temporary or long-term change in the point of diversion, place of use, or purpose of use due to a transfer or exchange of water or water rights. They can be between individual water right holders, water districts that are neighboring, or across the state provided that there is a means to convey and/or store the water.

In the USR Region, this has been seen when a water bottling company mines groundwater to sell elsewhere, resulting in a draw down of wells for surrounding inhabitants. While this is not a traditional transfer, it can be seen as such in this way. More information on groundwater is available in Strategy "q", Watershed Management.

Specific to the USR, future actions may include:

- Work collaboratively to identify where shortages may occur in times of supply constraint (due to weather or climatological patterns) and address these needs through advance planning
- Identify opportunities for water transfer between in-basin interests/stakeholders in order to be most efficient with regional resources while protecting current water users
- In years of above-normal rainfall, look at opportunities for temporary transfers in order to pay for improved infrastructure and/or to make use of conjunctive basin management in below-normal years

d. Conjunctive Management and Groundwater Storage[15]

Shasta County has begun planning for conjunctive use within the Redding Basin and could provide a basic foundation for regional planning of the same type. This could be especially helpful in the case of multiple dry years. In addition, regions throughout the state have investigated the possibility of working with downstream agencies reliant upon groundwater to establish collaboratively-based conjunctive use. Actions taken regionally could include:

- Identify aquifers in the region and the potential for conjunctive use for both agricultural and urban purposes
- Begin long-term monitoring of region-wide municipal and industrial groundwater water sources, including age dating, flow, timing, drawdown response, and response to water year types to better prepare for possible hydrologic changes due to climate change
- Identify aquifers that may be threatened by overuse and discuss management plans to stabilize these levels
- Groundwater storage may be appropriate in some parts of the region; this would require an identification of basins with adequate capacity and residence time, as well as infiltration areas

e. Recycled Municipal Water

There are opportunities for recycled water — especially for agricultural and/or recreational (golf course) use — in areas proximal to central wastewater treatment plants. Costs could be shared through partnering within and outside of the region, where possible. In the case that a recycled water project is considered by regional stakeholders, a salt and nutrient management plan (SNMP) will be examined in cooperation with the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) program (see Salt and Salinity Management, Strategy "ee", below).

f. Surface Storage — California Bay-Delta Program (CALFED)

The strategy to raise Shasta Dam would result in a portion of the currently identified USR being periodically inundated. The state and federal governments have funded an investigation into raising the dam; explicitly conceived of to support three of CALFED's program

[15] Conjunctive management is the practice of using both groundwater and surface water as the resource is available. For example, in a dry year when surface water either isn't available or is needed for fisheries uses, groundwater may be used; in a wet winter, additional supplies may be stored in a groundwater aquifer for use during dry seasons and/or years.

objectives of water supply reliability, water quality, and ecosystem restoration. While some statewide interests support this effort, it receives varying support in the USR. It may add flexibility to the state's water management system, but that benefit comes at a cost to local tribes, many of whose sacred sites and ancestral villages have already been inundated by the current reservoir footprint. Stakeholders acknowledge that this process, while controversial within and outside the region, is not part of the IRWM planning process.

g. Surface Storage – Regional/Local

Climate change could have an effect on regional hydrology. Most models show a short-term increase in the snow pack on Mt. Shasta with a decrease in the snowpack in the long-term as an increasing percentage of precipitation comes as rain. How these changes will affect municipal water supplies collected from mountain-fed springs is uncertain. In addition, growing population may put additional pressure on local storage capacity. An important activity for the region is to identify the need for new, additional, and replacement storage including conventional and off stream reservoirs as well as tank storage

h. Matching Quality to Use

Matching water quality to use is a management strategy that recognizes that not all water uses require the same quality water. 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. Accordingly, the following actions could be applied in the USR region:

- It may be possible in the region to allocate effluent for in-stream uses
- 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
- Also see applications for recycled water use (RMS "e", above)

8.1.2 Using Less Water

Using less water for human activities means that a greater amount can be left in natural systems for aquatic biota and habitats. In addition, using less means less investment in infrastructure for ever-larger pipes, treatment plants, and inputs. Because of technological advancements in efficiency mechanisms, using less water doesn't have to mean lower economic output or gain. On a simple level, using a low-flow showerhead means an individual can take the same length shower and use less water than with a conventional showerhead. More complex technology can result in high efficiency commercial dishwashers, or car washes that recycle the wash water. For agriculture, this may mean switching from flood irrigating alfalfa, which is a low-value, high-water-use crop, to vegetables, which usually use less water and have a greater economic return.

i. Agricultural Water Use Efficiency and Rain-fed Agriculture

Climate change may impact water availability for all uses. Increased efficiency can only increase resiliency and adaptability of agricultural uses to uncertain changes, and may provide economic benefits to agricultural users. While it's not likely to generate significant water resources within the basin, the strategy is relevant and may be applied to any amount of agricultural acreage throughout the region. Activities supporting this strategy could include:

- Installing more efficient irrigation infrastructure, including gated piping, tailwater ponds for reuse and replacing gravity fed systems with pumps
- Lining canals and ditches
- Planting crops with lower water requirements

- Make available and utilize water conservation tools such as soil moisture monitoring

j. Urban Water Use Efficiency

Similarly to above, climate change impacts to the region's hydrology may impact water supply availability for all users. In addition to this, a growing statewide population will put additional pressure on all supplies. Experience has shown that improving urban water usage efficiency has economic benefits. Suggested actions for increasing urban water use efficiency include the following:

- Implementing efficiency measures (best management practices, or BMPs) such as low-flow toilets, water-efficient landscape (such as native plants)
- Identifying areas where increased education and outreach targeting water use efficiency could be effective
- Water system metering

k. Irrigated Land Retirement

It's possible that, on an individual and opt-in basis, some landowners would be interested in retiring portions of their land adjacent to streams or other waterways (due to flooding risk and the cost associated with protection and/or insurance), or putting property in conservation easements.

8.1.3 Land and Water Stewardship

While all strategies contribute to a region's stewardship of resources, the strategies listed below especially lend themselves to responsible resource planning and management. This requires, in most cases, collaboration between at least two organizations, and often many more. Stewardship is the act of managing resources so that they may support multiple uses and endure for future generations.

l. Agricultural Lands Stewardship

Agricultural lands maintain the character of the watershed, and benefit local economies. They can retain carbon and may be part of a carbon sequestration program to mitigate climate change. The protection of agricultural lands can aid in the maintenance of a balanced and collaborative approach to resource management, including ecosystem and open space preservation. In light of these benefits, possible actions could include:

- Improve on-farm irrigation efficiency practices, and minimize runoff — a potential source of pollution
- Work with land conservation agencies to reduce development pressure on agricultural land

m. Ecosystem Restoration

Source water areas are important to the state for many reasons, including the fact that intact watersheds provide many ecosystem services, some quantifiable, others more difficult to assess. Climate moderation, carbon and nutrient storage, water purification and supply, recreation, habitat, forest products, and genetic reservoirs are just some of the services provided by these watersheds, and the services provided by this "green" infrastructure is usually much cheaper than the engineered alternatives. While few ecosystems have the potential to be restored to pre-Gold Rush condition, a functional and beneficial ecosystem provides many services to communities. Additionally, ecosystems and components within them can have spiritual importance/relevance to communities throughout the region and so should be maintained in order to provide for that use. Actions supported by stakeholders include:

- Meadow restoration, stream bank stabilization, riparian vegetation planting, removal of invasives, and other restoration activities
- The protection and preservation of springs as water supply sources as well as valuable ecological and spiritual resources in the region
- Identify where recreational development has harmed water quality in the region and take action to remediate it
- 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
- Assess culverts for adequate passage of aquatic organisms as appropriate
    - Where ecologically appropriate and financially feasible, replace culverts with dips or bridges

n. Forest Management

Similar to ecosystem restoration, forest management is an integral component of water management and planning. Forests serve as water reservoirs through biomass water retention; they reduce sedimentation and erosion through slowing water down and allowing substrate to drop out; and forests support many riparian plant and animal species. Natural systems preserve the flexibility and robustness in water supply systems, enabling regions to better prepare for and adapt to changing conditions due to climate change, changing economic conditions, population pressure, and others. Actions may include:

- Protect regional forests from catastrophic fire through strategic fuels management programs
- Improve forest health through forest restoration programs
- Identify areas important to water supply and provide incentives for management of those parts of the forest specifically for water quality protection and supply
- Work to emphasize the importance of Upper Sacramento-McCloud forests to California's water supply, including through collaborative partnerships, such as with the U.S. Forest Service's "Forests to Faucets" project
- Identify opportunities to purchase conservation easements or fee title on forestland from willing sellers to protect water supply and quality and prevent the conversion of the property out of forestland.
- Maintain the use of the forests as a renewable forest product resource and major component in the regional economy
- Assess the condition and management of forest roads (on public and private land) for adherence with best management practices in order to reduce sediment loads and erosion while providing needed access for forest management activities

o. Recharge Area Protection

The USR is a source water area for the Sacramento Valley, as well as for the Federal Central Valley Project. In addition, the region provides recharge to both the Cascade and Central Valley ground water sources. It is not known exactly where these recharge areas are or how they work (including transport time). Stakeholders need a better understanding of how these underground systems work, and how the region is connected to groundwater resources throughout the state. Actions could include:

- Identify and describe/delineate significant aquifers in the region and the recharge areas supplying them

- Chart historical snowpack in these recharge areas, and develop long term monitoring of these recharge zones to forecast potential drought years and impacts from climate change
- Model how changes in precipitation (from snow to rain) could impact recharge and residence time in the aquifers
- Where possible and appropriate, work with the appropriate local, state, and/or federal agencies to protect and restore these areas from activities (such as geothermal energy development) that could harm supply or quality
- Preserve and, where degraded, restore meadow habitats, which serve as important recharge areas and can provide a dry season "buffer" against climate change

p. Precipitation Enhancement

Precipitation enhancement occurs throughout California, especially in source water areas. Stakeholders have mixed feelings about the topic, and feel that it should be broadened with the title of Weather Modification. Because it already occurs, it is important for some stakeholders that they have a better understanding of:

- The effects of these efforts (particularly to water quality and ecological health), and
- The extent to which they occur.

In the long term, stakeholders may choose to try to support or discourage this strategy, or engage with those who manage weather modification activities to influence where, when, and how it is implemented.

q. Watershed Management

Similar to forest and ecosystem preservation, management, and restoration, watershed management is essential in providing a robust resource base from which to respond to projected climate change effects as well as existing and future water demands. Watershed management can help to maintain a regional flexibility and response in the face of climate change and/or extreme weather events (long-term drought, intense rainfall events, impacts on snow pack and hydrologic recharge, etc.). Some regional actions specific to the physical watershed could include:

- Preserve habitats and ecosystems that provide functions essential to water management
  - These include erosion prevention, healthy sedimentation levels, water temperature preservation, and the provision of a cold-water pool in the summertime
  - Promote conservation of terrestrial and aquatic habitat connectivity
  - Protect, preserve, and restore, where appropriate, the riparian zone
- Identify where noxious weeds may become a serious problem for recreational use, agricultural activities, water quality, ecosystem integrity, or other reasons and manage those infestations accordingly
- Improve data collection and sharing amongst/between watershed stakeholders and outside entities

Watershed management could also include an emphasis on public outreach, coordination between stakeholders, and increasing regional capacity and investment in watershed services. These actions would strengthen the local control of water resources as well as ensure more comprehensive and consistent management strategies between organizations. It would also increase both in-region and outside investment into regional resource management. Potential actions could include:

- Increase levels of community knowledge regarding their watershed and encourage responsible stewardship and protection
- Identify places where collaborative planning/management would be feasible and best implement management activities
    - Coordinate with and between stakeholders where appropriate
- Build regional capacity through stakeholder partnerships and collaboration
- Encourage continued collaboration and regional stability through development of intra-agency relationships through the RWMG

Groundwater and its effects and interaction with surface water are a prominent issue in the USR. The groundwater resources available in the region are largely of a fractured rock, or volcanic, nature. In fractured rock aquifers, groundwater is stored in the fractures, joints, and cavities of the rock mass. Water availability is largely dependent on the nature of the fractures and their interconnection, creating a resource that is unpredictable and unreliable, especially when impacted by additional activities such as increased pumping from development or industry. Most inhabitants rely, to some extent, on groundwater resources for potable water use. Groundwater is also part of industrial use and development. In California, if a groundwater basin is not adjudicated[16], all landowners are essentially water rights holders to the water underlying their property, without limits beyond that of "reasonable and beneficial use" as defined in the California Water Code and state constitution. If a groundwater user pumps beyond the capacity of the basin (which varies depending on the aquifer and geology of the region), this user can affect the ability of other groundwater users to make use of the resource. Those negatively affected users then have no recourse (beyond the courts system) due to the informal nature of groundwater management in California.

Siskiyou County does have a groundwater ordinance that prevents the withdrawal and sale of the water outside the county boundaries without a permit from the County Board of Supervisors, with an exception for bottled water operations. The ordinance is effective on all lands in the jurisdiction of Siskiyou County; city councils must adopt the ordinance for it to be effective within city jurisdiction. The City of Mt. Shasta has adopted an ordinance almost identical to Siskiyou County's. These local laws make the county groundwater ordinance applicable within the jurisdictional boundaries. Some of the actions below could be very important to the region in planning for a sustainable water source for all users over the long term:

- Assess the connection between groundwater and spring and surface water sources to better understand their interactions
- Monitor the effects of groundwater use by industrial sites on surrounding residential wells; work with jurisdictions to minimize negative effects to inhabitants of the region

r. Land Use Planning and Management

Developing a clear connection between land use planning and water management is essential for a balanced water supply, preservation of regional aesthetics, and retaining systemic flexibility to adapt to changes. Activities might include:

[16] In basins where a lawsuit is brought to adjudicate the basin, the groundwater rights of all the overliers and appropriators are determined by the court. The court also decides: 1) who the extractors are; 2) how much groundwater those well owners can extract; and 3) who the Watermaster will be to ensure that the basin is managed in accordance with the court's decree. The Watermaster must report periodically to the court. There are 22 adjudicated groundwater basins in California; none are in the USR. Text taken on 5/2/2013 from http://www.water.ca.gov/groundwater/gwmanagement/court_adjudications.cfm.

- Further the relationship between county and city planning departments and their counterpart water agencies to ensure that adequate water supply, resource protection, and efficiency is considered in infrastructure planning
- Implement low impact design, where appropriate and feasible, to protect and maintain water quality, quantity, and to manage stormwater
- Identify water supply constraints and communicate these to counterpart planning entities; foster cooperation to address these challenges
- Compilation of a basin study/inventory can aid land use planning entities in identifying viable areas for growth and development
- Identify and assess recharge areas for ground water supplies and limit development in those locations (see also strategy "o", above)

s. Water-dependent Recreation

Recreation activities contribute significantly to the USR's annual revenue, and include activities as diverse as backcountry uses in winter and whitewater rafting and boating in the summer. These activities are dependent upon having a reliable water resource available at the right time and place. Actions to support these values include:

- Provide public access to regional water features while ensuring that private property rights are respected
- Enhance the educational qualities of recreational activities throughout the region
- Work with a variety of stakeholders (USFS, power providers, educational institutions, non-profits) to identify recreational and educational opportunities
- Ensure that current and future recreational developments do not endanger water quality and/or environmental characteristics
- Ensure that current and future recreational developments do not harm areas and resources of indigenous cultural value; this includes activities ranging from the unintentional harm done through the use of sensitive locations to the purposeful degradation of cultural sites and even removal of cultural artifacts

8.1.4 Water Quality Management and Protection

The quality of water resources affects how and when they are used. Through the Basin Plan for the Sacramento Valley, the State Water Resources Control Board assigns beneficial uses to waterways and water bodies throughout the state, naming the uses applicable to these places (information specific to the USR on beneficial uses may be found in Chapter 3, Region Description). The beneficial use identified then comes with water quality parameters to uphold and, in some cases, apply restoration activities. The health of those who use these water bodies is dependent upon their quality. If a water body is designated for recreation, for example, but is polluted by excessive fecal coliform, those who use that water body for its designated use will get sick. Likewise, plants and animals require specific water quality parameters. The strategies below identify a variety of ways that USR stakeholders can see taking action to protect water quality throughout the region.

t. Pollution Prevention

Pollution prevention can improve water quality for all beneficial uses by protecting water at its source and therefore reducing the need and cost for other water management and treatment options. Actions might include:

- Restore degraded riparian habitats where elevated sediment or turbidity cause nuisance or adversely impact beneficial uses per the Basin Plan
- Identify whether dams have significantly altered the sediment regime downstream and address the issue where appropriate

- Assess the costs and impacts of current water quality management activities and use this assessment to guide future implementation programs
- Identify abandoned mines throughout the region and assess the level to which these sites contaminate regional waters
- Construct and maintain livestock exclusions around sensitive meadow and riparian habitats, particularly in areas that are important for groundwater recharge or source water protection; Consider existing storm water treatment and management and identify areas where pollution prevention would be possible
- Consider industrial pretreatment as applicable

u. Groundwater Remediation / Aquifer Remediation

While this RMS can be listed as an issue on the macro scale for longer-term consideration, contamination of these resources is not at a level of concern currently. There are specific locations throughout the region where old industrial sites (mills, mines, etc.) may be leaching contaminants into the groundwater. One of the issues identified through the RWMG interview process is a need for more detail regarding basin characterization; this process would aid in the RWMG's understanding of this issue, as well.

v. Drinking Water Treatment and Distribution

While much of the region is served high-quality water by small municipal water districts, drinking water is a challenge for some Native American tribes in the region. These are largely cases on an individual residence basis, where inhabitants must go to the river with buckets for drinking water, or have such inadequate wastewater management systems that grey- and black-water is disposed of on the ground's surface. In addition, some of the small water systems, especially those serving disadvantaged communities (DACs), may have a difficult time complying with continually updated potable water standards. Distribution systems that have inadequate storage and/or pressure, under-sized pipes and/or tanks, or are made up of aging infrastructure may present risks to drinking water quality and service. The cost and the expertise necessary to identify issues and update the system are both potential challenges. Source water area uses, including forests at risk of catastrophic wildfire, can negatively affect water quality for potable use through increased sediment loads, nutrients, and, in some cases, heavy metals. The following activities could be important components of this strategy:

- A basin inventory/study would be helpful in identifying supply sources throughout the region
- Identify places where drinking water quality is threatened and assess the source(s) of contamination
- Replace degraded our outdated water delivery infrastructure to secure reliable water supply and reduce system loss
- Assess drinking water quality of private wells (homes) where sewer systems are close (such as one-acre private homes where sewer and groundwater wells are close)

w. Urban Runoff Management

Urban runoff management encompasses a broad series of activities to manage both storm water and dry weather runoff (when landscape irrigation water flows to storm drains). Often, watershed approaches to urban runoff can be more efficient and more aesthetic than traditional infrastructure. These activities might include swales and infiltration basins, increasing stream or wetland capacity, or other strategies to increase the landscape's capacity to hold water. This is also called "green infrastructure". Runoff management activities might include the following:

- Monitor and mitigate, where appropriate, urban drain dump sites and dry weather runoff from sprinklers
- Identify whether storm events cause water quality problems downstream of regional communities and, if so, take action to implement best management practices to mitigate these negative effects
- Implement low-impact design in communities close to potable water sources
- Identify potential locations for green infrastructure to control pollutant entry into waterways
- Assess adequacy of storm water detention infrastructure
- 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

x. Wastewater Treatment

This strategy was identified by the USR stakeholder group as essential in the region due to the 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

8.1.5 Other Applicable Strategies

y. Flood Risk Management

Flood risk may be felt in different ways in different communities. Because the region is located outside of the state's focus-area for flood management, there is a lack of information regarding which communities feel these effects and when. Actions for this strategy may include:

- Identify communities suffering from severe, episodic flooding
- Take action to aid to remediate flood risk, either through traditional or non-traditional infrastructure development
- Assess the future risk of catastrophic flooding due to projected climate change effects

z. Economic Incentives (Loans, Grants, and Water Pricing)

Economic incentives include financial assistance, water pricing, and water market policies to influence water management. These incentives can influence the amount and time of use, wastewater volume, and source of supply, and are important tools for water managers.

- Seek loans and grants to fund water infrastructure maintenance and improvement
- Encourage regular examination and adjustment, where necessary, of water rates
- Encourage use of tiered rate structures
- Work with organizations throughout the state to identify a source water area investment fund

aa. Education

Similar to many other IRWM regions, stakeholders throughout the USR make use of this tool to bridge the divide between stakeholders, establish relationships within the basin, reach out to local residents and seasonal recreational use populations and inform policy makers. Education is a strategy that is used by most regional water management groups but is chronically undervalued. A community must have at its foundation a similar understanding of basic concepts; the role of education is to develop this shared vocabulary. A shared understanding facilitates communication and integration of key concepts into planning and policy on a variety of levels. In the case of environmental education, those concepts will include watershed connectivity, the water cycle, and humans' place in the ecosystem. This strategy should contribute to the provision of educational opportunities for local and state policy makers as well as in-region stakeholders, via field trips, workshops, and other means to ensure they have a full understanding as they develop policies and programs that will affect this source water area. Ongoing and potential new activities are identified in the list below.

- Lectures and nature walks open to the public would help locals to gain a better understanding, enjoyment, and respect for the local environment, as well as potentially representing a tourism attraction
- Work between and among regional educational entities and efforts to develop a regional K-12 curriculum that includes topics of water supply, water quality, environmental, cultural, and other resource-related issues
- Invite tour events to local water and wastewater infrastructure — while preserving human health and resource safety and protection — to help the local public to develop a better understanding of where their water comes from and why it costs money
- Initiate an educational program helping stakeholders to understand how uplands and watershed management affects water quality and supply
- Ensure that local policy makers have a full understanding of regional resource management issues from a variety of sources and viewpoints

8.1.6 Strategies Considered but Not Applicable to the USR

bb. Crop Idling for Water Transfers

This strategy is not relevant to the Upper Sacramento-McCloud IRWM Region, as the region doesn't have adequate agricultural areas to make crop idling a viable strategy for increased water supply.

cc. Conveyance — Delta

This topic is not relevant to the Upper Sacramento-McCloud IRWM Region, as the region doesn't receive water from the Delta.

dd. Desalination

This topic is not relevant to the Upper Sacramento-McCloud IRWM Region, as the region is not close enough to the ocean for this to be viable, nor are there challenges with saline water resources.

ee. Salt and Salinity Management[17]

This topic is not relevant to the Upper Sacramento-McCloud IRWM Region, as the region doesn't have challenges related to salt or saline water. However, stakeholders recognize that other water users throughout the state are dealing with water too saline to be used for its identified beneficial use. While this is not an issue for USR stakeholders and the RWMG does not accept regional responsibility for the problem, projects addressing this issue may be considered, including the benefit of decreasing salinity; nevertheless, in-region benefits will be of foremost concern when prioritizing issues and projects for funding.

In the event that a recycled water project is identified, collaboration with the CV-SALTS program to develop a Salt and Nutrient Management Plan will be pursued.

ff. Dewvaporation or Atmospheric Pressure Desalination[18]

This topic is not relevant to the Upper Sacramento-McCloud IRWM Region, as the region currently has adequate water resources and the cost of this strategy is prohibitive.

gg. Fog Collection

This topic is not relevant to the Upper Sacramento-McCloud IRWM Region, as the region currently has adequate water resources and the cost of this strategy is prohibitive.

hh. Waterbag Transport/Storage Technology[19]

This topic is not relevant to the Upper Sacramento-McCloud IRWM Region, as the region currently has adequate water resources; in addition, there is no portion of the region for which this strategy would be easy to implement (the region is inland) and the cost of this strategy is prohibitive.

8.2 Benefits of Integrating Multiple Management Strategies

Integration between multiple water management strategies provides benefits in many ways. Integration reduces conflict between water users, allowing both sides to see the benefits of a multi-strategy approach. This can also be explained by defining integration as a process of diagnosing, responding to, and resolving water use problems through the acknowledgement of their interrelationship. Integration recognizes that choices must be made and tradeoffs must be analyzed to achieve the best use of limited resources among competing uses. Using integrated strategies in each project means that stakeholders have looked at the challenge they are addressing with a particular project, and decided to address it thoroughly through the use of multiple management strategies and, in all likelihood, through collaboration with multiple stakeholders and organizations.

8.3 How Objectives Integrate the RMS

In the identification of applicable RMS, stakeholders assessed how well each of these strategies would serve the region in diversifying the implementation strategies for each objective. Table 8.1, below, identifies the applicability of each of the RMS to each of the objectives.

[17] Salts include materials originating from dissolution or weather of the rocks and soil, and salinity describes a condition where dissolved minerals of any origin and carrying an electric charge (ions) are present. This is usually measured as electrical conductivity (or total dissolved solids) in water. Salt is present to some degree in virtually all natural water supplies, but can be a problem if the levels get too high.

[18] Dewvaporation is a specific process of humidification-dehumidification desalination. Brackish water is evaporated by heated air, which deposits fresh water as dew on the opposite side of a heat transfer wall. This is used exclusively on a small (150-1000 gallon) scale.

[19] The use of waterbag transport/storage technology involves diverting water in areas that have unallocated freshwater supplies, storing the water in large inflatable bladders, and towing them to an alternate coastal region.

Table 8.1: How USR Objectives address State and local resource management strategies

USR Objectives	***Resource Management Strategies*** *(all from the 2009 California Water Plan unless otherwise indicated)* a. Conveyance - local	b. System Reoperation	c. Water Transfers	d. Conjunctive Management	e. Recycled Water	f. Surface Storage - CALFED	g. Surface Storage - local	h. Quality to Use	i. Ag Efficiency	j. Urban Efficiency	k. Irrigated Land Retirement	l. Ag. Stewardship	m. Ecosystem Restoration	n. Forest Mgmt	o. Recharge Area Protection	p. Precipitation Enhancement	q. Watershed Management	r. Land Use	s. Water-dependent Recreation	t. Pollution Prevention	u. GW Remediation	v. Drinking Water	w. Urban Runoff	x. Wastewater Treatment (USR RMS)	y. Flood Risk Management	z. Economic Incentives	aa. Education (USR RMS)
1. Increase knowledge of basin characteristics and raise public awareness and understanding of fractured rock aquifers, watershed dynamics, existing water rights, water resource allocation, and existing management authorities to inform and develop support for IRWM planning and projects.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2. Encourage, improve and maintain an environment that fosters cooperation, facilitates collaboration, and builds relationships of trust and respect among water resource stakeholders and community members with respect to water management efforts in the basin.																											X
3. Maintain and enhance the ecological health of the basin to: 1. Support the local economy; 2. Ensure public health and safety; 3. Respecting and support indigenous cultures; 4. Improve recreational infrastructure and opportunities for both tourism and the local economy; and 5. Prepare for potential reintroduction of native species to the region.												X	X	X	X		X	X	X	X	X		X	X		X	X
4. Support and improve ongoing forest management efforts with regard to local water quality and supply including fire management within existing regulatory frameworks.													X	X	X		X								X		
5. Ensure support for and foster success of water management efforts for disadvantaged	X	X	X	X	X	X	X	X					X	X	X		X	X	X	X	X	X		X	X		X

and Native American communities while respecting the cultural values of existing communities.																											
6. Support local participation in development and implementation of water quality standards that reflect local conditions and implementation of projects that maintain and enhance the basin's existing water quality.					X			X							X	X		X	X	X	X	X	X	X	X		X
7. Ensure adequate water supply and quality while maintaining regulatory compliance, minimizing conflict, and recognizing and respecting existing water rights and users.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8. Facilitate development of sustainable water/wastewater infrastructure to ensure public health, protect ecological integrity, and support economic stability.																						X		X		X	X
9. Address flooding concerns through infrastructure improvements and support ongoing local flood management efforts.		X					X											X					X	X	X	X	X
Totals:	***3***	***4***	***3***	***3***	***4***	***3***	***4***	***4***	***2***	***2***	***2***	***3***	***5***	***5***	***6***	***3***	***5***	***6***	***5***	***5***	***5***	***5***	***5***	***7***	***6***	***5***	***8***

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9. Climate Change

Warming of the Earth's climate has become evident over the last several decades. The Department of Water Resources' (DWR) guidelines require that the Integrated Regional Water Management Plan (IRWMP) address "both adaptation to the effects of climate change and mitigation of greenhouse gas (GHG) emissions." In developing the general information in this chapter and our approach to modeling potential changes at a regional scale, we have relied extensively on work previously completed by those in other source water regions, in particular the Inyo-Mono IRWM region and, to a lesser extent, the Upper Pit IRWM region.

Though there is still debate over the anthropogenic (or man-made) contribution to climate change, the overwhelming consensus among climate scientists is that human-derived sources of greenhouse gases have sped up, if not caused, the observed warming in the last century. In the most recent report from the Intergovernmental Panel on Climate Change (IPCC), a body of international scientists and climate experts established by the United Nations, the authors state: "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level" (IPCC 2007).

In the last decade several studies evaluating past changes as well as potential future changes and vulnerabilities within the USR have been undertaken. However, given the remote and rural nature of the USR, extensive information regarding climate change impacts, greenhouse gas mitigation, and adaptation strategies is not available in the same way that it is for a more populated area. The IRWM program is committed to improving the availability of climate change related information for water practitioners in the area through the availability and accessibility of the data management system (see Chapter 13, Data Management) and through the continued work of the regional water management group (RWMG) in implementing the Integrated Regional Water Management Plan (IRWMP). This will be done through partnerships with entities already doing work on climate projections, and through building on current understanding. Because the region is small and largely made up of disadvantaged communities, unless a grant opportunity specific to climate change research is made available, the Upper Sacramento, McCloud, and Lower Pit Region (USR) RWMG is not likely to be the primary investigator for future studies. However, because of the RWMG's collaborative and diverse nature, the organization represents and excellent opportunity for partnerships with research institutions, including private research, U.S. Forest Service (USFS) efforts, or state work on water supply and resources.

The discussion in this chapter will focus on anticipated climate change vulnerabilities in the USR. However, it should be noted that while climate change variability in California generally is predicted to be great in the coming century, that preliminary comparisons of variability in the State to variability in the USR show that the Mount Shasta region may potentially be buffered from climate change impacts as the variability may be slightly less. This indicates that the region may act as a potential refuge for both fish and wildlife species. In a Water Talks program put on by California Trout in early October, researchers discussed the importance of spring-fed systems as climate refugia; this potential warrants increased investment in this critical water source area to maintain the characteristics that make it potentially resilient to climate change and a resource for the rest of California.[20]

When assessing and evaluating climate change impacts and vulnerabilities, DWR's guidelines encourage IRWM regions to bear in mind four documents in particular. These documents, and how they are incorporated in this document, are briefly described below:

California Air Resources Board (CARB): *Climate Change Scoping Plan* (2008):
CARB's Scoping Plan discusses different business sectors, including water management, and recommends specific strategies that may help reduce GHG emissions. Because the USR is a source water area with minimal energy demands for water delivery (due to gravity-based delivery systems) and little energy intensive industry, much of this document is not applicable to the region. Nevertheless, in developing projects, proponents considered GHG emissions associated with project development and management, and where possible incorporated practices to reduce GHG emissions or provide alternative, renewable energy sources. Restoration and conservation projects that prevent forest loss and promote sustainable forests that act as a carbon sink are also consistent with CARB's recommendations.

DWRs' *Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water* (2008):
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. The document emphasizes IRWM as the mechanism for fostering a collaborative regional approach to water management. At a regional level assessing and understanding vulnerability to the long-term increased risk and uncertainty associated with climate change is a key strategy. IRWM plans are expected to include projects that seek to improve understanding of springs and groundwater resources in the region, and to consider how they may be impacted by climate change. Because much of the region relies on these resources for water supply, understanding groundwater hydrology is essential for evaluating the region's vulnerability to climate change. Several statewide strategies identified in the DWR's white paper, particularly those addressing long-term funding for IRWM and management of water infrastructure, are critical to the region, and the USR RWMG had identified a potential strategy (in Chapter 15) to work together with other source water areas to advocate for the interests of these areas that are so critical to the water supply of the region as well as for the rest of the state.

California Natural Resource Agency's *California Climate Adaptation Strategy* (2009):
California Natural Resource Agency's (CNRA) Climate Adaptation Strategy (CAS) discusses statewide and sector-specific vulnerability assessments, looking, in particular, at which climate factors will be driving impacts within each sector and how impacts interact across sectors. By identifying these inter-relationships the document also highlights

[20] The Water Talks program is an ongoing series of information and educational events on water-related topics in the region and is a project of California Trout. Dr. James Thorne and PhD candidate Robert Lusardi spoke on October 2, 2013 on the topic of climate change in the USR, and specifically regarding spring-fed systems. While not specifically in the USR, one of the published studies on this topic is available at https://watershed.ucdavis.edu/pdf/Jeffres-et-al-SWRCB-2009.pdf.

opportunities to implement adaptation strategies across sectors. Strategies considered by the USR RWMG drew primarily from the following sectors addressed in the CAS:

- Biodiversity and Habitat: Potential impacts from climate change identified in the CAS include increased risk of wildfire, spread of invasive plants and animals, and loss of critical instream flows, among others.
- Water Management: Potential impacts from climate change identified in the CAS include reduced water supply due to loss of snowpack and changes in water quality.
- Forestry: Potential impacts from climate change identified in the CAS include changes in forest productivity, tree mortality, species migration barriers, increase in invasive species, changes in natural community structure, spread of diseases and insects, and reduction in ecosystem goods and services.
- Transportation and Energy Infrastructure: While the USR does not rely heavily on hydropower, hydropower energy facilities exist within the region. A decrease in water availability for hydropower generation is a potential impact from climate change identified in the CAS.

Climate Change Handbook for Regional Water Planning (2011):
This document was prepared jointly by DWR, United States Environmental Protection Agency (USEPA), United States Army Corps of Engineers (USACE), and the Resource Legacy Fund to assist IRWM regions in incorporating climate change analysis and methodologies into their planning efforts. This chapter closely follows the suggested guidelines laid out in that document. In particular, one of the core elements is a more detailed vulnerability assessment comprised of a series of questions related to various aspects of water management. The questions from this vulnerability assessment are addressed in Section 9.4 below.

9.1 Region Characterization

Chapter 3, Region Description, provides a thorough description of the USR, including climate, hydrology, geography, watersheds, and associated ecosystems, human uses, cultural resources, and water supplies and demands.

Some of the cost-share used to match the planning grant-funding award for the development of the USR IRWMP came from work completed in examining climate change in the USR. One of those projects is the long-term environmental data collection being done on Castle Lake as part of the Castle Lake Environmental Research and Education Program (CLEREP).[21] Castle Lake, located southwest of the City of Mount Shasta in the headwaters of the Upper Sacramento River watershed, has one of the longest continuous datasets (52 years) on biological, physical, and water quality parameters. One study in particular focused on ecosystem production through observing food web interactions in the lake, and how these might be affected and altered by climate change. The CLEREP study is not yet complete, but will be instrumental in understanding how species flexibility, persistence, and response may

[21] Work provided as match for this grant included researchers from Castle Lake Environmental Research and Education Program (CLEREP) continuing long-term physical and ecological monitoring from October 2008 through September 2010 and refining an empirical model based on CLEREP's dataset to investigate the effect of climate scenarios on water quality and ecosystem productivity.

occur to projected climate change effects throughout the Cascade, Sierra Nevada, and Great Basin portions of California.

One of the outcomes of the CLEREP effort at Castle Lake that has informed regional climate understanding on multiple levels is the research thesis produced in 2012 by Jacquelyn D. Brownstein. She investigated the connection between fish stocking, invertebrates, and the linkage between benthic (bottom) and pelagic (water column) feeding and energetics. Understanding how ecosystems throughout the USR function now will help landscape managers to be better prepared for the future and make decisions that add flexibility to the system in order to better accommodate adaptation as the climate changes.

Another important component of the region's vulnerability assessment is the STNF's National Climate Change Assessment of Watershed Vulnerability. The STNF, which manages large areas of land in the USR, represented U. S. Department of Agriculture's (USDA) Region 5 in this process and contributed key data and findings to the USR process. The pilot study assessed the inter-relationship of regional climate models and the projected exposure to key aquatic resources, recognizing that existing models and predictions project serious changes to worldwide hydrologic processes as a result of global climate change. Projections indicate that significant change may threaten National Forest System watersheds that are an important source of water used to support people, economies, and ecosystems.

A result of this study was the publication of *Assessing the Vulnerability of Watersheds to Climate Change: Results of National Forest Watershed Vulnerability Pilot Assessments*.

Eleven National Forests throughout the United States, representing each of the nine Forest Service regions, conducted assessments of potential hydrologic change due to ongoing and expected climate warming. A pilot assessment approach was developed and implemented. Each National Forest identified water resources important in that area, assessed climate change exposure and watershed sensitivity, and evaluated the relative vulnerabilities of watersheds to climate change. The assessments provided management recommendations to anticipate and respond to projected climate-hydrologic changes. Completed assessments differed in level of detail, but all assessments identified priority areas and management actions to maintain or improve watershed resilience in response to a changing climate. The pilot efforts also identified key principles important to conducting future vulnerability assessments. Initial priorities identified by the Forest Service in this report are to build knowledge, skills, and expertise, and to develop experience and partnerships. The report acknowledges that these initial steps will build toward planning and designing management actions to improve ecosystem resilience and improve forest response to climate change.

The study outcomes specific to the USR included an emphasis on using finer-scale assessment tools to get more detail on changes (the use of Hydrologic Unit Codes (HUCs) for sixth-order streams rather than fourth or fifth), and the importance of local historical data when assessing region-specific change. These lessons learned will be noted as the USR stakeholders proceed in their planning efforts.

9.2 Climate Change Impacts

Globally, air temperature has increased 1.3°F (0.7°C) over the last century (1906–2005) (IPCC 2007). This warming is not uniform, however. Polar regions are showing more warming than mid-latitude regions, at up to twice the global average rate in the last 100 years. High-elevation/mountainous regions are also experiencing increased warming. Trends in precipitation have also been observed, although not in consistent directions. Some areas, such as the Sahel, southern Africa, and parts of southern Asia have experienced decreased precipitation, while eastern North and South America and northern Europe have experienced increased precipitation. Other impacts related to these climatic changes include sea level rise, melting glaciers and polar ice caps, warming oceans, decreased snow cover, melting permafrost, droughts, and an increase in extreme weather events. All of these changes are expected to continue, if not accelerate, in the coming decades.

While it is important to understand current global climatic trends, regional and local climatic changes are more pertinent to natural resources management, planning, and policymaking. It is possible to understand past climatic trends through observed data, where they are available. Yet in order to predict future climate, scientists must use models, which are inherently imperfect. General circulation models (GCMs) are most commonly used to incorporate information about greenhouse gas emissions and other elements of the atmosphere-ocean system. These models produce large-scale output based on grid cells on the order of several kilometers, which, in mountainous areas, is not a useful scale for natural resources planning and management. Efforts to downscale GCMs and to develop regional climate models (RCMs) have improved over the last few years, although there is criticism as to the accuracy of these smaller-scale representations.

Perhaps the most criticized part of using models to project future climate is the uncertainty inherent in these models. Each model contains different assumptions about the atmosphere-ocean system and parameterizes elements of the climate differently. Thus, each model delivers slightly different projections of future temperature, precipitation, and other climatic variables. To use just one model as an indication of future climate is, therefore, problematic. Instead, the convention is to use an ensemble of several climate models to create a general picture of future climatic trends. In this way, the uncertainty of each model is accepted, but it does not prevent the use of climate models in climate change analyses.

A 2009 study commissioned by the California Climate Action Team (CAT), a group of state government officials working to implement greenhouse gas emissions reductions programs as well as the state's Climate Adaptation Strategy, used six GCMs to drive subsequent impact analyses (DWR 2010). These GCMs were selected based on their ability to model historical precipitation and temperature patterns and variability, as well as the El Niño Southern Oscillation, and are listed in Table 9.1, below.

Table 9.1: General circulation models used by the California CAT and by those models used here.

Number	Model Name; group, country	Model ID	Primary Reference Year
1	Parallel Climate Model; National Center for Atmospheric Research (NCAR), USA	PCM	2000
2	Geophysical Dynamics Laboratory model version 2.1; U.S. Department of Commerce/National Oceanic and Atmospheric Administration (NOAA)/Geophysical Fluid Dynamics Laboratory, USA	GFDL-CM2.1	2006
3	Community Climate System Model; NCAR, USA	CCSM3	2006
4	Max Planck Institute for Meteorology, Germany	ECHAM5/MPI-OM	2006
5	Center for Climate System Research (University of Tokyo), National Institute for Environmental Studies, and Frontier Research Center for Global Change, Japan	MIROC3.2 (medres)	2004
6	Meteo-France/Centre National de Recharches Meteorologiques, France	CNRM-CM3	2005

One of the primary drivers of GCMs and RCMs are GHG emissions scenarios. The 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, etc. (IPCC 2007). GCMs and RCMs incorporate these emissions scenarios to produce a suite of possible climatic changes.

A collaboration of research institutions and federal agencies has made the models, along with others, readily available through the World Climate Research Programme's (WRCP's) Coupled Model Intercomparison Project Phase 3 (CMIP3) model output archive[22]. Through the archive's website, the user can request biased-corrected spatial downscaled (BCSD) model output for any geographic region and for any time period within the 21st century. Both temperature and precipitation projections are available. This set of projections has been widely reviewed and used by scientists and practitioners in California. Models can be run with any combination of three IPCC Special Report on Emissions Scenarios (SRES) — A1B, A2, or B1. These emissions scenarios represent a set of "best guesses" of what future emissions might be based on population, economic conditions, energy sources, technological development, environmental policy, etc. A1B is a medium-emissions scenario, reaching approximately 700 parts per million (ppm) CO2 by 2100 (global CO2 is currently approximately 400 ppm). B1 represents a lower-emissions scenario, leveling-out at just over 500 ppm by 2100, while A2 is a higher-emissions scenario and reaches 850 ppm by 2100.

Several different runs of the six GCMs listed in Table 9.1 were used for an analysis of projected climatic changes for the USR for the 21st century, using the downscaling method described above. Data from the CMIP was used and the project team analyzed this data to get the results described in this chapter. Only the A2 and B1 emissions scenarios were used, in order to bound the high and low probabilities of changes in the atmosphere. Because the

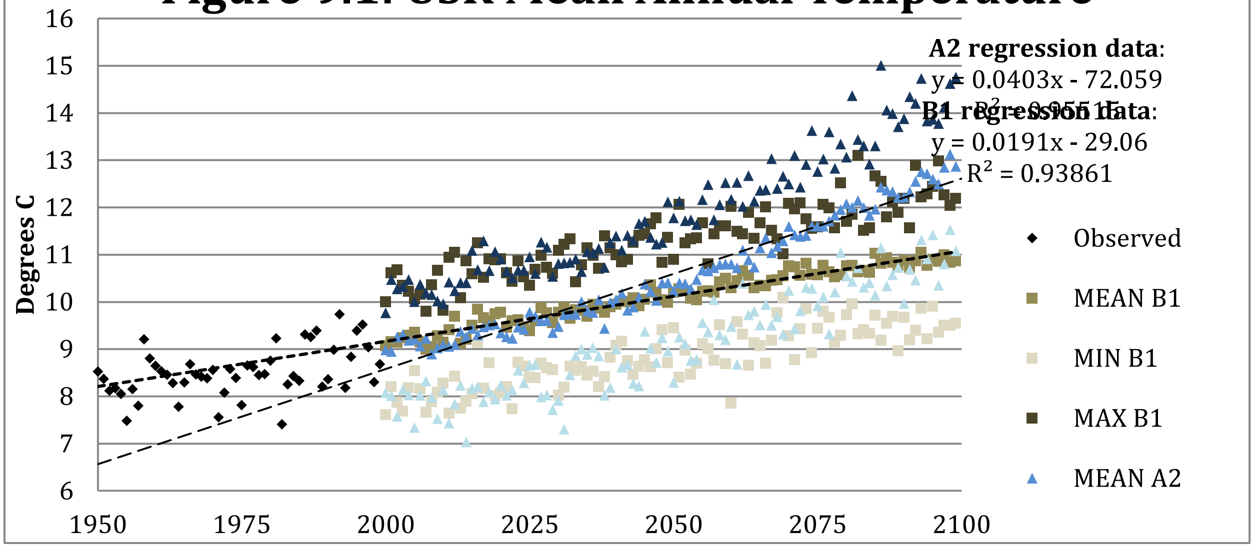
[22] Available at: http://gdo- dcp.ucllnl.org/downscaled_cmip3_projections/dcpInterface.html#Welcome.

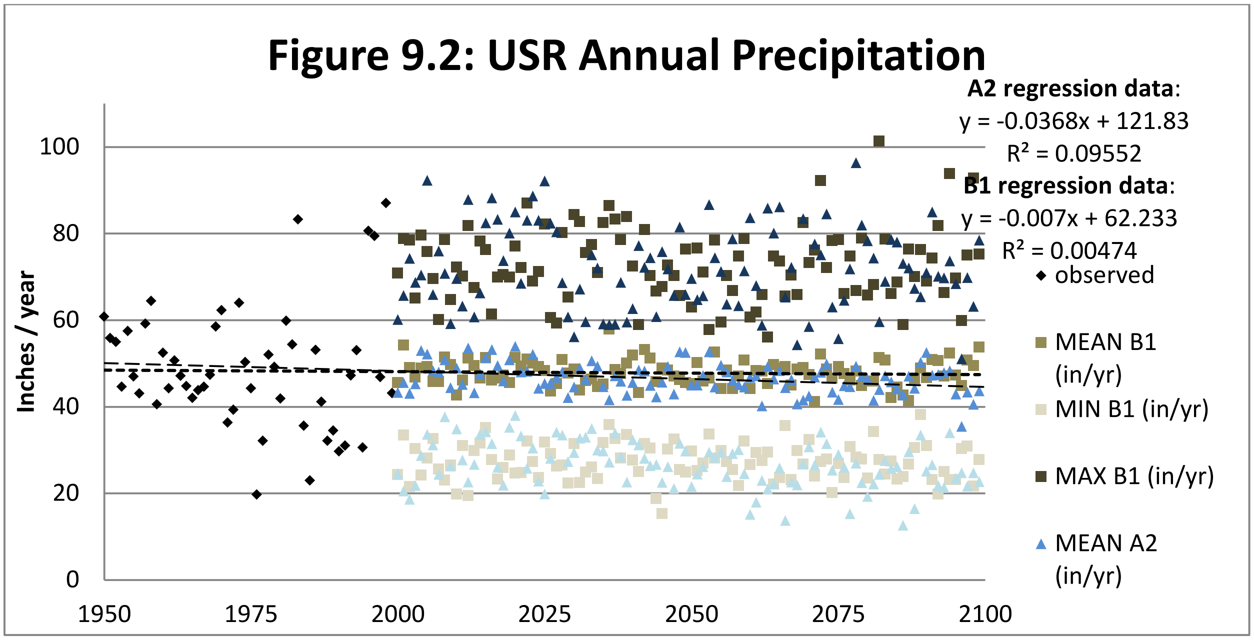
model output is only available on a grid scale, it was not possible to request projections for true watersheds. Instead a rectangle including the boundaries of the region was used as a best approximation.

Projections of temperature and precipitation were examined through the 21st century. For each year, average temperature was calculated for each of the two emissions scenarios. In addition, the highest temperature value and lowest temperature value were identified in an attempt to elucidate the range of possible temperature scenarios. Similarly, cumulative precipitation was calculated for each year based on the model output and two emissions scenarios. An average was calculated over the six models and then a highest precipitation value and lowest precipitation value were identified in order to acknowledge the uncertainty in the projections and the range of possibilities.

The graphs below show the outputs for these models for average daily temperature (Figure 9.1) and precipitation (Figure 9.2). For both emissions scenarios, temperature is expected to increase over the next century, increasing on average 0.019°C /year for the B1 scenario and 0.040°C /year under the A2 scenario. This means that under the more extreme A2 scenario, the models show that temperatures would be expected to increase on average by 4.2 °C (or 7.6 °F) between 2000 and 2100. There is less of a clear trend 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 from year to year. A finer analysis might also reveal changes in timing or concentration of precipitation. These would be interesting topics for future investigation by members of the RWMG.

Figure 9.1: USR Mean Annual Temperature





9.2.1 Water Supply

When considering climate change impacts to water resources in the USR, the biggest concerns are with changes to the winter snowpack, glaciers, and long-term impacts on groundwater and spring resources. The connection between precipitation (snow and rain) that falls on Mount Shasta and the surrounding ranges that comprise the watersheds of the USR and the numerous springs that supply much of the water supply for the residents of the region is only beginning to be understood. California Trout's spring assessment (2009) and vulnerability assessment (2011), discussed in greater detail in Chapter 3, gave some insight into the complex interactions between climate, weather, and geology that affect the springs. Significant variation was found in the recharge elevation, residence time, and seasonal fluctuations in spring discharge. These findings suggest that some of the springs may be more vulnerable to impacts from climate change, especially springs with a lower recharge elevation and shorter residence time being most susceptible to changes in mountain snowpack.

Research done by the United States Geological Survey (USGS) on the Klamath Basin (immediately north of the USR, where geologic conditions may be similar), indicate that, while groundwater dependence and the occurrence of springs do buffer users somewhat from climate change, the "ground-water system in the upper Klamath Basin responds to external stresses such as climate cycles, pumping, lake stage variations, and canal operation. This response is manifest as fluctuations in hydraulic head (as represented by fluctuations in the water-table surface) and variations in groundwater discharge to springs. Basin-wide, decadal-scale climate cycles are the largest factor controlling head and discharge fluctuations. Climate-driven water-table fluctuations of more than 12 feet have been observed near the Cascade Range, and decadal-scale fluctuations of 5 feet are common throughout the basin. Ground-water discharge to springs and streams varies basin-wide in response to decadal-scale climate cycles" (USGS, 2010).

Further compounding this complex issue, previous research by Howat, et al. (2006) showed that the primary driver of the extent of the glaciers on Mount Shasta is precipitation, not temperature. Since there is much less agreement among models on precipitation, it follows that the future trends in the glaciers would also be uncertain, which is what Howat, et al. found. While some models showed the extent of Mount Shasta's glaciers continuing to expand downslope through 2100, under other models, the glaciers completely disappear by 2100.

Forest management adaptations to extreme precipitation, higher temperatures, and more extreme weather events are paramount to how the USR, surrounding regions, and much of northern California adapts to climate change with respect to water supply and ecological needs. Because the USR is the source water area for Shasta Lake Reservoir (California's largest surface water reservoir), which supplies water to much of California, understanding how specific management strategies affect the forests' response to climate change will continue to grow in importance. The USFS program Forests to Faucets is a good example of the growing understanding surrounding urban regions' and economies' dependence upon forested watersheds for water supplies.

9.2.2 Water Demand

The potential impacts of climate change on water demand in the USR have not been analyzed. Because of the sparse population, water demand is not high; however, during peak summer use, daily usage does, at times, exceed daily output from water sources, particularly in the City of Mount Shasta. The primary use for water during high demand times is maintenance of residential landscaping. Without changes in practices, it is likely that water usage will increase as temperatures increase. There are opportunities to reduce water demand, as demonstrated by the lower per capita usage in the City of Dunsmuir following the installation of water meters. In addition, regional jurisdictions may want to investigate the potential for temporary storage options, such as additional water tanks.

9.2.3 Water Quality

Water quality in the USR is very good and is considered to be some of the highest quality water in the United States. The protection of this resource is paramount to the USR and the State of California.[23] The primary threats to water quality in the USR are from transportation infrastructure, road and rail, the extensive network of dirt roads on both private and public forestlands, and, in the Lower Pit River, upstream agricultural practices. The increased risk of catastrophic wildfire associated with a changing climate, higher temperatures, and prolonged periods of drought, followed by significant storm events, can result in run-off and sedimentation that pose a significant threat to water in the USR. This combination of high intensity wildfire followed by intense rainfall was well illustrated during the late fall / early winter storms in 2012 following the 50,000-acre Bagley Fire. The result was massive volumes of debris flowed into Squaw Creek and several tributaries of the McCloud River. Stakeholders have suggested that a study of Squaw Creek may be helpful in understanding future climate effects in the USR; with a stand-replacing fire followed by two substantial floods, this may represent the region's future.

[23] Letton, Ben; personal communication 7/31/2013.

9.2.4 Flooding

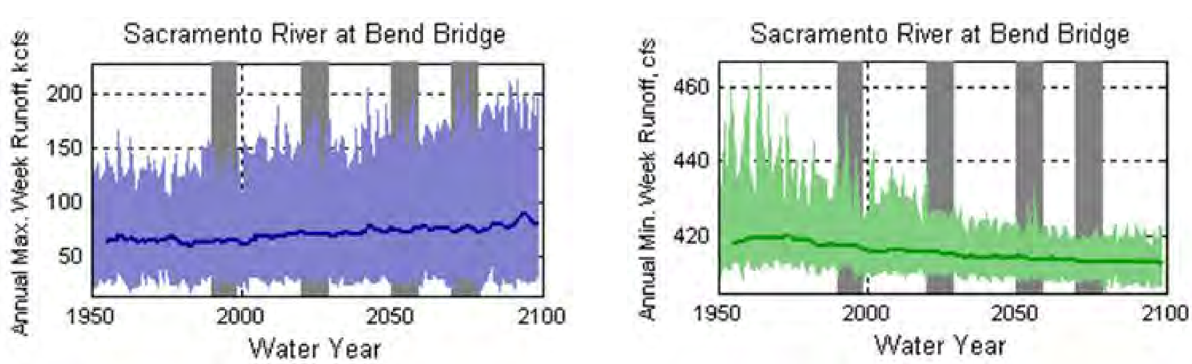
Although the USR does not experience flooding on the scale of the Sacramento-San Joaquin Delta or the Central Valley, localized flooding can be a major concern. The communities of McCloud and Dunsmuir, as well as several smaller communities along the Upper Sacramento River, have been impacted by flooding. In the USR, flooding is of greatest concern during rain-on-snow events. There have also been occasional significant impacts from debris flows associated with sections of Konwakiton Glacier (one of Mount Shasta's glaciers) breaking off, the most notable being in Mud Creek, a tributary to the McCloud River, which experienced substantial mud flows in years between 1924 and 1931. The impacts of warming temperatures and changing precipitation patterns on both of these types of events are not clear, but it seems likely that there could be an increased risk of flooding and debris flows, for which communities that fall in the USR's floodplains need to be prepared.

9.2.5 Ecosystem and Habitat Vulnerability

Impacts of a changing climate on terrestrial and aquatic ecosystems have been studied worldwide. One of the primary concerns related to climate change impacts on ecosystems is the movement of animal and plant species. In the USR, biologists from the STNF undertook vulnerability assessment as part of a pilot project implemented nationwide by the USFS. As part of this pilot study they identified that sensitive aquatic species were especially vulnerable to habitat loss due to potential increased risk of drying of small ponds and streams. In addition, threatened and endangered aquatic species were at risk due to warmer base flows.[24]

The Bureau of Reclamation, in its Draft Climate Change Modeling Appendix to the Shasta Lake Water Resources Investigation (U.S. Bureau of Reclamation 2013), shows the annual maximum runoff rising slightly over the next century (see graph below), while the annual minimum decreases slightly. Higher annual maximums indicate an increase in the number of extreme events (flooding), while lower annual minimums indicate decreased base flows through the dry season.

Figure 9.3: Maximum and minimum annual flow projections of the Sacramento River to 2100. Source: Bureau of Reclamation Draft Climate Change Modeling Appendix to the Shasta Lake Water Resources Investigation



[24] Mai, Christine; personal communication 2012.

9.3 Regional Climate Change Vulnerabilities, and Adaptation and Mitigation Strategies

This section examines major vulnerabilities related to water resources following the categorized impacts of the previous section. The questions posed follow the guidance provided in the *Climate Change Handbook for Regional Water Planning* (2011). Following each category are resource management strategies that could be employed to enhance regional adaptation to climate change impacts and/or mitigation of those impacts through decreased emissions. A useful companion piece to this review is the Western Shasta Resource Conservation District's (RCD's) Forest and Water Climate Adaptation: A Plan for Shasta County, California (Bryan, et al. 2012). While specific to the Shasta County portion of the USR, much of the information regarding vulnerabilities, as well as the strategies identified for adaptation, could be applied throughout the region. An important point for the USR is that any adaptive strategy must be practical and pragmatic because projected effects are usually vague and cannot be pinpointed. According to the RCD's plans, it is important to preserve the adaptive capacity of the region through increasing systemic flexibility and preserving resource managers' available options.

9.3.1 Water Supply

1) *Does a portion of the water supply in the region come from snowmelt?*
   Yes. Most communities in the region rely on spring water sources that are recharged primarily by snow that falls on the slopes of Mount Shasta. Recent studies of have found that both the recharge elevation of these springs and the residence time of the water underground vary widely among the springs, indicating that some supplies may be more vulnerable to impacts from climate change than others (California Trout 2009). A few small communities in the region rely on surface water diverted from streams that are fed by a combination of snowmelt and perennial springs. The region is largely forested, which presents an excellent opportunity for strategic management in order to preserve snowmelt and rainfall, and to enhance natural storage capacity.

2) *Would the region have difficulty in storing carryover supply surpluses from year to year?*
   Yes. There is almost no long-term storage capacity within the region associated with water supply above Shasta Lake Reservoir. That said, there is limited storage capacity associated with flood control and power supply infrastructure in the Upper Sacramento (Lake Siskiyou reservoir), McCloud (McCloud Reservoir), and Lower Pit (Iron Canyon and Pit 4, 5, and 6 Reservoirs) watersheds. The significant water storage in the region is in the groundwater systems, which are not well understood.

3) *Has the region faced a drought in the past during which it failed to meet local water demands?*
   Recent significant drought periods in California, from 1975–1977, 1987–1992, and in 2001, have had some impacts in Siskiyou and Shasta County; however, because community water systems in the region are dependent on perennial spring water sources, these communities are somewhat buffered from the impacts of drought. That said, in some dry years, the City of Mount Shasta has restricted water use by means of an odd/even day irrigating restriction, but never for domestic use. This has not been

implemented since the mid-1980s. Since that time, the City of Mount Shasta has added an additional well to the water supply system, and has better monitoring of storage tank levels.

4) *Does the region have invasive species management issues at its facilities, along conveyance structures, or in habitat areas?*
There are no invasive species issues that are currently impacting water infrastructure in the region. New Zealand mud snail has recently been found in Shasta Lake Reservoir and could easily be transported into USR rivers, streams, and reservoirs on boats or boots. While the mud snail may not have significant impact on water infrastructure as compared to other parts of California, its presence could have significant impacts on native aquatic populations and could affect regulatory activities throughout the region.

There are several invasive plants that are abundant along watercourses in the region including brooms, Marlahan mustard, and dyer's woad. With climate change altering the historic temperature and moisture regimes, these species are likely to grow quickly, creating a fire risk, using up water resources, and outcompeting native riparian species that are a food source for wildlife. Invasive species can represent a serious threat to the health of natural environments and habitats and agricultural and ranching operations, and can alter entire ecosystems by outcompeting natives. It is likely that climate change will only encourage this progression, so human action will be necessary to control the risk to resources and of catastrophic fire. (Bryan, et al. 2012)

<u>RMS for adapting to water supply vulnerabilities</u>:

- Regional/local Conveyance: add efficiency and control invasive species
- Recycled Municipal Water: to extend summer supplies for landscape use
- Conjunctive Use: high-flow/precipitation years could result in greater groundwater storage
- Regional/local Surface Storage: expand carryover capacity for rainwater throughout the region
- Ecosystem Restoration: functional ecosystems help to provide a more consistent water supply, and controlling invasive species will help the natural ecosystem to adapt without competition
- Groundwater Management: closely monitor seasonal flows to understand the groundwater/surface water dynamic
- Forest Management: see Ecosystem Restoration
- Watershed Management: see Ecosystem Restoration, also increase knowledge regarding groundwater interactions and use throughout the USR
- Land Use Planning and Management: identify recharge areas, and areas of low groundwater dependability, and avoid development in those areas
- Pollution Prevention: protect water supplies through maintaining beneficial uses
- Drinking Water Treatment and Distribution: ensure that distribution systems are efficient and effective

9.3.2 Water Demand

1) *Are there major industries that require cooling/process water in the planning region?*
   There are several water bottling plants in the region. These facilities rely on spring water and groundwater for their operations. Apart from the bottling plants, there are no other industries in the region that currently demand significant quantities of water.

2) *Does water use vary by more than 50% seasonally in parts of the region?*
   Yes. Summer use of water is several times the amount of winter use in the communities of Mount Shasta, Dunsmuir, and McCloud. Primary use of water during these periods of heavy use is for maintenance of residential landscaping. Particularly in Mount Shasta and McCloud, where there are no water meters, average household monthly water demand in the summer far exceeds averages statewide.

3) *Are crops grown in the region climate sensitive?*
   There is no large-scale agriculture in the region.

4) *Do groundwater supplies in the region lack resiliency after drought events?*
   Due to the volcanic geology of the region, groundwater resources are extremely complex and poorly understood. Recent studies by California Trout (2009) reflect some of this complexity, indicating that groundwater that emerges as springs around the region originates at varying elevations and resides underground for long periods of time, in some cases more than 50 years. While spring flows do vary seasonally and year to year, how these fluctuations are impacted by periods of extended drought is not currently known. Given the vast water resources found in this region, this is an area in need of additional study.

5) *Are water use curtailment measures effective in the region?*
   Maybe. Given the relatively abundant water supply in the region, there have been few water use curtailment efforts. Water usage throughout the USR is far above state averages, particularly in summer months, so there is likely some cost effective "low-hanging fruit" to reduce water use in the region. Furthermore, average daily water usage in Dunsmuir, the only town in the USR to have installed water meters, is significantly less than in other communities, suggesting that curtailment measures could be effective if implemented.

6) *Are some instream flow requirements in the region either currently insufficient to support aquatic life, or occasionally unmet?*
   No. With abundant perennial water supplies in all three watersheds and relatively little consumptive use of water from streams in the region, there is little problem with meeting instream flow requirements to support aquatic life. There is need to maintain adequate outflows from dams in the region, as regulated by licensing programs (e.g. Federal Energy Regulatory).

   <u>RMS for adapting to water demand vulnerabilities</u>:
   - Urban Water Use Efficiency: increase efficiency, especially for summer uses

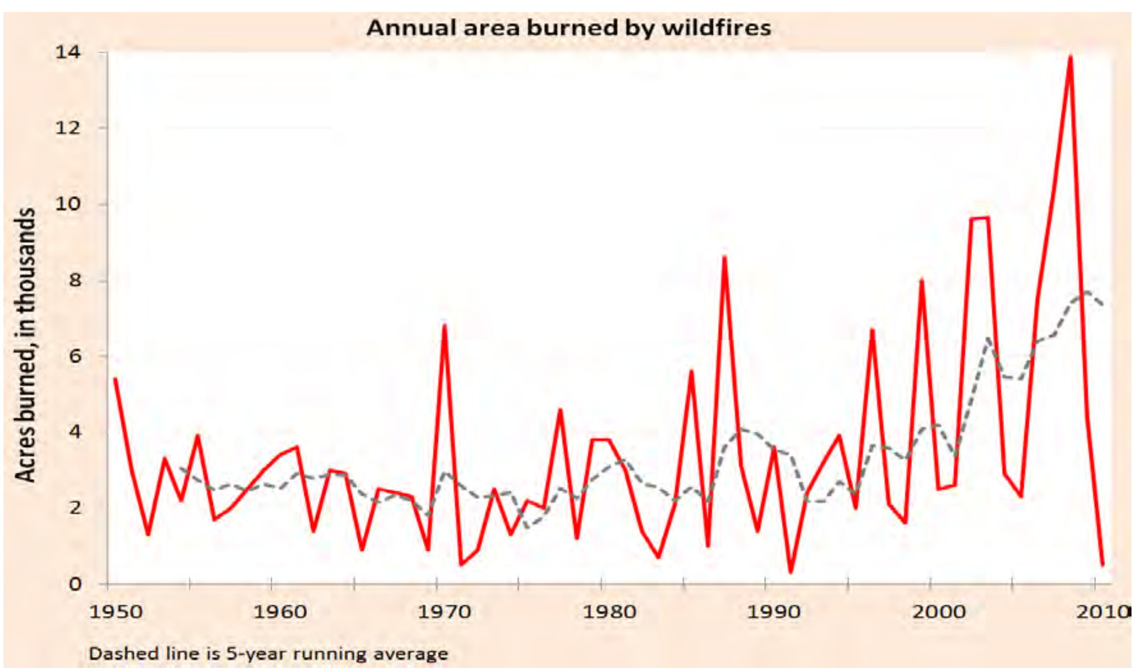
- Watershed Management: see Ecosystem Restoration, also increase knowledge regarding groundwater interactions and use throughout the USR
- Ecosystem Restoration: quantify ecosystem needs
- Land Use Planning and Management: use low-impact-development design wherever possible to minimize water use
- Education: ensure that water users understand the significance of potential change and how to adjust their water use habits
- Economic Incentives: could be used to encourage conservation

9.3.3 Water Quality

1) *Are increased wildfires a threat in the region? If so, does your region include reservoirs with fire-susceptible vegetation nearby which could pose a water quality concern from increased erosion?*

Yes. Wildfire is a pervasive threat to communities and water resources throughout the region. While local communities do not rely heavily on surface water resources in the USR, the watersheds are critical source water areas for the Central Valley Project, which provides water for municipal and agricultural uses throughout California. In 2012 the Bagley fire burned nearly 50,000 acres of rugged, difficult to access timberland in the McCloud and Squaw Creek watersheds. Extreme fire behavior in the summer followed by significant rainfall events that November and December resulted in significant erosion in these watersheds and substantial inputs of sediment and larger debris to Shasta Lake Reservoir.

Figure 9.4: Annual area burned by wildfires in California between 1950 and 2010. Source: OEHHA 2013 update to Indicators of Climate Change in California.



The potential for more frequent, extreme fire behavior is undoubtedly a risk associated with predicted temperature increases, longer dry periods, and, potentially, more storms. All the major reservoirs in the region are surrounded by mature, often over-stocked timber stands that are susceptible to natural or anthropogenic fire ignition. Potential impacts from wildfires on water quality are prevalent throughout the USR; areas of particular concern include the Upper Sacramento River canyon and Rainbow Ridge above Lake Siskiyou Reservoir due to the increased risk of ignition in the wildland-urban interface and along roads and railroads.

The California Office of Environmental Health Hazard Assessment (OEHHA) recently updated their 2009 report: Indicators of Climate Change in California. In this report, OEHHA states that "[t]he area burned by wildfires each year is highly variable, ranging from 31,000 acres in 1963 to 1.4 million acres in 2008, making it difficult to determine long-term trends. However, the data suggest a trend toward increasing acres burned statewide since 2000. The three largest fire years since 1950 have occurred in the past decade (2003, 2007 and 2008), and the annual average since 2000 (598,000 acres) is almost twice that for the 1950–2000 period (264,000 acres)."

2) *Does part of the region rely on surface water bodies with current or recurrent water quality issues? Are there water quality constituents potentially exacerbated by climate change?*
The Pit River is on the 303(d) list for nutrients, dissolved oxygen, and temperature. While surface water is not a large component of local water supplies, there are several small communities and Rancherias along the Pit River that rely on Pit River as a source of water. While flows in the Lower Pit River are heavily managed due to the series of dams and diversions for hydroelectric production on the river, increased temperatures and lower flows that could result from climate change have the potential to exacerbate the water quality issues already present in the Pit River.

In addition to the Pit River, West Squaw Creek and the portion of Shasta Lake Reservoir affected by the creek inflow are listed for cadmium, copper, lead, and zinc. While outside the USR planning area, the entirety of Shasta Lake Reservoir is listed for mercury.

As the region is largely forested, greater understanding of the role the forests play in preserving and improving water quality is an important consideration. Specific forest management strategies could aid in preserving summer base flow, supply water of adequate temperature and quantity for endangered species, and attenuating extreme precipitation events.

3) *Are seasonal low flows decreasing for some water bodies in the region? Are the reduced flows limiting the water bodies' assimilative capacity?*
To date, summer flows have not been observed to be decreasing in the USR's major rivers. As mentioned elsewhere, base flows remain relatively high on many streams in the region due to abundant perennial spring sources, which provide somewhat of a buffer as far as water supply and stream temperature throughout the region. That said, the current trends in flows are not well studied, and the potential long-term impacts and shifts in hydrology as a result of climate change are not well understood. The

impacts to assimilative capacity of local water bodies is of particular concern in the Upper Sacramento River where both Mount Shasta and Dunsmuir currently have permits to discharge treated effluent to the river from their wastewater treatment plants (WWTP). Seasonal low flows below Box Canyon dam, where the City of Mount Shasta's WWTP discharges, are already necessitating facility upgrades. Decreasing future flows could exacerbate this problem for the City of Mount Shasta.

The flow requirements on regional reservoirs for their downstream rivers have been met in the past, but the future for these flow requirements is unknown due to regulatory uncertainty. Box Canyon Dam, run by the Siskiyou Power Authority, has a mandate for temperature, dissolved oxygen, and flow into the river below the dam. While there has never been a problem with the dissolved oxygen and temperature (the water is pulled from deep in the reservoir, maintaining a cool temperature; it then runs through the power production mechanism, which substantially increases the dissolved oxygen content), the outflow required is more than the inflow during most summer months. The facility is outside Federal Energy Regulatory (FERC) oversight, so power production capacity projections have not been completed, and are currently unknown. It is possible that, because of projected climate effects on regional hydrology (longer periods of drought, with precipitation occurring less often, but with greater intensity), the flow mandate for Box Canyon Dam will become increasingly difficult with which to comply.

Future consumptive use of spring and groundwater by bottled water and beverage plants could reduce local river and stream flows due to the dependence of these waterways on springs and groundwater for the majority of their flow.

4) *Are there beneficial uses designated for some water bodies in the region that cannot always be met due to water quality issues?*
Yes. In 2012, the City of Mount Shasta renewed its discharge permit for its WWTP. The permit included a compliance schedule for several contaminants because it is not currently able to meet discharge limits associated with one or more of the designated beneficial uses in the Upper Sacramento River, which include municipal and agricultural water supply, water-contact recreation, cold freshwater habitat, and wildlife habitat. The City of Mount Shasta is currently exploring options for upgrades to its plant, all of them likely costing several million dollars, to meet these standards.

5) *Does part of the region currently observe water quality shifts during rain events that impact treatment facility operations?*
Yes. During significant precipitation events there is increased inflow and infiltration into wastewater collection pipes, as well as sedimentation, some of which makes its way into municipal treatment systems. The challenge, however, is not so much the constituents of this runoff, but the volume of the runoff that must be treated. WWTPs for water service utilities in all three of the region's communities (Mount Shasta, Dunsmuir, and McCloud) have limited capacities that are unable to handle high volumes during significant rain or rain-on-snow events.

RMS for adapting to water quality vulnerabilities:

- Matching Quality to Use: this may stretch USR water supplies
- Agricultural and Urban Water Use Efficiency: taking less water out of streams could allow for greater instream flow, and great dilution capacity
- Agricultural Lands Stewardship: agricultural lands could represent a carbon sequestration opportunity, and best management practices encourage on-farm runoff management
- Ecosystem Restoration: a functional ecosystem will help to filter polluted water, and will keep water at a temperature that is good for aquatic biota
- Forest Management: address catastrophic wildfire risk with fuels control efforts, address capacity of roads to withstand larger precipitation and post-fire runoff events, and maintain adequate forest cover to ensure clear cold-water streams
- Watershed Management: see Ecosystem Restoration, also, effective groundwater management will maintain the resource for use by all
- Water-dependent Recreation: ensure that recreation activities are designed and managed to protect water quality
- Pollution Prevention: take action to protect all waters from pollution
- Groundwater/aquifer Remediation: in the localized areas where historic industry may be a point source, work to control that pollution
- Drinking Water Treatment and Distribution: identify potential threats and work to remediate those; ensure that infrastructure is efficient and managed to a high standard
- Urban Runoff Management: prevent avoidable urban runoff
- Wastewater Treatment: make sure that wastewater treatment plants are designed and operated to standards that protect the waters to which they contribute
- Education: ensure that the public is aware of water quality issues and how to protect water quality

9.3.4 Flooding

1) *Does critical infrastructure in the region lie within the 200-year floodplain?*
200-year floodplain mapping is not available for the USR. Instead, 100-year data were used. Because of the generally high relief terrain, virtually no broad floodplains are present in the region. According to the Siskiyou County – Draft Hazard Mitigation Plan (2011), the majority of flood related hazards have to do with transportation. Roads are typically closed due to varying degrees of erosion-related washout; sections of Interstate 5 and Highway 89 pass through the 100-year floodplain and thus are exposed to flooding.

2) *Does aging critical flood protection infrastructure exist in your region?*
There is little flood protection infrastructure in the region. There are some older levees, but their exact extent is undetermined. Many of these older levees were built under earlier flood control and flood management goals, are exposed to scouring, and are at risk of failure. Some of the dams in the region were built with flood control as one of their intended purposes (e.g. Box Canyon Dam on the Upper Sac), though this is not their primary purpose.

3) *Have flood control facilities been insufficient in the past?*
There is no documented failure of flood control facilities (dams or levees) in the USR.

4) *Are wildfires a concern in parts of the region?*
Yes. Wildfires and potential flooding as a result of the loss of vegetation is a serious concern. See discussion regarding wildfires under Question 1 in Section 9.4.3, above.

<u>RMS for adapting to flooding vulnerabilities</u>:

- System Reoperation: manage water storage and conveyance facilities with climate projections in mind to better protect infrastructure from flooding
- Conjunctive Use: high-flow years could result in greater groundwater storage
- Regional/local Surface Storage: additional storage, or re-operated facilities, could contribute to flood security for local communities and infrastructure
- Agricultural Lands Stewardship: best management practices encourage water infiltration, which could attenuate peak flows
- Ecosystem Restoration: see Agricultural Lands Stewardship
- Forest Management: address catastrophic wildfire risk with fuels management projects
- Watershed Management: see Agricultural Lands Stewardship
- Land Use Planning and Management: avoid urban development in flood-prone areas
- Flood Risk Management: identify the flood risk throughout the USR
- Education: ensure that regional inhabitants and recreationalists understand regional flood dangers

9.3.5 Ecosystem and Habitat Vulnerability

1) *Does the region include aquatic habitats vulnerable to erosion and sedimentation issues?*
Yes. Because of the complex topography of the region and numerous waterways, erosion is an ongoing occurrence. As discussed earlier, the most significant threat to aquatic habitats is erosion exacerbated by extreme wildfire events.

2) *Do climate-sensitive fauna or flora populations live in the region?*
All plant and animal species are sensitive to shifts in climate in some way, although some species have broader tolerances than others. Generally wide-ranging or broadly distributed species like deer, bear, mountain lion, and ponderosa pine are better able to adapt to changing conditions. Species with narrow distributions or those whose presence in the USR is already at the edge of their habitat envelopes are at greater risk. For example, McCloud Redband trout, which only occur in a few small upper watershed streams, may be vulnerable to more frequent or extended dry periods. Overall, there has been little research on the potential impacts of climate change on species within the region.

3) *Do endangered or threatened species exist in the region? Are changes in species distribution already being observed in parts of your region?*

The only federally-listed species in the region is the Northern Spotted Owl, which is listed as threatened. The Pacific Fisher is currently a candidate species for listing under the Endangered Species Act. In addition, as discussed elsewhere in this document (Chapter 3, Region Description), the feasibility of restoring endangered winter-run Chinook salmon to portions of the McCloud or Upper Sacramento watersheds is being explored.

While not threatened or endangered, the local Redband Trout population inhabits some areas of intermittent and/or isolated stream segments (see Chapter 3, Region Description). This is located in the McCloud watershed, and these segments are largely spring-dependent. While the springs provide some buffer against low flows, extended drought could dry the streams, springs, and thereby strand or kill these trout populations. While some Redband would remain in other, more connected portions of regional waterways, losing this diversity would decrease regional biodiversity.

4) *Does the region rely on aquatic or water-dependent habitats for recreation or other economic activities?*
Yes. The area has a rich history of recreation and related tourism, much of it based around enjoyment of water resources. The beauty of the area, mineral springs, and other recreational opportunities have been a draw to the area since the late 19th century. The rivers, lakes, and streams provide opportunities for hiking, camping, fishing, and boating. All three watersheds are popular destinations for anglers; both the McCloud and Upper Sacramento are renowned for world-class cold-water trout fishing. The area around Mount Shasta is also a destination for tourism, an important component of which is the high quality spring waters that flow from the mountain.

5) *Does the region include one or more of the habitats described in the Endangered Species Coalition's Top 10 habitats vulnerable to climate change?*
No.

6) *Are there areas of fragmented aquatic or wetland wildlife habitat within the region? Are there movement corridors for species to naturally migrate? Are there infrastructure projects planned that might preclude species movement?*
Dams fragment aquatic habitat and prevent movement of fish and other aquatic species in all three watersheds in the region to varying degrees. Because of the rural nature of the region, terrestrial and wetland habitats are fairly intact, allowing for relatively unobstructed movement of most wildlife in a north-south pattern, allowing for access to a variety of elevations. The Interstate and railroad may be an obstacle to some wildlife movement between the Eddys and Mount Shasta (east-west movement). In recent years there has some been some development of wind power at the eastern edge of the region near around Hatchet Mountain. Impacts on avian and other species from these projects are not well understood.

<u>RMS for adapting to ecosystem and habitat vulnerabilities</u>:

- System Reoperation: address projected climate effects through system reoperation (low base flows, etcetera)
- Conjunctive Management and Groundwater Storage: make use of this strategy where possible to keep flows in the river when in a dry year
- Agricultural and Urban Water Use Efficiency: increased efficiency could maintain higher summer base flows
- Agricultural Lands Stewardship: implementing species management on grasslands could enhance the habitat value of agricultural lands
- Ecosystem Restoration: good habitat and ecosystem values adds flexibility into the system that should accommodate projected climate change impacts
- Forest Management: catastrophic fire is one of the most — if not the most — important and high-profile vulnerabilities for ecosystems, terrestrial and aquatic; fuels management is an important component of adaptation to climate change
- Watershed Management: address catastrophic wildfire risk with fuels control efforts
- Land Use Planning and Management: a careful identification of areas of high habitat value could result in avoided development in order to preserve these locations
- Education: this is an essential component of any adaptation strategy to reinforce the values provided by a functional ecosystem and rich biodiversity

9.3.6 Hydropower

1) *Is hydropower a source of electricity in the region?*

Pacific Power is the primary provider of electricity in the region. As of 2011, about 8.4% of their electricity was generated by hydropower. None of Pacific Power's hydroelectric facilities are located within the region; however, Pacific Gas & Electric generates substantial amounts of hydropower from its facilities in the McCloud and Pit River watersheds. Box Canyon Dam, located on the Upper Sacramento River, generates a small amount of hydropower. Box Canyon Dam is owned by the Siskiyou Power Authority, which is part of Siskiyou County government. This power operation is not large enough to come under FERC regulations, though it does have flow requirements. Please see Section 9.4.3, Water Quality: Question 3 (regarding flows) for more information regarding this power operation. The Redding Electric Utility, while outside the region, gets approximately 30% of its power from the power operations of the Central Valley Project, of which the power operations at Shasta Dam are a part. Climate change could substantially alter the power production of the Shasta Dam hydropower facilities due to higher temperatures reducing snowpack, a changed hydrologic regime, and higher rates of evaporation and transpiration in the feeder watersheds (e.g. the USR) (Bryan, et al. 2012).

2) *Are energy needs in the 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?*

While energy use throughout California has decreased as population has increased — due to efficiencies and public information campaigns — statewide energy needs are expected to increase as the temperature warms due to increased use and dependence on cooling technologies. While there is likely little opportunity for development of additional major hydropower facilities in the region, the abundant spring water sources and high topographical relief do present opportunities to develop in-line hydropower associated with existing water delivery infrastructure. This opportunity is being explored by the McCloud Community Services District to meet local demand, as identified in Chapter 10, Project Development. The feasibility studies in McCloud could be applied to other communities in the region.

RMS for adapting to hydropower production vulnerabilities:

- System Reoperation: this could be examined in order to accommodate hydropower production under projected climate change effects
- Regional/local Surface Storage: additional storage could provide for additional resources for hydropower production

Table 9.2, below, shows a succinct summary of the climate change impacts, vulnerabilities, and adaptive strategies associated with each category of water use and resources, as described in the text above. More detail regarding how the strategies will be used is available in Chapter 8, Resource Management Strategies.

Table 9.2: The impacts, vulnerabilities, adaptation strategies, and opportunities based on different categories of water use and resources in the USR.

Category	*Impacts*	*Vulnerabilities*	*Adaptive Strategies*
Water Supply	• Changes in amount of snowpack water equivalent • Loss of storage with the retreat of glaciers • Timing of snowmelt, runoff and streamflow • Increased rain-on-snow events • Extreme precipitation events • More rain, less snow • Groundwater recharge and storage • Greater demands on storage infrastructure	• Storage capacity • Springs recharge • Knowledge of groundwater supply	• Regional/local Conveyance • Recycled Municipal Water • Conjunctive Use • Regional/local Surface Storage • Ecosystem Restoration • Forest Management • Watershed Management • Land Use Planning and Management • Pollution Prevention • Drinking Water Treatment and Distribution • Storm water management (natural and constructed)
Water Demand	• Longer, drier summers • Increase in summer water demand • Less water to share between a growing number of users • Increased drought periods	• Competing groundwater uses • Landscape irrigation • Municipal water use	• Urban Water Use Efficiency • Watershed Management • Ecosystem Restoration • Land Use Planning and Management • Education • Economic Incentives
Water Quality	• Intensified summer recreation • Unknown impacts to groundwater quality	• Increasing wildfire • Wildfire & sedimentation • In-stream water	• Matching Quality to Use • Agricultural and Urban Water Use Efficiency • Agricultural Lands

Table 9.2: The impacts, vulnerabilities, adaptation strategies, and opportunities based on different categories of water use and resources in the USR.

Category	*Impacts*	*Vulnerabilities*	*Adaptive Strategies*
	• Greater pressure on standards for WWTP effluent • Catastrophic fire • Limited functionality of dirt roads	temperature • Wastewater treatment • Recreation • Storm water	Stewardship • Ecosystem Restoration • Forest Management • Watershed Management • Water-dependent Recreation • Pollution Prevention • Groundwater/aquifer Remediation • Drinking Water Treatment and Distribution • Urban Runoff Management • Wastewater Treatment • Education
Flooding	• Increased rain-on-snow events • Extreme precipitation events • Increased wildfire incidence • Unknown impacts of altered snowpack, snowmelt, and streamflow • Potential increase of glacial pool melting resulting in debris flows	• Transportation infrastructure • Aging flood control infrastructure • Increased risk of wildfire • Increased risk of debris flows	• System Reoperation • Conjunctive Use • Regional/local Surface Storage • Agricultural Lands Stewardship • Ecosystem Restoration • Forest Management • Watershed Management • Land Use Planning and Management • Flood Risk Management • Education • Retention
Terrestrial and Aquatic Ecosystems	• Changes to species distributions • Novel and unpredictable species relationships and interactions • Competitive advantage of invasive species • Hydrological impacts – changes to water temperature, pH, DO, turbidity, and flow regimes	• Increasing Wildfire • Wildfire & sedimentation • Climate sensitive species • Aquatic habitat-reliant recreation • Fragmented aquatic habitat • In-stream water temperature	• System Reoperation • Conjunctive Management and Groundwater Storage • Agricultural and Urban Water Use Efficiency • Agricultural Lands Stewardship • Ecosystem Restoration • Forest Management • Watershed Management • Land Use Planning and Management • Education
Hydropower	• Changes in amount of snowpack, SWE • Timing of snowmelt, runoff and streamflow • Increased rain-on-snow events • Extreme precipitation events • More rain, less snow	• Storage capacity • Increased energy needs • Decreased reliability of flows	• System Reoperation • Regional/local Surface Storage

Table 9.2: The impacts, vulnerabilities, adaptation strategies, and opportunities based on different categories of water use and resources in the USR.

Category	*Impacts*	*Vulnerabilities*	*Adaptive Strategies*
	• Groundwater recharge and storage • Greater demands on storage infrastructure • Changes to species distributions		

9.4 Prioritizing Vulnerabilities

All of the vulnerabilities listed above represent important issues and considerations for the USR 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; these will likely differ from another stakeholder group for the same reasons. Thus, it is not possible to base an evaluation of priority on the relative importance of each from a qualitative perspective.

Identifying vulnerabilities for such a diverse group of stakeholders and issues should be an exercise in assessing how soon that vulnerability may occur, if it's not already (urgency), the degree of probability that the vulnerability will become a hazard, if it's not already (risk), and the relative level of effort and/or cost to address the vulnerability in addition to the efforts already occurring. While it's possible that a variety of scenarios may change the status of any of the vulnerabilities listed below (for example, the award of grant funds may make a wastewater treatment plant — otherwise a very high cost and effort activity — very low cost), these possible scenarios are not considered in this evaluation.

Table 9.3, below, displays the vulnerabilities on the left, and assesses their urgency, risk, and the cost/effort of addressing each, and assigns a level of priority based on those findings. A higher priority generally goes to something that has a higher urgency, higher risk, and lower cost/effort input — this is a way of identifying what some call "low hanging fruit". It is important to make the distinction that these priorities are relative to responding to climate change and not IRWM project prioritization.

Table 9.3: Prioritizing USR vulnerabilities via High, Medium, or Low (H, M, or L) Urgency, Risk, and Cost or Effort to address the vulnerability. The list is organized first by Urgency (High to Low), then Risk (High to Low), then Cost or Effort (Low to High, assuming that a lower cost is preferable for low-hanging fruit).

Vulnerability	Urgency	Risk	Cost or Effort	Priority
Loss of forest ecosystem function	H	H	L	1
Increasing wildfire	H	H	M	2
Wildfire & sedimentation	H	H	M	
Water temperature	H	H	M	
Knowledge of groundwater supply	H	H	M	
Climate sensitive species	H	H	M	
Natural system storage capacity	H	H	M	
Springs recharge	H	H	M	
Municipal water use	H	H	H	3
Competing uses for groundwater	H	H	H	

Table 9.3: Prioritizing USR vulnerabilities via High, Medium, or Low (H, M, or L) Urgency, Risk, and Cost or Effort to address the vulnerability. The list is organized first by Urgency (High to Low), then Risk (High to Low), then Cost or Effort (Low to High, assuming that a lower cost is preferable for low-hanging fruit).

Vulnerability	Urgency	Risk	Cost or Effort	Priority
Wastewater treatment	H	H	H	
Fragmented aquatic habitat	M	H	H	4
Decreased reliability of flows	M	H	H	
Reservoir storage capacity	M	M	H	5
Transportation infrastructure	M	M	H	
Aging flood control infrastructure	M	M	H	
Storm water	M	L	H	6
Recreation (general)	L	H	M	7
Recreation (aquatic)	L	H	M	
Landscape irrigation	L	M	M	8
Increased energy needs	L	L	H	9

9.5 Greenhouse Gas Emissions and USR Project Development and Selection

Assessing each project's emissions was an important component of project sponsors' preparations and presentation of their submitted projects for RWMG consideration. In the process of project development, sponsors were encouraged to consider project alternatives that resulted in lower emissions projections, such as the inclusion of solar power in infrastructure upgrades, or the identification of a local labor force to decrease transportation emissions for workers coming from farther away (this latter strategy has the added benefit of keeping local resources within the region, thereby helping the local economy).

As stated in Chapter 10, Project Review Process and Implementation, the RWMG has identified the need for a technical advisory committee (TAC) for project development and review. They anticipate that points of greenhouse gas emissions and climate change adaptation will be some of the first considerations that the TAC examines as standards for project development. There are good examples throughout California and the west of adaptive strategies for infrastructure, as well as good cooperative strategies for natural resource management and integration. The TAC will look at best practices for all project types and will work with project sponsors to identify the best strategy to accommodate current needs, adaptive capacity for projected climate change impacts, and mitigate emissions to the extent possible.

10. Project Review Process and Implementation

10.1 Framework and Scope of Project Summary

As required by the Integrated Regional Water Management (IRWM) guidelines, this chapter presents a summary of the process by which projects were identified, developed, integrated, submitted to the regional water management group (RWMG), accepted into the Integrated Regional Water Management Plan (IRWMP), and prioritized, as well as future steps for project development and implementation. This chapter provides an overview summary of proposed projects and identifies how they meet the Upper Sacramento, McCloud, and Lower Pit Region (USR) IRWMP issues, objectives, and resource management strategies.

10.1.1 Delta Dependence

Note: This section refers to the potential for the USR to impact or be impacted by actions in the Sacramento – San Joaquin Delta. It does not refer to the community of Delta along the Upper Sacramento River above Shasta Lake Reservoir in Shasta County.

One request of the guidelines that is not relevant to the USR is the question of Delta dependency. While activities implemented in the Delta have the potential to affect the USR as a whole and RWMG members on an individual basis, no USR stakeholder is dependent upon the Delta for water resources. The USR represents a major opportunity for the State of California to invest in headwaters management and has identified important benefits on a statewide level. Being at the head of the state's water source and feeding the largest reservoir in California creates a unique opportunity for California's water managers and regulators to partner with USR stakeholders in implementing watershed management approaches. More information on this opportunity may be seen in Section 10.9, Economic Feasibility and Analysis, below.

10.2 Project Review Process

The project development process in the USR was a stakeholder-driven process that included substantial cooperation between project sponsors and answered directly to IRWMP components, including Issues and Interests (Chapter 6), Objectives (Chapter 7), and Resource Management Strategies (Chapter 8). Projects were openly solicited during the planning process, after regional issues and challenges, objectives, and resource management strategies had been identified. This allowed for integration of regional needs and the development of projects that responded directly to regional objectives. The following process was implemented for project solicitation and submittal.

10.2.1 Project Submittal During IRWMP Development

During the December 2012 stakeholder meeting, project staff introduced the idea of project development to the group and summarized key proposal elements that proponents should begin to consider. In answer to this presentation and the questions received at the time, a project application was developed for use by project sponsors (Appendix E). The application had a place for contact information, project description, and each review factor identified in the Department of Water Resources' (DWR) Guidelines (A-L), and was introduced to the RWMG at the February 2013 meeting. As a first step in the submittal process, proponents were asked to submit the first page of the project application, with contact information and project abstract, by mid-March 2013. Discussions between project team members and stakeholders indicated that there was interest in the region to include conceptual projects (i.e. not fully developed to schedule, budget, and work plan level); this information was formalized through statements in email notices regarding the project application.

The project proposals submitted in March were reviewed to determine the range of potential projects and, where needed, project team members followed up with proponents to clarify project needs.

Further project development materials were developed and made publically available, including templates for budget, schedule, work plan, and greenhouse gas emissions calculations, all developed and structured pursuant to state program guidelines. A project development workshop took place in April 2013, where the project application and templates were reviewed and questions about project proposals and application requirements were answered. The workshop also gave a chance for project proponents to begin discussion of project integration.

The April workshop was followed by a workshop in May that was dedicated to project integration. While project proponents had already worked to meet multiple IRWM issues and objectives, and make use of multiple strategies, this workshop provided a background and further understanding of the potential for, and value of, integration between project proponents within the given project pool. Participants considered how their project might be of greater potential, use, and/or applicability throughout the USR. It also provided opportunity for discussion. Each entity briefly discussed their project and goals, which was followed by questions and input from other participants. This workshop provided opportunities for participants to better understand others' needs and plans and it facilitated contact and potential for collaboration and integration. It also provided opportunities for participants to comment on projects with limited potential for integration (such as water purveyor-specific infrastructure). The discussion helped the group better understand the proponent's goals and provided some ideas for the proponent to consider that might improve their project. Several projects were adapted based on this discussion.

Following this workshop, participants were asked to submit the remainder of the application form, including all of the review factors, by May 23, 2013. Templates for budget, schedule, work plan, and greenhouse gas (GHG) estimates would be due at a later date. The project team reviewed the submittals and worked with specific entities to develop additional information and facilitate additional integration efforts. This submittal deadline was followed up with a funding and finance workshop in which stakeholders discussed implementation project funding options, started thinking about post-planning efforts, and identified potential funding options for ongoing IRWM efforts. More about this effort is available in Chapter 15, Financing IRWM Implementation.

Project proponents were asked to submit the budget, schedule, work plan, and GHG attachments by mid-July. A workshop was scheduled for late July to review the cost/benefit review factor and develop an approach. At this workshop, project proponents also discussed project status and discussed methods for project prioritization. The prioritization approach is discussed further below (see Section 10.3). The approach decided on for cost/benefit by the project proponents as a recommendation to the RWMG is straightforward and informative. Knowing that any project applying for funds through the IRWM funding opportunity would be required to do a very in-depth cost/benefit assessment, stakeholders felt that a descriptive overview and list format would meet program criteria as a review of the financial considerations for each project.

Throughout the process, proposal materials were submitted by project sponsors directly to the River Exchange (via mail@riverexchange.org) or individual project team members, who then placed the material within the project directory. Materials were made available on the website, fully accessible to any stakeholder interested in submitting a project.

As reported, the overall process included a preparation period of more than eight months with specific workshops to assist with each step of proposal development. Throughout this process, stakeholders developed a total of 11 ready-to-proceed projects and 20 conceptual projects for consideration for inclusion in the Plan by the RWMG. The process by which the RWMG reviewed and accepted projects is described in Section 10.2.2, below, and a summary of projects accepted into the Plan is provided in Sections 10.4 and 10.5.

The process by which future project solicitations will occur is described further in Section 10.11, below.

10.2.2 RWMG Project Review and Adoption into the IRWMP

As the projects were developed, integrated, and refined, information about the proposed projects was made available and comments were received as described below.

RWMG Review Process:

A list of anticipated projects, based on initial project proponent input was made available at the stakeholder meeting on June 5, 2013. Following that meeting, project proponents further developed projects, completed integration exercises, and prepared the application document information for the plan. Larger group input was then sought through electronic document review. In mid-August 2013, a single document was emailed to the USR listserve. This document included all projects that had been submitted by proponents, as well as information regarding the proposed project sponsor, location, partners, budget, and an abstract summarizing the project. This email included specific directions regarding project review as follows:

1. Review each of these projects in-depth regarding the topic, location, partners, and proposed work effort;
2. If interested, contact the River Exchange (mail@RiverExchange.org) for more information on any specific project (if the project is identified as potentially “ready-to-proceed”, it should have a budget, schedule, work plan, greenhouse gas accounting, and cost/benefit assessment available);
3. Submit comments, edits, suggestions, or any other challenges to the River Exchange by September 9th, 2013;
4. The project team will encourage project sponsors to meet with commenters to go over suggestions and challenges in order to better address regional needs;

5. All projects, including those for which common ground cannot be found, will be reviewed by the RWMG at the earliest possible date, and will be voted on for inclusion in the IRWMP (see the following description of the adoption process).

RWMG Project Adoption Process:
After the project review task has been accomplished, the process will move forward into project adoption. This will occur pursuant to the RWMG's established governance and decision-making process. The first time the list is brought to the group for review, a consensus decision will be pursued for adoption of the projects into the IRWMP. If that cannot be achieved, those projects with outstanding issues and those parties challenging the projects will be identified. Immediately following the meeting, a conversation between the project sponsor(s) and commenting parties will be arranged in an attempt to bridge any misunderstandings and/or conflicts. The projects will be brought forward in the next RWMG meeting for a consensus review. If consensus cannot be reached at this second meeting, the project proponent will be allowed to initiate the Formal Issue Resolution (FIR) Process as described in the memorandum of understanding (MOU). If this is approved by at least 75% of those RWMG members in attendance, the project will go to the FIR.

The FIR Process consists of a voting mechanism where the Members are classified into three subgroups: Statutory Authorities, Tribal Authorities, and Resource Management Interests. A motion may only be adopted with the approval of at least two-thirds of the active members of each of the three subgroups. Chapter 16, Governance, has more information on this process.

The process described for review and adoption allows for stakeholders to have equal input into project design, development, and adoption into the IRWMP. It also encourages regionalism and integration of additional project elements and partners — sometimes including unconventional project partners in implementation design. This process helps the region to build bridges between interests and to find common ground and shared interests in otherwise controversial issues.

Once the final suite of projects is adopted, and the IRWMP is finalized, individual project proponents will adopt the IRWMP as an organization. This information will be recorded in Appendix D.

10.2.3 Procedure for Communicating List of Selected Projects
After the final RWMG vote for accepting projects into the IRWMP, a list of all projects accepted for inclusion in the plan, as well as their status (priority/ranking), will be made public via the website and an email announcement going out to all participants in the IRWM process. This email will be accompanied by two things: 1) a short description of the process by which interested stakeholders may submit projects for RWMG consideration in the future, and 2) the next steps for project implementation, including grant opportunities and timelines.

10.3 Project Prioritization
At their July work group meeting, project sponsors discussed and identified an approach for project prioritization. Part of these discussions included the following desires:

- Prioritization must be simple and straightforward, and allow for all RWMG members to participate in the evaluation process;
- It must also be repeatable: when the planning process is over, RWMG members need to be able to continue to implement it;
- Project prioritization must reflect the priorities identified throughout the planning effort, including the consistent identification of disadvantaged community (DAC) and tribal critical water needs;
- While readiness-to-proceed (and the availability of corresponding project development materials) is an important consideration in the prioritization process, it should not be a pass/fail for inclusion in the IRWMP;
- It's important to make the prioritization specific to the USR — grant-specific criteria are not appropriate for use until a grant opportunity is identified; and
- Economic feasibility must include more than hard costs and benefits; it should also include projects with qualitative benefits (e.g. providing value that is not necessarily quantifiable on a monetary basis).

With these principles in mind, participants in the project workshop recommended the inclusion of five considerations. These included:

1. Promotes USR IRWM Objectives
2. Addresses a Documented Health Risk
3. Favorable Cost-benefit
4. Regulatory Compliance Schedule
5. Readiness to Proceed

A prioritization proposal was discussed at the August meeting of the project development work group, and while participants maintained that a more detailed process was desirable, they also decided that a more general approach was needed for immediate application. A suggestion was made to simply use the "ready-to-proceed" designation, along with an absence of ongoing issues with the project design or topic, as a priority indication. Conceptual proposals, as well as full project proposals having "unresolved" issues, would be in a second and third priority group, based both on level of development as well as level of controversial or unresolved issues, until such time as they were adequately developed to be considered a priority project and "ready-to-proceed". At that time they'd be considered for full support by the RWMG. In addition, participants felt that the conceptual projects should be accompanied by text indicating that they would need to be fully vetted through the RWMG as they were more fully developed.

At the following project workshop at the end of September, participants again considered the categories, and felt that Categories 2 and 3 didn't have enough differences between them to validate separate categories. Further, they felt that the issues surrounding some of the projects (those issues that first created the third category) were more political than technical and, because the RWMG could not, at the current time, be expected to resolve political issues, those should be set aside in order to identify good projects addressing RWMG objectives and issues. Another consideration brought forward by one of the participants was the point that, if the project would not be considered supported, and show in this way in the IRWMP, then they may not want to put their projects forward at all. This would lead to fewer projects being brought forward to the RWMG for consideration, defeating the purpose of the IRWM planning mechanism for an integrated, comprehensive, and deliberative approach to water management. The ensuing decision with regard to prioritization can be seen in the tables below, in Section 10.4.

At this same meeting, stakeholders unanimously agreed that a technical advisory committee (TAC) would be an essential addition to the process of project development and prioritization. They identified a recommendation to the RWMG to discuss and take action on this consideration as soon as was practical.

10.4 Project List

Table 10.1: Priority 1 Projects — These are projects that have been fully developed (all application materials submitted, including a budget, work plan, schedule, and greenhouse gas emissions assessment), with minimal issues to be worked out prior to implementation. These projects have the full support of the RWMG.

Category	Project Name	Project Sponsor	Budget
Municipal Infrastructure	Water System Improvement Project 1	City of Dunsmuir	$1,550,000
	Water System Improvement Project 2	City of Dunsmuir	$4,800,000
	Mt. Shasta Wastewater Treatment Plant Upgrade	City of Mt. Shasta	$10,000,000
	Lower Elk Springs Rebuild	McCloud CSD	$600,000
	Elk Springs Transmission Line Replacement	McCloud CSD	$11,400,000
Watershed Assessment	Upper Sac, McCloud, Lower Pit River Groundwater Monitoring Project	McCloud Watershed Council	$161,086
	Hydrological and Climate Change Evaluation of the Medicine Lake Volcano and its Connectivity to the Fall River Springs and Potential Connectivity to the McCloud River	Mount Shasta Bioregional Ecology Center	$150,000
Education, Outreach, and Regional Partnerships	Grants Specialist	Western Shasta RCD	$46,000
	Climate Stewardship Coordinator	Western Shasta RCD	$89,000
Conservation/ Restoration	Upper Sacramento and McCloud Watershed Working Forest Conservation Easements	Pacific Forest Trust	$22,500,000
	Rainbow Ridge Collaborative Forest Stewardship	Siskiyou County Land Trust and the Shasta Valley RCD	$50,000

Table 10.2: Priority 2 Projects — These are projects that are conceptual only, but have submitted a full application (though not the cost/benefit, greenhouse gas, work plan, schedule, or budget materials). These projects are supported by the RWMG in concept, but must be more fully developed to move to Priority 1 and be considered for funding through the IRWMP by the RWMG.

Category	Project Name	Project Sponsor	Budget
Municipal Infrastructure	Intake Springs – Hydro Electric Project	McCloud Local First Network / Shasta Energy Group	$17-$33,000
Watershed Assessment	Comprehensive Springs and Groundwater Monitoring	CalTrout	$100,000
	Mount Shasta Glaciers long term monitoring project	CalTrout	$60,000
	Hydrologic Study of the Mt. Shasta Watershed	Mount Shasta Bioregional Ecology Center	TBD
	Comprehensive Surface Water Monitoring	River Exchange	TBD
Education, Outreach, and Regional Partnerships	Water Talks and Coordinated Educational Water Management Programs Project	CalTrout	TBD
	Building Relationships of Trust and Understanding project	CalTrout	TBD
	Shasta Climate Initiative – Curriculum Development & Implementation	Mount Shasta Bioregional Ecology Center	TBD
	McCloud 9 – Climate Community: Mill Site & Rail Yard Bioremediation	McCloud Watershed Council	$60,000
	Headwaters Stewardship Fund	McCloud Watershed Council	$60,000
Conservation / Restoration	Lakehead Fuels Reduction Project: Control of French Broom, Scotch Broom, and Spanish Broom in the I-5 Corridor from Packers Bay to the Shasta County Line	Western Shasta RCD	TBD
	Preservation of Springs, Biological, and Cultural Resources	McCloud Watershed Council	TBD
	McCloud/Moosehead Creek Trail Crossing Stabilization and Restoration	River Exchange	TBD
	Panther Creek Riparian Zone Invasive Species Removal	Shasta Valley RCD	$45,000
	Upper Sac. Headwaters "Green Infrastructure" Conservation Project: Phase 1	Siskiyou Land Trust	$1-5M
	Control of Broom	Western Shasta RCD	$90,000
	Keystone Species Reintroduction for More Resilient Habitats	Winnemem Wintu	TBD
	McCloud River Restoration	Winnemem Wintu	TBD
	Panther Meadows Tourist Education	Winnemem Wintu	TBD
	Salmonid Habitat Restoration and Economic Activity Protection	Winnemem Wintu	TBD

10.5 Project Summaries

10.5.1 Municipal and Jurisdictional Projects

Dunsmuir Water System Improvement Project 1 —
Ready to Proceed; Priority 1

Sponsor: City of Dunsmuir
Location: Dunsmuir, CA
Partners: None, currently
Budget: $1,550,000 (100% grant funding request)
Abstract: As indicated in the 1994 Master Water Plan and 2010 Draft Preliminary Engineering Report, many deficiencies, including inadequate system pressures and fire flows, currently pose health and safety risks to the City of Dunsmuir due to the presence of 4-inch to 18-inch mains that are 60- to 70-year-old steel pipelines. As reported by city staff, the existing water mains on Oak Street and Bush Street have had major maintenance issues in recent months. The proposed improvements include replacement of approximately 250 feet of 6-inch water main in Oak Street from Dunsmuir Avenue to Shasta Avenue, and approximately 1250 feet of 6-inch water main and fire hydrants from Butterfly Avenue to Mountain Avenue. The existing 6-inch water main in Bush St. is located between residences and under a pedestrian stairway. As a result, the existing main will be abandoned in Bush Street, while the new main will be routed around Bush Street via Butterfly and Mountain Avenues. The 8-inch steel pipeline between the High School Tank and Downtown Tank will be replaced with a new 12-inch pipe to increase hydraulic capacity, replace a deteriorated pipeline, and relocate it from a steep hillside that currently makes access difficult. The Blackberry Hill area is served by a 4-inch water main in Scherrer Avenue, which significantly limits hydraulic capacity in this area, which low pressures during peak demand periods and very limited fire flows. Proposed improvements would replace the 4-inch main in Scherrer Avenue with an 8-inch main and provide a looped system of 6-inch mains with fire hydrants. Order-of-magnitude preliminary project cost is approximately $1.5 million. The City of Dunsmuir is a disadvantaged community with a median household income (MHI) of $36,813 – just 60% of the state's MHI per the US Census.
Review Factors:

A. IRWM Objectives:
   Overarching goal: Climate change
   This project contributes to this overarching goal by improving water conservation through replacement of leaking pipe.

   Regional resiliency: By improving the city's system reliability and reducing leakage, the supply is more resilient because less water is required to meet the same user demand and the water supply is better positioned to maintain service if city resources are diverted elsewhere.

   Objective 1 – *Increase knowledge of basin characteristics and raise public awareness and understanding…*

This project supports this objective through public education during project development.

Objective 3 – *Maintain and enhance the ecological health of the basin to support the local economy and ensure public health and safety...;* AND Objective 5 – *Ensure support for and foster success of water management efforts for disadvantaged communities;* AND Objective 8 – *Facilitate development of sustainable water/wastewater infrastructure to ensure public health, protect ecological integrity, and support economic stability.*
The proposed project provides the city a more robust system through which to provide a basic utility service. The proposed improvements enhance the safety and reliability of the town's potable water system by reducing the potential for contamination of the water supply and relieving the city of the cost to maintain aging and vulnerable infrastructure. The Dunsmuir Water System Improvement Project 1 is within the Sacramento River watershed. Existing or potential beneficial uses of the Sacramento River include municipal and domestic water supply, power generation, recreation, cold freshwater habitat and wildlife habitat. Proposed water system improvements help protect these multiple uses. The City of Dunsmuir is considered a DAC.

B. Resource Management Strategies:
Urban Water Use Efficiency: By replacing aging infrastructure, water loss to leakage and line breaks is reduced, thus increasing system efficiency.

Drinking Water Treatment and Distribution: The proposed project specifically addresses drinking water supply quantity and quality for a DAC.

Watershed Management: The proposed project includes providing public information during development.

The proposed project would ultimately provide positive social and economic impacts by improving the municipal water supply to the City of Dunsmuir. By improving the distribution system, the proposed project anticipates a positive benefit to all users of the system.

C. Technical Feasibility:
The proposed project was developed as part of a system wide water system master plan. Excerpts from that plan are attached to this proposal. The city regularly manages water infrastructure improvement projects and key staff members are well versed in the permitting, funding, and implementation of these projects.

D. Specific benefits to critical DAC water issues:
The improvements to the city's water system are an effort to improve service and meet state drinking water standards. It also will improve the ability of the city to meet potable water quality requirements. Dunsmuir is considered a DAC.

E. Specific benefits to critical Native American water issues:
None identified at this time.

F. Environmental justice considerations:
The proposed project would ultimately provide positive social and economic impacts by improving the municipal water system operation throughout the city. As a result, the proposed project is expected to result in the fair treatment and meaningful involvement of all people regardless of age, race, color, national origin, or income.

The project does intend to result in an increase in water use. No additional land area would be covered by impervious surfaces. The project will therefore have no impact on groundwater supply or recharge within the project area resulting in a net deficit in aquifer volume or a lowering of local groundwater tables.

G. Project costs and financing:
   a. <u>Total un-funded to date</u> (project need/funding request): $1,550,000
   b. <u>Please describe secured funding sources</u>: none secured as yet.
   c. <u>How operations and maintenance (O&M) will be covered</u>: O&M will be covered under the current rate structure for the city.

H. Economic Feasibility:
Financial Feasibility Assessment
Based on the following, the proposed project is financially feasible.
   a. Financial capacity to cover cost: The city is familiar with the project funding process having completed multiple other infrastructure improvement projects utilizing multiple funding sources some of which operate on a reimbursement basis. In addition, the city anticipates retiring a loan before implementing this project that will free up income for the new project expenses.
   b. Ongoing costs: As with any service provider, the city anticipates regular O&M costs. As documented in the city's water system planning study, current rates are adequate to cover these anticipated costs and it is anticipated that, if anything, the proposed improvements will reduce O&M by reducing frequency of repair.

Economic Feasibility Assessment
It is the city's assertion that the project provides positive value to the region. In terms of tangible benefits, the city currently spends approximately $30,000

per year on system repair costs. Replacement of the proposed water lines will significantly reduce expenditure on system repair.

Other avoided costs are related to potential damage from a system failure. Road or sidewalk damage may result from a pipe or valve failure, and businesses or homes may be flooded or otherwise damaged from a system failure. In addition, improved system operation can reduce the chance that a home or business may be lost to fire. A direct cost comparison is difficult because of the unknown probability of a damage event. However, a major road reconstruction can cost tens of thousands of dollars and replacement of a structure hundreds of thousands of dollars. Avoiding these costs represents a significant savings when compared to the proposed project cost over a 50-year design life.

There are also less tangible benefits that are of value to the City of Dunsmuir and the region in general. An improved city water delivery system means reduced potential for contamination and therefore helps protect public health. By improving the delivery system and eliminating leakage, water is conserved. Another important secondary benefit is the potential to improve service to existing businesses and potentially attract new businesses. The availability of a clean, reliable water source can affect the decision for a business to remain or to start up in the region.

The following table summarizes, by category, the benefits described above.

Benefit Summary	
Benefit Category	Project Benefits
Primary	*Tangible* • Cost of avoided repair ($30,000/year) • Cost of avoided property damage • Value to the local economy of existing businesses *Intangible* • Meeting IRWMP Objectives: ▪ Obj. 3: Support the local economy; Ensure public health and safety ▪ Obj. 5: Support water management efforts for DACs ▪ Obj. 7: Ensure adequate water supply /quality; maintaining regulatory compliance. ▪ Obj. 8: Facilitate sustainable water infrastructure to ensure public health, protect ecological integrity, and support economic stability.
Secondary	*Tangible* • Service companies benefit from the economic activity of primary beneficiaries

Project capital and other related costs are summarized below.

Cost Summary	
Costs	Examples
Capital	• As reported in Attachment 1 projected cost is $1.5M
Operations	• Increase in cost above current O&M is not anticipated.
Externalities *(costs imposed on others not a party to the proposed project)*	• Externalities not anticipated. Improvements reduce water use and may reduce O&M costs. No uses are precluded by this project, and the project does not appear to negatively affect any resources or communities. The whole system benefits from improved overall pressure and reduced costs of continual repair.

Multiple benefits of the proposed project have been identified that, although difficult to quantify, are of significant value to the City of Dunsmuir and the region. Multiple IRWMP objectives are focused on supporting DAC infrastructure improvement and that is the outcome of this project. From ensuring public health, to conserving water use to improving safety, this project provides benefits commensurate with the investment of funds.

I. Project Status: Ready to proceed pending permitting and funds

J. Strategic considerations for IRWMP implementation:

i. *Has this project been integrated with another or include additional aspects because of IRWM conversations?*
This project was presented and discussed at the Integration Workshop held on May 10, 2013, and the following integration elements could be incorporated into this project:
1. Education and outreach: It was recommended that public participation be incorporated.
2. Evaluation of potential for incorporating a hydropower element and coordinating efforts and lessons learned with the hydropower project proposed by McCloud Local First Network

ii. *Has this project scope and/or geography been widened because of IRWM conversations?*
The scope has been expanded to include education and outreach and coordination with McCloud Local First Network.

iii. *Describe your strategy for project integration and relevance to the IRWMP:*
It is our intent to continue to work closely with the RWMG to find ways to work with, learn from, and support the efforts of other members.

K. Contribution of the project in adapting to the effects of climate change:
This project contributes to the overarching goal of responding to climate change by reducing water use and improving system efficiency.

L. Contribution of the project in reducing GHG emissions:
Although the project will result in temporary air quality impacts during construction, there are no long-term impacts to air quality. The project does not have the potential to generate significant emissions that would be subject to state and federal ambient air quality, because it is anticipated that the project will not include power-consuming equipment.

Annual emissions: Over a projected 30-year life, the project is expected to release an averaged 3.20 million tons of emissions on an annual basis.

Dunsmuir Water System Improvement Project 2 —
Ready to Proceed; Priority 1

Sponsor: City of Dunsmuir
Location: Dunsmuir, CA
Partners: None, currently
Budget: $4,800,000 (100% grant funding request)
Abstract: As indicated in the 1994 Master Water Plan and 2010 Draft Preliminary Engineering Report, many deficiencies, including inadequate system pressures and fire flows, currently pose health and safety risks to the City of Dunsmuir due to the presence of 4-inch to 18-inch mains that are 60- to 70-year-old steel pipelines. City staff has identified various pipelines as needing significant repair, and as such they are recommended for replacement. These include the North Dunsmuir Water Main Replacements and the Downtown Water Main Replacements. The Downtown Water Mains located on Oak and Bush Streets were not considered high priority projects until recently. Due to the history of recent significant leaks, both are now considered high priority replacement projects. The Bush Street water main is located in the same trench, and in some cases below the existing sewer main. When the water main is depressurized during leak repairs, significant public health risks exist.

Additionally, in recent years, the existing water mains in Dunsmuir Avenue and Prospect Avenue have required costly repairs. The Dunsmuir Avenue water main is primarily located on private property and traverses under existing large trees, landscaping, and structures rendering access for repairs difficult. The deteriorating pipeline and poor access increase the health and safety risks to the city.

Currently, the Dunsmuir Elementary School is fed by the Downtown Pressure Zone, which obtains pressure equivalent to the elevation of the spring box at Mossbrae Falls. This pressure zone does not provide adequate pressure for irrigation water to the upper ball fields and playgrounds, and severely reduces the available fire flow of the system. The Dunsmuir Elementary School Improvements would allow the school to be fed by the North Dunsmuir Pressure Zone, increasing pressure for fire flow and irrigation.

Review Factors:

A. IRWM Objectives:
Overarching goal: Climate change
This project contributes to this overarching goal by improving water conservation through replacement of leaking pipe.

Regional resiliency: By improving the city's system reliability and reducing leakage, the supply is more resilient because less water is required to meet the same user demand and the water supply is better positioned to maintain service if city resources are diverted elsewhere.

Objective 1 – *Increase knowledge of basin characteristics and raise public awareness and understanding…*
This project supports this objective through public education during project development.

Objective 3 – *Maintain and enhance the ecological health of the basin to support the local economy and ensure public health and safety*; AND Objective 5 – *Ensure support for and foster success of water management efforts for disadvantaged communities;* AND Objective 8 – *Facilitate development of sustainable water/wastewater infrastructure to ensure public health, protect ecological integrity, and support economic stability.*
The proposed project provides the city a more robust system through which to provide a basic utility service. The proposed improvements enhance the safety and reliability of the town's potable water system by reducing the potential for contamination of the water supply and relieving the city of the cost to maintain aging and vulnerable infrastructure. Transmission line improvements and water storage tank improvements help maintain adequate system pressures which helps to protect public health and safety by minimizing the potential for contaminants to enter the water system and by improving the ability of first responders to fight fires. The Dunsmuir Water System Improvement Project 2 is within the Sacramento River watershed. Existing or potential beneficial uses of the Sacramento River include municipal and domestic water supply, power generation, recreation, cold freshwater habitat and wildlife habitat. Proposed water system improvements help protect these multiple uses. The City of Dunsmuir is considered a DAC.

B. Resource Management Strategies:
Urban Water Use Efficiency: By replacing aging infrastructure, water loss to leakage and line breaks is reduced, thus increasing system efficiency.

Drinking Water Treatment and Distribution: The proposed project specifically addresses drinking water supply quantity and quality for a DAC.

Watershed Management: The proposed project includes providing public information during development.

The proposed project would ultimately provide positive social and economic impacts by improving the municipal water supply to the City of Dunsmuir. By improving the distribution system, the proposed project anticipates a positive benefit to all users of the system.

C. Technical Feasibility:
The proposed project was developed as part of a system wide water system master plan. Excerpts from that plan are attached to this proposal. The city regularly manages water infrastructure improvement projects and key staff members are well versed in the permitting, funding, and implementation of these projects.

D. Specific benefits to critical DAC water issues:
The improvements to the city's water system are an effort to improve service and meet state drinking water standards. It also will improve the ability of the city to meet potable water quality requirements. Dunsmuir is considered a DAC.

E. Specific benefits to critical Native American water issues:
None currently identified.

F. Environmental justice considerations:
The proposed project would ultimately provide positive social and economic impacts by improving the municipal water system operation throughout the city. As a result, the proposed project is expected to result in the fair treatment and meaningful involvement of all people regardless of age, race, color, national origin, or income.

The project does intend to result in an increase in water use. Negligible additional land area would be covered by impervious surfaces. Although a new tank will be constructed, it is anticipated that it will replace an existing tank. The project should to have a significant impact on groundwater supply or recharge within the project area resulting in a net deficit in aquifer volume or a lowering of local groundwater tables.

G. Project costs and financing:
   a. <u>Total un-funded to date</u> (project need/funding request): $4,800,000
   b. <u>Please describe secured funding sources</u>: none secured as yet.
   c. <u>How operations and maintenance will be covered</u>: O&M will be covered under the rate structure for the city.

H. Economic Feasibility:

Financial Feasibility Assessment

Based on the following, the proposed project is financially feasible.

a. Financial capacity to cover cost: The city is familiar with the project funding process having completed multiple other infrastructure improvement projects utilizing multiple funding sources some of which operate on a reimbursement basis. In addition, the city anticipates retiring a loan before implementing this project, which will free up income for the new project expenses.
b. Ongoing costs: As with any service provider, the city anticipates regular O&M costs. As documented in the city's water system planning study, current rates are adequate to cover these anticipated costs and it is anticipated that, if anything, the proposed improvements will reduce O&M by reducing frequency of repair.

Economic Feasibility Assessment

The project provides positive value to the region. In terms of tangible benefits, the city currently spends approximately $30,000 per year on system repair costs. Replacement of the proposed water lines will significantly reduce expenditure on system repair.

Other avoided costs are related to potential damage from a system failure. Road or sidewalk damage may result from a pipe or valve failure, and businesses or homes may be flooded or otherwise damaged from a system failure. In addition, improved system operation can reduce the chance that a home or business may be lost to fire. This project includes a fairly comprehensive system upgrade to improve system pressure by replacing transmission lines and adding water storage at higher elevation, both of which will improve system ability to maintain pressure and deliver fire flows. A direct cost comparison is difficult because of the unknown probability of a damage event. However, a major road reconstruction can cost tens of thousands of dollars and replacement of a structure hundreds of thousands of dollars. Avoiding these costs represents a significant savings when compared to the proposed project cost over a 50-year design life.

There are also less tangible benefits that are of value to the City of Dunsmuir and the region in general. An improved city water delivery system means reduced potential for contamination and therefore helps protect public health. Improving the delivery system and eliminating leakage conserves water. Another important secondary benefit is the potential to improve service to existing businesses and potentially attract new businesses. The availability of a clean, reliable water source can affect the decision for a business to remain or to start up in the region.

The following table summarizes, by category, the benefits described above.

Benefit Summary	
Benefit Category	Project Benefits
Primary	*Tangible* • Cost of avoided repair ($30,000/year) • Cost of avoided property damage • Value to the local economy of existing businesses *Intangible* • Meeting IRWMP Objectives: ▪ Obj. 3: Support the local economy; Ensure public health and safety ▪ Obj. 5: Support water management efforts for DACs ▪ Obj. 7: Ensure adequate water supply /quality; Maintaining regulatory compliance. ▪ Obj. 8: Facilitate sustainable water infrastructure to ensure public health, protect ecological integrity, and support economic stability.
Secondary	*Tangible* • Service companies benefit from the economic activity of primary beneficiaries *Intangible* • Improved fire flow capacity helps reduce fire hazard within and adjacent to the community (e.g. in forested areas)

Project capital and other related costs are summarized below.

Cost Summary	
Costs	Examples
Capital	• As reported in Attachment 1 projected cost is $4.8M
Operations	• Increase in cost above current O&M is not anticipated.
Externalities *(costs imposed on others not a party to the proposed project)*	• Externalities not anticipated. Improvements reduce water use and may reduce O&M costs. No uses are precluded by this project, and the project does not appear to negatively affect any resources or communities. The whole system benefits from improved overall pressure and reduced costs of continual repair.

Multiple benefits of the proposed project have been identified that, although difficult to quantify, are of significant value to the City of Dunsmuir and the region. Multiple IRWMP objectives are focused on supporting DAC infrastructure improvement and that is the outcome of this project. From ensuring public health, to conserving water use to improving safety, this project provides benefits commensurate with the investment of funds.

I. Project Status: Ready to proceed pending permitting and funds

J. Strategic considerations for IRWMP implementation:
   i. *Has this project been integrated with another or include additional aspects because of IRWM conversations?*
   This project was presented and discussed at the Integration Workshop held on May 10, 2013, and the following integration elements could be incorporated into this project:
      1. Education and outreach: It was recommended that public participation be incorporated.
      2. Evaluation of potential for incorporating a hydropower element and coordinating efforts and lessons learned with the hydropower project proposed by McCloud Local First Network
   ii. *Has this project scope and/or geography been widened because of IRWM conversations?*
   The scope has been expanded to include education and outreach and coordination with McCloud Local First Network.
   iii. *Describe your strategy for project integration and relevance to the IRWMP:*
   It is our intent to continue to work closely with the RWMG to find ways to work with, learn from, and support the efforts of other members.

K. Contribution of the project in adapting to the effects of climate change:
This project contributes to the overarching goal of responding to climate change by reducing water use and improving system efficiency.

L. Contribution of the project in reducing GHG emissions:
Although the project will result in temporary air quality impacts during construction, there are no long-term impacts to air quality. The project does not have the potential to generate significant emissions that would be subject to state and federal ambient air quality, because it is anticipated that the project will not include power-consuming equipment.

Annual emissions: Over a projected 30-year life, the project is expected to release an averaged 6.56 million tons of emissions on an annual basis.

Mt. Shasta Wastewater Treatment Plant Upgrade — *Ready to Proceed; Priority 1*

Sponsor: City of Mt. Shasta
Location: City of Mt. Shasta
Partners: None
Budget: $10,000,000 ($5 million requested of IRWM funds)
Abstract: The City of Mt. Shasta will upgrade its current aerated pond wastewater treatment system to provide treatment levels equivalent to Title 22 Standards for reclaimed water prior to discharging to the Upper Sacramento River below Box Canyon Dam. These enhanced treatment requirements are necessary to preserve that stretch of the Upper Sacramento River as a pristine white water rafting and fishing

area. Although dilution levels completely mitigate any impact from the discharge beyond that point, the higher levels of treatment will reduce loading on the river for the entire course to Shasta Lake. The city is currently in the process of completing a feasibility analysis to determine what type of new treatment methodology will best achieve Title 22 Standards.

Review Factors:

A. IRWM Objectives:

The Mt. Shasta Wastewater Treatment Facility Upgrade Project is located within the watershed of the Sacramento River. Existing or potential beneficial uses of the Sacramento River include municipal and domestic water supply, power generation, recreation, cold freshwater habitat, and wildlife habitat.

Overarching goal: Climate change
This project contributes to this overarching goal by providing reclaimed treated water that can be returned to the overall water supply for reuse and relieving pressure on existing potable water sources.

Objective 1 – *Increase knowledge of basin characteristics:* This project supports this objective through public education throughout project development. The required reporting data from the project and its implementation will provide significant data sources about the constituents generated by the community in their wastewater which can lead to behavior modification efforts to both reduce the cost of wastewater treatment and increase the quality of returned water.

Objective 3 – *Maintain and enhance the ecological health of the basin:* The very nature of the requirements of the final effluent limitations of the Mt. Shasta National Pollution Discharge Elimination System (NPDES) Permit are to improve the ecological health of the Sacramento River ecosystem. Some of the effluent limitations that create such a burden on a small community are designed to protect the aquatic species that inhabit the river ecosystem.

Objective 5 – *Ensure support for and foster success of water management efforts for disadvantaged communities:* Like all of Siskiyou County, Mt. Shasta, although not as bad as other areas, has an overall designation as a disadvantaged community, and although better able to handle the costs of advanced wastewater treatment will still incur a significant burden, which impacts the more vulnerable segments of the population more than most.

Objective 7 – *Ensure adequate water supply and quality while maintaining regulatory compliance…* AND Objective 8 – *Facilitate development of sustainable water/wastewater infrastructure:* The proposed project will improve the wastewater treatment facility to the point where it will utilize some of the most cutting edge technologies and processes to maintain the quality of the Sacramento River. This is important to all of the users of the river, which is a major focal point of the local economies

B. Resource Management Strategies:
Recycled Municipal Water: The proposed project will increase the facility's ability to provide recycled water that can relieve pressure on domestic water supply and groundwater basin for irrigation purposes. The facility currently supplies an adjacent golf course, but new opportunities would be possible if transport issues can be solved.

Ecosystem Restoration: The proposed project will enhance the quality of water in the Upper Sacramento River by discharging a high quality effluent back to the river. The additional flow will help to further offset the impacts of the Box Canyon Dam impoundment on the benthic organisms in the river.

Wastewater Treatment: The proposed project directly addresses what has been identified as an essential strategy by the IRWMG by upgrading an identified aging facility to meet much more stringent standards for wastewater effluent.

Matching Quality to Use: The proposed project will include processes for matching quality to use. It is anticipated that treatment objectives will take into account place of disposal (e.g. golf course vs. instream discharge) and timing of discharge (e.g. winter vs. summer).

Water Dependent Recreation: The Upper Sacramento River has now been identified as an especially valued whitewater-rafting venue in addition to its historical importance as a trout fishery. The proposed project is a result of more stringent limitations on discharge to the Upper Sacramento River to eliminate even the perception of an impact on these two recreational uses, and this will ultimately provide positive social and economic impacts to what is a major component of the regional economy.

C. Technical Feasibility:
The need for, design basis, and objectives of the proposed project are well defined. The city has documented through feasibility studies and operational records, the quality and quantity of water requiring treatment. Treatment requirements have been established through the NPDES permitting process. The city is currently in the process of preparing a feasibility analysis to determine the ultimate parameters of this project to provide the most cost-effective solution to achieve the best long-term water quality results for the facility's effluent. The city's National Pollution Discharge Elimination System (NPDES) Permit that outlines the new final effluent limitations, which are the impetus for this project, is attached.

In addition, the city has ample knowledge and capability to complete the proposed project. City staff has been maintaining water treatment infrastructure and equipment and monitoring water quality and treatment processes for decades. They regularly manage infrastructure improvement projects and will have the capability to assure the successful completion of this project.

D. Specific benefits to critical DAC water issues:
The improvements to the wastewater treatment facility will contribute to the quality of the discharge and reduce the burdens on downstream water users to treat water for other beneficial uses. Mt. Shasta is considered a DAC.

E. Specific benefits to critical Native American water issues:
The project will help to protect water quality in the Sacramento River and support proposed projects to improve habitat conditions within the river, both of which are important to Native American interests as described in one of the overarching objectives of this plan.

F. Environmental justice considerations:
The proposed project would ultimately provide positive social and economic impacts by improving the water quality of the Sacramento River and reducing what is perceived as a disproportionate burden on the community of Mt. Shasta to make these improvements for a broad cross section of downstream users. The proposed project is expected to result in the fair treatment and meaningful involvement of all people regardless of age, race, color, national origin, or income.

The project will not result in an increase in water use. The project could increase the use of reclaimed water for irrigation purposes and reduce the need for new water sources. Only minor additional land area could be covered by impervious surfaces. The project will therefore have no, or even a positive, impact on groundwater supply or recharge within the project area and will not result in a net deficit in aquifer volume or a lowering of local groundwater tables.

G. Project costs and financing:
Total project costs are preliminary at this point depending on the parameters of the final project design resulting from the feasibility study. Estimated project costs have ranged from $10 million to $20 million depending on the process design chosen for implementation:
   a. <u>Total un-funded to date</u> (project need/funding request): $15,000,000
   b. <u>Please describe secured funding sources</u>: none secured as yet.
   c. <u>How operations and maintenance will be covered</u>: O&M will be covered under the utility rates for the Mt. Shasta Wastewater Fund that will be revised during the project implementation.

H. Economic Feasibility:

Financial Feasibility Assessment

The City of Mt. Shasta has an annual budget of just under $6 million for all components. The city maintains a cash reserve of over $4 million spread over its various components. Although only $900,000 of that reserve is directly available for the Wastewater Fund operations, the size of the reserve gives the city the ability for internal borrowing among its various Funds to cover project cash flows until reimbursement is received. In addition, for a project of this size, the city's strong financial position would give it the ability to obtain bridge loan financing until the project is completed and fully reimbursed. This is an even more likely potential given the fact that a project of this magnitude will probably have multiple funding sources beyond the funding through the Water Bonds. The city has completed at least two Wastewater system projects in the past where interim financing was required before costs were reimbursed from the Infrastructure Development Bank or the Small Communities Grant fund.

This project is very likely to require some long term borrowing on the part of the city's Wastewater Operations Fund. The lending agencies, such as the Infrastructure Development Bank with which the city currently has a loan, require that the city implement a user charges rate structure, which will cover the loan re-payment costs, over and above the operating costs. The city must comply with California Proposition 218 requirements in order to increase its user charges, which would include a rate study analysis and protest vote, but the city has been able to implement the necessary rate increases in the past without significant opposition. The city has also been preparing its users for an upcoming rate increase for a couple of years.

The city is aware of the challenges involved in putting together the complete financing package for this project which will likely be a combination of grants, loans, and local matching funds, but beyond that challenge, the project is financially feasible given the financial position of the city.

Economic Feasibility Assessment

This project has estimated costs of around $10 million or more depending on the recommended treatment alternative selected. While some of the project benefits are tangible, the bulk of the benefits are intangibles to which only an estimated magnitude of value can be ascribed. The most evident tangible benefit would involve the avoidance of Water Quality Control Board mandatory minimum penalties. The city is under a Time Schedule Order for the removal of copper, zinc, and ammonia from its effluent discharge to the Sacramento River, which it is not capable of meeting with the current facility. Violation of these discharge limits would result in penalties of $3,000 per constituent per day or even per hour. Even at only one per day for each of the three constituents, the penalties would amount to $360,000 per year for just the four months the city discharges directly to the Sacramento River. At this rate the facility upgrades would pay for themselves in 27 years, which is well short of the useful life of the improvements.

Other benefits cannot be so easily quantified, but the Sacramento River is the source of both drinking and irrigation water for a large part of the population of the State of California, as well as being a prime recreation resource for the North State. Since there are no immediate downstream water withdrawals from the river, there is no way to quantify the benefits of removing the additional pollutants from the water for domestic use or agriculture. However, a 2008 CalTrout study said sportfishing was worth $2 billion to the California economy in direct spending alone. Another study indicated that each $1 of direct angling spending would equate to $1.85 in total spending. If even 1/100th of a percent of that spending was on the upper Sacramento River and Shasta Lake, that would be a total of $370,000 per year that would be supported by these upgrades. These amounts would be even greater if salmon are reintroduced above Shasta Dam. Another recreational use of the Sacramento is whitewater rafting, which is one of the driving forces behind the upgrades being required of the facility. A 2006 study by the California Department of Boating and Waterways estimated the impact of non-motorized boating in the Sacramento Basin at $331.7 million per year, or about $900 per boat. Even if there were only 50 such boats using the upper Sacramento that would amount to another $45,000 per year. Since tourism is now the major economic driver for this region, the preservation of these attractions is of great benefit to the whole region.

Although the cost of this project is substantial, and the total benefit is difficult to quantify directly, the potential impacts of failing to implement the project on both the City of Mt. Shasta and the economy of the region makes support of this project a beneficial use of the IRWMP resources.

Benefits and Costs	
Benefits	Examples
Primary	• Avoidance of Mandatory Minimum Penalties
Secondary	• Maintenance of pristine condition of Upper Sacramento River
Tangible	• Cost of avoided penalties: $360,000/year or more
Intangible	• Meets IRWMP Objectives of development of sustainable infrastructure and enhancing ecological health of basin • Improves Sacramento River water quality
Private	• Supports sport fishing and rafting tourism: $400,000/year
Public	• Protects health of recreational water users in Upper Sacramento River and Shasta Lake Reservoir
Costs	
Capital	• See budget summary; approximately $10M in expenditures
Operations	• Operational costs of treatment facility will depend on treatment alternative chosen, but will be covered by user charges.
Externalities	• Increased user charges will be implemented for system customers

I. Project Status: Ready to proceed pending permitting and funds
Upon completion of the feasibility study in September, 2013 the project will be ready for design and implementation. The NPDES permit includes a time schedule order that requires compliance with certain effluent limitations by June 2017. Completion of the project in accordance with that time line will require acquisition of funding and initiation of the permitting and design phase of the project as soon as possible. The scope of environmental studies and permitting efforts will be developed as soon as information from the feasibility study is available to do so.

J. Strategic considerations for IRWMP implementation:
   i. *Has this project been integrated with another or include additional aspects because of IRWM conversations?*
   This project was presented and discussed at the Integration Workshop held on May 10, 2013. Participants discussed the project and the city received recommendations for integration of other project aspects, which included:
      1. Education and outreach. It was recommended that public participation be incorporated.
      2. Consideration of inclusion of in line hydropower generation in the outfall
      3. Inclusion of habitat enhancement or experimental treatment (e.g. wetlands) was suggested.
   ii. *Has this project scope and/or geography been widened because of IRWM conversations?*
   This project could be designed to include a habitat enhancement or wetlands creation aspect if transport issues can be resolved.
   iii. *Describe your strategy for project integration and relevance to the IRWMP:*
   It is our intent to continue to work closely with the RWMG to find ways to work with, learn from, and support the efforts of other members.

K. Contribution of the project in adapting to the effects of climate change:
This project contributes to the overarching goal of responding to climate change by reducing impacts to existing water sources and providing a treated water that can reduce dependence on existing water supplies.

L. Contribution of the project in reducing GHG emissions:
Although the project will result in temporary air quality impacts during construction, there are no predicted long-term impacts to air quality. The project could have the potential to generate additional emissions, if increased mechanical treatment is the recommended solution, which would be subject to state and federal ambient air quality. However, the project may be able to offset most of this potential with the inclusion of alternative energy generation sources as part of the design.

Annual emissions: Over a 40-year project life, the sponsor estimates approximately 2.00 million tons of CO_2 equivalent (carbon dioxide, or its equivalent in other GHGs) annually.

Lower Elk Springs Rebuild —

Ready to Proceed; Priority 1

Sponsor: McCloud Community Services District
Location: McCloud, CA
Partners: None at this time
Budget: $600,000 (100% grant funding request)
Abstract: The Lower Elk Spring collection facility was taken off-line in December 31, 2011 because of rats and bats polluting municipal drinking water. Configuration of existing infrastructure makes it difficult to control infestation, and existing infrastructure is aging. Improvement of this spring source provides water supply redundancy for the system. The McCloud Community Services District (MCSD) and the community would not be able to finance the project over the next 30 years without assistance from federal and / or state funding programs.

Review Factors:

A. IRWM Objectives:

The Lower Elk Water Improvement Project is located within the watershed of the McCloud River, which ultimately flows to the Sacramento River. Existing or potential beneficial uses of the McCloud River and the Sacramento River include municipal and domestic water supply, power generation, recreation, cold freshwater habitat and wildlife habitat.

Overarching goal: Climate change
This project contributes to this overarching goal by providing water supply from a source that does not depend on equipment (e.g. pumps) to generate the flow.

Regional resiliency: By putting in place redundant supplies that are not dependent upon equipment, the water supply is better position to sustain if there is a general decrease in supply.

Objective 1 – *Increase knowledge of basin characteristics:* This project supports this objective through public education during project development. If reconstructed, it also serves as a source for data regarding spring characteristics. The project will include sources of information (pressure gages, flow meters) that provide information source points for understanding spring flow conditions.

Objective 3 – *Maintain and enhance the ecological health of the basin;* AND Objective 5 – *Ensure support for and foster success of water management efforts for disadvantaged communities;* AND Objective 8 – *Facilitate development of sustainable water/wastewater infrastructure:* The proposed project provides the McCloud CSD a more robust system through which to provide a basic utility service. The proposed improvements enhance the safety and reliability of the town's potable water system.

B. Resource Management Strategies:
System Reoperation: The proposed project provides an additional supply source that can be utilized for resiliency, to improve operator ability to maintain infrastructure at other sources.

Drinking Water Treatment and Distribution: The proposed project specifically addresses drinking water supply for a DAC.

Watershed Management: The proposed project includes providing public information during development and designing the spring source with means of measuring discharge conditions which are both part of this strategy.

The proposed project would ultimately provide positive social and economic impacts by improving the municipal water supply to the community of McCloud. As a result, the proposed project is expected to result in the fair treatment and meaningful involvement of all people regardless of age, race, color, national origin, or income

C. Technical Feasibility:
A feasibility study has been completed for this project.

D. Specific benefits to critical DAC water issues:
The improvements to the MCSD's existing water collection system is an effort to improve service and meet state drinking water standards. It also will improve the security and hygiene of the Lower Elk springhouse. McCloud is considered a DAC.

E. Specific benefits to critical Native American water issues:
None at this time.

F. Environmental justice considerations:
The proposed project would ultimately provide positive social and economic impacts by improving the municipal water supply to the community of McCloud. As a result, the proposed project is expected to result in the fair treatment and meaningful involvement of all people regardless of age, race, color, national origin, or income.

The project will not result in an increase in water use. No additional land area would be covered by impervious surfaces. The project will therefore have no impact on groundwater supply or recharge within the project area resulting in a net deficit in aquifer volume or a lowering of local groundwater tables. There are no lakes, or oceans near by the project.

G. Project costs and financing:
The estimated cost in 2010 dollars is $432,131.00. The community of McCloud will not be able to finance this project over the 20-year planning period without assistance from federal and state funding programs, the districts existing reserves are not adequate to pay for the estimated $432,131 to $600,000 to rebuild Lower Elk Springs.
   a. Total un-funded to date (project need/funding request): $600,000
   b. Please describe secured funding sources: none secured as yet.
   c. How operations and maintenance will be covered: O&M will be covered under the rate structure for the McCloud CSD.

H. Economic Feasibility:
Financial Feasibility Assessment:
Based on the following, the proposed project is financially feasible.
   a. Financial capacity to cover cost: The CSD is familiar with the project funding process having completed multiple other infrastructure improvement projects utilizing multiple funding sources some of which operate on a reimbursement basis.
   b. Ongoing costs: As with any service provider, the CSD anticipates regular O&M costs. It is anticipated that the proposed improvements will result in a decrease in O&M costs. Significant cost was expended for pest control and cleaning at the site. The proposed installation is designed to minimize potential for pest problems. The CSD has the financial capacity to cover normal O&M costs.

Economic Assessment:
The project provides positive value to the region. In terms of tangible benefits, the CSD has spent nearly $33,000 attempting to eradicate the rats and bats and it is estimated that ongoing O&M to continue vermin control would be approximately $4,700 per year. Replacement of the proposed spring water collection facility should reduce expenditure on O&M.

There are also less tangible benefits that are of value to the CSD and the region in general. Constructing an improved facility at a high quality water source means reduced potential for contamination and therefore helps protect public health. Restoring the function of this source also improves system reliability, which improves public safety by assuring water availability for fire suppression. Another important secondary benefit is the potential to improve service to existing businesses and potentially attract new businesses. The availability of a clean, reliable water source can affect the decision for a business to remain or to start up in the region. The following table summarizes, by category, the benefits described above.

Benefit Summary	
Benefit Category	Project Benefits
Primary	*Tangible* • Cost of avoided O&M ($4,700/year) • Value to the local economy of existing businesses *Intangible* • Meeting IRWMP Objectives: ▪ Obj. 3: Support the local economy; Ensure public health and safety ▪ Obj. 5: Support water management efforts for DACs ▪ Obj. 7: Ensure adequate water supply /quality; maintaining regulatory compliance. ▪ Obj. 8: Facilitate sustainable water infrastructure to ensure public health, protect ecological integrity, and support economic stability.
Secondary	*Tangible* • Service companies benefit from the economic activity of primary beneficiaries

Project capital and other related costs are summarized below.

Cost Summary	
Costs	Examples
Capital	• As reported in Attachment 1 projected cost is $600,000
Operations	• Decrease in O&M cost is anticipated.
Externalities *(costs imposed on others not a party to the proposed project)*	• Externalities not anticipated. Improvements do not increase water use and should reduce O&M costs. Reestablishing spring use does not preclude uses that were typical and concurrent with spring use, and the project does not appear to negatively affect any resources or communities. The whole system benefits from improved system redundancy and improved water quality protection.

Multiple benefits of the proposed project have been identified that, although difficult to quantify, are of significant value to the CSD and the region. Multiple IRWMP objectives are focused on supporting DAC infrastructure improvement and that is the outcome of this project. From ensuring public health, to providing a resilient water supply, this project provides benefits commensurate with the investment of funds.

I. Project Status: Ready to proceed pending permitting and funds
If secured funding source is provided, project can start July 1, 2013. We have a supporting environmental study done, which includes a mitigated negative declaration, California Environmental Quality Act (CEQA) document.

J. Strategic considerations for IRWMP implementation:
   i. *Has this project been integrated with another or include additional aspects because of IRWM conversations?*
      This project was presented and discussed at the Integration Workshop held on May 10, 2013. Participants discussed the project and the district received recommendations for integration of other project aspects, which included:
      1. Education and outreach: It was recommended that public participation be incorporated
      2. Coordination of these improvements with the hydropower project proposed by McCloud Local First Network

      Subsequent to the project, it was determined that this project could contribute to the basin groundwater study project by providing spring discharge condition information.
   ii. *Has this project scope and/or geography been widened because of IRWM conversations?*
      Subsequent to the project, it was determined that this project could contribute to the basin groundwater study project by providing spring discharge condition information.
   iii. *Describe your strategy for project integration and relevance to the IRWMP:*
      It is our intent to continue to work closely with the RWMG to find ways to work with, learn from, and support the efforts of other members.

K. Contribution of the project in adapting to the effects of climate change:
   The project would be confined to existing easement and facility locations. We don't anticipate impacts.

   This project contributes to the overarching goal of responding to climate change by providing water supply from a source that does not depend on equipment (e.g. pumps) to generate the flow. In addition, this project contributes to regional resiliency by putting in place redundant supplies that are not dependent upon equipment, the water supply is better position to sustain water supply if there is a general decrease in source availability.

L. Contribution of the project in reducing GHG emissions:
   Although the project will result in temporary air quality impacts during construction, there are no long-term impacts to air quality. The project does not have the potential to generate significant emissions that would be subject to state and federal ambient air quality, because it is a spring source and does not rely on equipment to supply the water. Installation of the water collection and discharge equipment should be carbon neutral with some ancillary power required for facility lighting, system control, and data collection.

   Annual emissions: Over a 30-year project life, the sponsor estimates approximately 2.04 million tons of CO_2 equivalent annually.

Elk Springs Transmission Line Replacement —
Ready to Proceed; Priority 1

Sponsor: McCloud Community Services District
Location: McCloud, CA
Partners: None, currently
Budget: $11,400,000 (100% grant funding request)
Abstract: The transmission line that delivers water from Upper and Lower Elk Springs to the water storage tank is a critical part of the town's water supply infrastructure because it conveys water from two of the town's three spring sources. This transmission line is key to providing a resilient water supply. Because the pipeline is only partially buried, it is susceptible to damage (e.g. freezing, tree fall, etc.) and the integrity of the pipe is deteriorating. These conditions can lead to water quality problems with the town's water supply. In addition, access to the water line is limited making regular repair of the line difficult and costly. Improvement of this transmission line provides water supply reliability and redundancy for the system. The MCSD and the community would not be able to finance the project over the next 30 years without assistance from federal and / or state funding programs.

Review Factors:

A. IRWM Objectives:

The Upper and Lower Elk Pipeline Improvement Project is located within the watershed of the McCloud River which ultimately flows to the Sacramento River. Existing or potential beneficial uses of the McCloud River and the Sacramento River include municipal and domestic water supply, power generation, recreation, cold freshwater habitat and wildlife habitat.

Overarching goal: Climate change
This project contributes to this overarching goal by providing water supply from a source that does not depend on equipment (e.g. pumps) to generate the flow. By providing transmission for redundant supplies that are not dependent upon equipment, the water supply is better positioned to sustain water supply if there is a general decrease in supply, increasing the region's resiliency.

Objective 1 – *Increase knowledge of basin characteristics:* This project supports this objective through public education during project development.

Objective 3 – *Maintain and enhance the ecological health of the basin;* AND Objective 5 – *Ensure support for and foster success of water management efforts for disadvantaged communities;* AND Objective 8 – *Facilitate development of sustainable water/wastewater infrastructure:* The proposed project provides the McCloud CSD a more robust system through which to provide a basic utility service. The proposed improvements enhance the safety and reliability of the town's potable water system by reducing the potential for contamination of the water supply and relieving the CSD of the cost to maintain aging and vulnerable infrastructure.

B. Resource Management Strategies:
System Reoperation: The proposed project maintains two additional supply sources that can be utilized for resiliency, to improve operator ability to maintain infrastructure at other sources.

Drinking Water Treatment and Distribution: The proposed project specifically addresses drinking water supply quantity and quality for a DAC.

Watershed Management: The proposed project includes providing public information during development.

The proposed project would ultimately provide positive social and economic impacts by improving the municipal water supply to the community of McCloud. As a result, the proposed project is expected to result in the fair treatment and meaningful involvement of all people regardless of age, race, color, national origin, or income.

C. Technical Feasibility:
The proposed project was developed as part of a system-wide water system master plan. Excerpts from that plan are attached to this proposal. The McCloud CSD regularly manages water infrastructure improvement projects. The current manager has been operating and maintaining the system for 25+ years and is well versed in the permitting, funding, and implementation of these projects.

D. Specific benefits to critical DAC water issues:
The improvements to the MCSD's existing water transmission line are an effort to improve service and meet state drinking water standards. It also will improve the ability of the District to meet water quality requirements. McCloud is considered a DAC.

E. Specific benefits to critical Native American water issues:
None at this time.

F. Environmental justice considerations:
The proposed project would ultimately provide positive social and economic impacts by improving the municipal water supply to the community of McCloud. As a result, the proposed project is expected to result in the fair treatment and meaningful involvement of all people regardless of age, race, color, national origin, or income.

The project will not result in an increase in water use. No additional land area would be covered by impervious surfaces. The project will therefore have no impact on groundwater supply or recharge within the project area resulting in a net deficit in aquifer volume or a lowering of local groundwater tables. There are no lakes, or oceans near by the project.

G. Project costs and financing:
The estimated project cost in 2013 dollars is $11,140,000; that cost includes phased improvements on three separate pipeline segments. The Lower Elk Springhouse improvements project listed in the feasibility study was submitted as a separate project. The community of McCloud will not be able to finance this project over the 30-year planning period without assistance from federal and state funding programs, the districts existing reserves are not adequate to rebuild Elk Springs Transmission Line.

d. Total un-funded to date (project need/funding request): $11,140,000
e. Please describe secured funding sources: none secured as yet.
f. How operations and maintenance will be covered: O&M will be covered under the rate structure for the McCloud CSD.

H. Economic Feasibility:
Financial Feasibility Assessment
Based on the following, the proposed project is financially feasible.

a. Financial capacity to cover cost: The CSD is familiar with the project funding process having completed multiple other infrastructure improvement projects utilizing multiple funding sources some of which operate on a reimbursement basis.
b. Ongoing costs: As with any service provider, the CSD anticipates regular O&M costs. It is anticipated that the proposed improvements will result in a decrease in O&M costs. Significant cost was expended for pest control and cleaning at the site. The proposed installation is designed to minimize potential for pest problems. The CSD has the financial capacity to cover normal O&M costs.

Economic Feasibility Assessment
The project provides positive value to the region. In terms of tangible benefits, the CSD has spent nearly $33,000 attempting to eradicate the rats and bats and it is estimated that ongoing O&M to continue vermin control would be approximately $4,700 per year. Replacement of the proposed spring water collection facility should reduce expenditure on O&M.

There are also less tangible benefits that are of value to the CSD and the region in general. Constructing an improved facility at a high quality water source means reduced potential for contamination and therefore helps protect public health. Restoring the function of this source also improves system reliability, which improves public safety by assuring water availability for fire suppression. Another important secondary benefit is the potential to improve service to existing businesses and potentially attract new businesses. The availability of a clean, reliable water source can affect the decision for a business to remain or to start up in the region. The following table summarizes, by category, the benefits described above.

Benefit Summary	
Benefit Category	Project Benefits
Primary	*Tangible* • Cost of avoided O&M ($4,700/year) • Value to the local economy of existing businesses *Intangible* • Meeting IRWMP Objectives: ▪ Obj. 3: Support the local economy; Ensure public health and safety ▪ Obj. 5: Support water management efforts for DACs ▪ Obj. 7: Ensure adequate water supply /quality; maintaining regulatory compliance. ▪ Obj. 8: Facilitate sustainable water infrastructure to ensure public health, protect ecological integrity, and support economic stability.
Secondary	*Tangible* • Service companies benefit from the economic activity of primary beneficiaries

Project capital and other related costs are summarized below.

Cost Summary	
Costs	Examples
Capital	• As reported in Attachment 1 projected cost is $11,400,000
Operations	• Decrease in O&M cost is anticipated.
Externalities *(costs imposed on others not a party to the proposed project)*	• Externalities not anticipated. Improvements do not increase water use and should reduce O&M costs. Re-establishing spring use does not preclude uses that were typical and concurrent with spring use, and the project does not appear to negatively affect any resources or communities. The whole system benefits from improved system redundancy and improved water quality protection.

Multiple benefits of the proposed project have been identified that, although difficult to quantify, are of significant value to the CSD and the region. Multiple IRWMP objectives are focused on supporting DAC infrastructure improvement and that is the outcome of this project. From ensuring public health, to providing a resilient water supply, this project provides benefits commensurate with the investment of funds.

I. Project Status: Ready to proceed pending permitting and funds
If secured funding source is provided, project design can start July 1, 2013. A previous engineering study was completed providing recommendations for replacement.

J. Strategic considerations for IRWMP implementation:
i. Has this project been integrated with another or include additional aspects because of IRWM conversations?

Although this project was not presented and discussed at the Integration Workshop held on May 10, 2013, it is anticipated that the same integration elements discussed for the spring construction could be incorporated into this project, namely:

1. Education and outreach: It was recommended that public participation be incorporated
2. Coordination of these improvements with the hydropower project proposed by McCloud Local First Network

ii. *Has this project scope and/or geography been widened because of IRWM conversations?*
The scope has been expanded to include coordination with the proposed hydropower project at the water storage tank.

iii. *Describe your strategy for project integration and relevance to the IRWMP:*
It is our intent to continue to work closely with the RWMG to find ways to work with, learn from, and support the efforts of other members.

K. Contribution of the project in adapting to the effects of climate change:
The project would be confined to existing easement and facility locations. We don't anticipate impacts.

This project contributes to the overarching goal of responding to climate change by providing water supply from a source that does not depend on equipment (e.g. pumps) to generate the flow. In addition, this project contributes to regional resiliency by putting in place redundant supplies that are not dependent upon equipment. The water supply is better positioned to sustain water supply if there is a general decrease in source availability.

L. Contribution of the project in reducing GHG emissions:
Although the project will result in temporary air quality impacts during construction, there are no long-term impacts to air quality. The project does not have the potential to generate significant emissions that would be subject to state and federal ambient air quality, because it is anticipated that the project will not include power-consuming equipment.

Annual emissions: Over a 30-year project life, the sponsor estimates approximately 2.04 million tons of CO_2 equivalent annually.

Intake Springs Hydroelectric Project —
Conceptual; Priority 2

Sponsor: McCloud Local First/Shasta Energy Group
Location: McCloud, CA
Partners: McCloud CSD; McCloud Local First Network; Pacific Power; State of California
(Departments of Water Resources and Energy Commission); State of California Department of
Water Resources and the Energy Commission; USDA; California Special Districts Association
Budget: $17-33,000 (depending on CEQA needs)
Abstract: In 2004, the MCSD, with the assistance of a $20,000 Community Development Block Grant from the California Department of Housing & Community Development, funded a $24,962 "Hydroelectric Feasibility Study". The prime consultation firm for the study was Kennedy / Jenks Consultants, Engineers & Scientists. That study, was based on preliminary engineering assumptions including hydraulic and hydrologic investigations of the district's water supply system. The study also included reports and presentations regarding the existing wholesale electric market at that time, together with a presentation of the regulatory framework and permitting policy associated with entering into the hydroelectric generation and sales market. Estimated average monthly water flows were calculated in the study to reflect potential revenues and to present projected cost and value statements. The study showed that there existed a viable opportunity to construct and operate a small hydroelectric system along the existing, Intake Springs pipeline, near the district's existing water tank site. Based on the study, there exists a potential to produce approximately 410 kilowatts (kW) of electricity from the existing Intake Springs pipeline.

Since the time of the study, a number of factors relative to micro-generation projects cost and value have developed and have changed the nature of that original study. There has been and continues to be a growing effort to make the regulatory climate more solution oriented in supporting alternative sources of clean energy which in turn, has developed potential new sources of funding to finance these types of projects. Presently, there is a trend, to decentralize electric production and develop multiple, diversified sources for power generation. Depending on the country of origin for construction materials used for plant and equipment development and the regulatory framework of a public utility, incentives have also become available which may include funding mechanisms that further affect a projects cost and value. These new and emerging issues were not a part of the original study yet should be considered in order for the overall project to proceed forward.

At this point in time, in order to proceed effectively with an overall project development, elements of the study will need to be reconsidered, verified and or otherwise modernized. Updating would include, but not be limited to: consolidating the water flows of record together with calculating the potential power based on actual data collected since the time of the original study. Identify current policy modifications and funding opportunities. Further develop a business model and operational plan for the project in order to obtain funding commitments for construction and operation. Updating the study will help identity the most practical courses to seek with regards to permitting and construction as well to aid in the development of a business model to consider for its operational needs.

Specifically, this Planning Study update would incorporate changes to the original study in order to proceed with project development and financing. It would seek to identify project partners to provide funding as well as establish purchase commitments, by a utility, for electricity; on a for-sale basis. Project design control commitments and CEQA determinations could also be established as a part of this updating effort. In this way, the course of project planning, construction and operational responsibilities can be considered / established for further project funding commitments to occur.

10.5.2 Watershed Assessment and Basin Characterization

Upper Sac, McCloud, Lower Pit River Groundwater Monitoring Project — *Ready to Proceed; Priority 1*

Sponsor: McCloud Watershed Council, Trout Unlimited
Location: Throughout the USR
Partners: Siskiyou County, California Trout, Mt. Shasta Bioregional Ecology Center
Budget: $161,086 (4% match; $155,086 requested grant funding)
Abstract: The State of California Department of Water Resources (DWR) initiated a program in 2011 to monitor the groundwater elevations in 515 groundwater basins statewide. Two of these basins are located in the Upper Sac/McCloud/Lower Pit IRWM plan area. Additionally, the DWR has prioritized the characterization of groundwater source areas; the Upper Sac/McCloud/Lower Pit IRWM plan area contains those areas as defined the DWR's Bulletin 118. This project is designed to meet the DWR objectives for groundwater basin characterization, extend that data collection to sensitive source areas, and address concerns of local groundwater quality. The collected data will be uploaded to the DWR online CASGEM (California State Groundwater Elevation Monitoring) database and be available to the general public.

The *quantity* of available groundwater is, generally, a function of its elevation in an aquifer; that characteristic will be documented by the groundwater elevation survey. The other significant characteristic of groundwater is its *quality*. To document baseline groundwater quality, a number of the wells in the elevation survey will be sampled for groundwater quality, including both organic and inorganic parameters.

This study will identify local well owners who will allow sampling and measurement of their wells. A limited number of additional monitoring wells will be advanced to address data gaps in critical areas. Much, if not all, of the skilled and semi-skilled work involved could be completed by local residents and businesses, further benefitting the disadvantaged communities and indigenous peoples of the project area.

Review Factors:

A. IRWMP Objectives:

By compiling and measuring baseline data for groundwater quality and quantity currently unknown to the public, this project will meet the following objectives by:

1) Increasing knowledge of basin characteristics and public understanding of watershed dynamics; 2) By uploading information collected to the CASGEM database we will encourage and improve an environment that fosters cooperation, facilitates collaboration, and builds relationships of trust and respect among community members and watershed stakeholders; 3) Generating data that can be used to maintain and enhance the ecological health of the basin; 5) Generating data that can be used to support the sustainable revitalization of disadvantaged and indigenous communities; 6) Informing public understanding of basin characteristics to foster meaningful public participation in watershed stewardship; 7) Measuring baseline data from which we can identify trends and ensure adequate source water supplies; and 8) Generate data that can be used to ensure public health and safety and protect ecological health in this critical source water basin.

B. Resource Management Strategies:

RMS 1.1.3 Source Water Area Strategies;

p. *Watershed Management* — especially as it pertains to improving data collection and sharing amongst watershed stakeholders, as well as increasing levels of community knowledge regarding their watershed to enhance feelings of responsibility and inclinations of stewardship toward their environment.

And to some extent;

l. *Ecosystem Restoration*, **m.** *Forest Management*, and **n.** *Recharge Area Protection* — as poorly documented/understood groundwater information becomes known, in combination with other water quality/quantity monitoring in the area, we may better understand the dynamics of groundwater-surface-atmospheric hydrological interaction, which may then inform priorities and best practices for regional water, climate and land management in our alpine to sub-alpine ecosystem.

C. Technical Feasibility:

The project sponsor and its members have significant personal experience in groundwater elevation monitoring. The sponsor member list includes a general engineering contractor, registered geologist, and licensed C-57 well driller in the State of California, all of whom are familiar with well installation, development, maintenance, and repair. The materials and methods for CASGEM compliance are detailed in the DWR *Groundwater Elevation Monitoring Guidelines* dated December 2010. That manual is designed to codify the groundwater measurement practices statewide; those practices will be applied here. Further, a work-plan will be submitted to the DWR prior to the initiation of work; comments and revisions based on DWR feedback will be incorporated into the project.

D. Specific benefits to critical DAC water issues:
Groundwater elevation survey will provide baseline data for groundwater levels in numbered groundwater basins identified by the DWR in the CASGEM program. The communities of McCloud, Mt. Shasta, and Dunsmuir, along with the tribal territory of the Winnemem Wintu, Modoc, Pit River, and Shasta tribes, will have groundwater elevation and quality data to utilize in developing management plans for use of their groundwater resources.

E. Specific benefits to critical Native American water issues:
Winnemem Wintu, Modoc, Pit River, and Shasta tribal members are present in significant numbers in the area and would receive the benefit of rational decisions on groundwater management based on scientific analysis. Current groundwater use in the area is rural residential; groundwater pumping for bottled water has occurred in the past and is expected to resume as pressure on water resources builds over time. In the Medicine Lake highlands, geothermal exploration has been proposed and should be expected to have a measurable impact on groundwater in the area. Evaluation of groundwater levels (quantity) and water constituents (quality) will provide a reference point for future evaluation of those impacts.

F. Environmental justice considerations:
This project will particularly provide environmental justice to disadvantaged and Native American communities. Evaluation of groundwater resources is a critical component in the protection, conservation, and judicious use of that resource. The monitoring component for the wells will be spread among the rural residential population surrounding the disadvantage communities of southern Siskiyou County. The primary benefit will be data that supports appropriate use of the groundwater resource that is primarily utilized by these disadvantage communities.

G. Project costs and financing:
    a. <u>Total estimated project cost</u> (include cost share AND funding request): $180,000
    b. <u>Total un-funded to date</u> (project need/funding request): $168,000
    c. <u>Please describe secured funding sources as shown in the second worksheet in Attachment 1A</u>: $11,000 is committed as cost share; this will come from in-region project participants.
    d. <u>How operations and maintenance will be covered</u>: There is no O&M for this project.

H. Economic feasibility:

Financial Feasibility Assessment

a. The combined involvement of the McCloud Watershed Council and Trout Unlimited provides significant technical and financial resources specific to the project area. Initial projects costs will be handled by appropriate agreements with contractors, cash on hand, and financing available to the project sponsors. The sponsors have successfully met the goals and obligations of many other grants issued from a variety of state and federal agencies.
b. We do not anticipate ongoing costs.
c. Yes, we believe the project is financially feasible.

Economic Feasibility Assessment

Benefits and Cost	
Benefits	
Intangible *(Benefits not easily expressed in $. These can be primary or secondary)*	• Improves long-term water management • Meets seven IRWMP objectives • Educates the local community about water resources • Provides needed baseline data to evaluate climate change • Provides groundwater monitoring data for the regional CASGEM database plus data on water quality • Reduces water resources conflicts • Preserves heritage for future generations • Benefits industries such as hydroelectric power generation, agriculture, and California's water providers • Spiritual and heritage value
Private *(Purchased goods or services, personal benefits)*	• Spiritual and/or heritage value • Increase in property values through well protection
Public *(Societal goods or services e.g. water system, highways, etc.)*	• Protection of groundwater for future public use
Costs	
Capital *(Initial costs to complete the project)*	• Project is scheduled for four calendar quarters over one year. See Attachment 1 budget summary submitted for the project that details the planning and implementation costs.
Operations *(Ongoing costs to sustain the project)*	• Additional grant funding, monitoring entity funding, or volunteers will be needed for a long-term monitoring program

Cost-effectiveness Assessment

The overarching goals of our proposal are to provide valuable groundwater data to the local communities whose fate are linked to groundwater resources, limit any expenses to Siskiyou County and keep the County eligible for future

DWR funding by CASGEM compliance, and provide the DWR with the groundwater basin monitoring that it needs to complete the CASGEM database. The project will also improve the overall long-term management of California water resources by establishing baseline groundwater data in areas that are not currently monitored. That data will be invaluable in both the evaluation of groundwater utilization and ongoing climate change.

The County of Siskiyou is a Monitoring Entity (ME) for the CASGEM program. The USR IRWM area includes both Siskiyou and Shasta counties; each of those counties has been evaluated for groundwater concerns. The areas that we have proposed for the groundwater-monitoring program in the IRWM are all contained within Siskiyou County; Shasta County does its own CASGEM monitoring and it appears that the northern areas of Shasta County (contained in the USR IRWM area) would not raise significant groundwater concerns. The groundwater monitoring we have proposed is based on the two groundwater basins identified in our IRWM area in Siskiyou County, and groundwater recharge areas that are identified by the DWR as areas of poorly understood hydrology and of particular environmental interest. The most prominent groundwater recharge areas that we proposed to monitor are in the Mt. Shasta and Dunsmuir areas.

This project meets seven of the Upper Sacramento Region IRWMP objectives (see the project review factors and work plan for a summary of the objectives that are met). The benefit to Siskiyou County is that this project would help it meet their monitoring obligation to the DWR. Siskiyou County risks eligibility to other DWR funding if they do not monitor basins within their jurisdiction, so by funding the monitoring program through the IRWM process we would be helping the county meet that obligation without costing it valuable resources.

Our proposal addresses the concerns of the Winnemem Wintu tribe near Mt. Shasta, the Modoc tribe in the Medicine Lake area, the McCloud Watershed Council in McCloud, and the cities of Mt. Shasta and Dunsmuir with elevation monitoring in their general vicinity. Many of the aforementioned also have overlapping interests in the listed areas. Also we would satisfy the DWR by monitoring two groundwater basins not currently monitored.

Statement of Relative Merit

This groundwater elevation and quality survey proposal was developed with input from all legitimate contributors to the IRWM process in the upper Sacramento River and Lower Pit River drainages. We have made a conscious effort to address all areas of potential groundwater interest, while economizing by excluding areas of marginal groundwater concern. Each of the cities and towns mentioned in this proposal is defined as a disadvantaged community by the DWR and this grant application represents the best opportunity for near term documentation of their valuable and vulnerable groundwater resources.

I. Project Status: Ready to proceed pending permitting and financing

J. Strategic considerations for IRWMP implementation:
   i. *Has this project been integrated with another or include additional aspects because of IRWM conversations?* YES
   ii. *Has this project scope and/or geography been widened because of IRWM conversations?* YES
   iii. *Describe your strategy for project integration and relevance to the IRWMP:* Groundwater elevation surveys are a key component to evaluating groundwater resources. Over time, elevation measurements can be utilized to evaluate both available resources and the impact of groundwater utilization. The elevation survey is a building block on which a future Groundwater Management Plan (GWMP) can be based. The elevation survey can further be utilized to evaluate water conservation and habitat restoration efforts, which typically have a remedial effect on shallow aquifers within a groundwater basin.

K. Contribution of the project in adapting to effects of climate change:
Groundwater should be considered as a more consistent and stable source of water than surface waters in a changing climate. Aquifers can be considered as underground reservoirs, and all groundwater originates as surface water. While fluctuations in precipitation as a result of climate change will have a relatively immediate effect on surface water quantities, groundwater will typically exhibit less of an effect over the short-term because of the time necessary for water to percolate into an aquifer. This buffering effect also extends to groundwater quality, where the mechanical and chemical effects of surface water percolating through an aquifer can manifest a remedial result on water contamination. By establishing a baseline of groundwater capacity in the relatively unutilized basins described in this proposal, and further investigating the recharge areas included, water managers will have the data necessary to optimally utilize groundwater resources without endangering the long-term capacity of this resource.

L. Contribution of the project in reducing GHG emissions:
This project is not expected to release significant emissions either within or outside of the USR. While the drilling of those wells necessary for research will result in some emissions, those emissions related to worker and researcher transportation will be more significant. This is consistent with the findings related to all emissions studies within California: transportation is a significant factor. The project sponsors and manager will work to minimize the emissions related to transportation by recruiting staff and laborers within the region; this will both minimize emissions as well as contribute to the region's economic well being.

Emissions quantification: Over one year of implementation, the GHG emissions are estimated at a total of 2.21 million tons of CO_2 equivalent.

Hydrological and Climate Change Evaluation of the Medicine Lake Volcano and its Connectivity to the Fall River Springs and Potential Connectivity to the McCloud River — *Ready to Proceed; Priority 1*

Sponsor: Mount Shasta Bioregional Ecology Center
Location: Medicine Lake Highlands
Partners: McCloud Watershed Council; Trout Unlimited
Budget: $150,000 (21% cost share)
Abstract: The Medicine Lake Highlands, the upper portion of Medicine Lake Volcano, is a primary recharge area for the Fall River Springs, the largest spring system in California. However, the hydrogeological relationship and the groundwater-surface water connection between the two are not well understood. Their interconnection is largely ignored in the IRWM planning process due to the two areas' inclusion in different IRWM regions — the Upper Sacramento Region and the Upper Pit River Region, respectively. New studies reflecting current conditions and an extensive monitoring plan are needed in light of proposed industrial-scale geothermal development and the implications of climate change. The Medicine Lake Highlands Hydrogeological Project will contribute to better knowledge of the hydrologic connectivity between the Medicine Lake Volcano and Fall River Springs through the following phases:

Phase I — Baseline monitoring survey of existing data (in cooperation with Trout Unlimited)
Phase II —Identification of data gaps and needed studies
Phase III — Implementation of studies
Phase IV — creation of a hydrologic model based on new information
Phase V —Development of a monitoring plan based on the hydrologic model

Review Factors:

A. IRWMP Objectives:
   - Overarching goal: Climate change
     - The project provides baseline-monitoring data that are currently lacking to evaluate climate change impacts.
   - Overarching goal: Native American values
     - The Medicine Lake Volcano provides important cultural and spiritual value to Native American tribes in the region.
   - Objective 1: Increase knowledge of basin characteristics and raise public awareness and understanding of fractured rock aquifers, watershed dynamics, existing water rights, water resource allocation, and existing management authorities to inform and develop support for IRWM planning and projects.
     - This project will complete research into the geology and groundwater resources in the Medicine Lake area, contributing to basin understanding.

- Objective 2: Encourage, improve and maintain an environment that fosters cooperation, facilitates collaboration, and builds relationships of trust and respect among water resource stakeholders with respect to water management efforts within the region.
  - The data collected will be included in the CASGEM database. This will allow information to be shared amongst/between watershed stakeholders and outside entities. The final project report will also be posted on MSBEC's website so all the information from the project will be available publicly.
- Objectives 6: Support local participation in development and implementation of water quality standards that reflect local conditions and implementation of projects that maintain and enhance the basin's existing water quality. Identify point source pollution and problem areas.
  - Local water quality standards will be used in this project. For instance, the Pit River Tribe's Tribal Water Quality Standards in the Medicine Lake Historic Properties Management Program (HPMP).

B. Resource Management Strategies:

Using Water More Efficiently

- Conjunctive Management and Groundwater Storage
  - While the Medicine Lake Volcano/Fall River Springs region is not yet being considered for conjunctive management and groundwater storage, the groundwater data collected in this project will be included in the CASGEM monitoring database for the region. This information could be useful for future evaluations of conjunctive management in the region.

Source Water Area Strategies

- Ecosystem Restoration
  - This project addresses the protection and preservation of springs as water supply sources as well as valuable ecological and spiritual resources in the Medicine Lake Volcano region.
- Recharge Area Protection
  - One of the outcomes of this project is to better understand the extent of the recharge area of Medicine Lake Volcano and the Fall River Springs groundwater system. The Medicine Lake Highlands is the primary recharge area for this system and protecting this area is important from water supply and quality perspective.
- Watershed Management
  - The data collected and included in the CASGEM database will allow information to be shared among/between watershed stakeholders and outside entities. The final project report will also be posted on MSBEC's website so all the information from the project will be available publicly.
  - Through the educational outreach component of the project and the formation of a citizen's monitoring program, the community's knowledge regarding their watershed will increase and feelings of responsible stewardship and protection will be enhanced.

Water Quality Management and Protection

- Pollution Prevention
  - A better understanding of the hydrogeology of this groundwater system combined with baseline water quality measurements collected in this project will provide information that can be used to evaluate potential water quality impacts from proposed geothermal and other industrial development projects.

C. Technical Feasibility:

- MSBEC and the Medicine Lake Citizens for a Quality Environment (MLCFQE) have worked on water related issues in the Medicine Lake Volcano area for over 15 years.
- MSBEC and MLCFQE know the residents in the area and can obtain the needed permission to access their property for monitoring.
- Technical consultants working with MSBEC and MLCFQE have knowledge of the hydrogeology of the system have performed hydrology measurements and water quality analyses in the project area.
- Technical consultants have designed baseline hydrologic monitoring programs in other regions with similar issues as the Medicine Lake region including spring flow, groundwater flow through volcanic rocks, and water resources threats from development.

D. Specific benefits to critical DAC water issues:
The baseline monitoring data that will be collected from this study and the implementation of a long-term monitoring program is needed to ensure adequate water quality and supply in this region are maintained. DAC's located within the Project Area, such as Fall River Mills and McArthur, will benefit from this project. Since the Fall River is a major tributary to the Pit River, this project will also be valuable to DAC's located along the Pit River (e.g., Big Bend). In addition, Native American tribes living in the region will benefit

E. Specific benefits to critical Native American water issues:
The Pit River Tribe and Modoc Tribe rely on the water resources in the Medicine Lake Volcano area for both supply and cultural values.

F. Environmental justice considerations:
The project impacts from monitoring will be minimal. The only minor disruption will be accessing private land to monitor wells and springs that we will have permission to enter. The project will provide equitable benefit to the Medicine Lake Highlands and Fall River Springs region by providing data that the entire region can use in managing their water.

G. Project costs and financing:
   a. <u>Total estimated project cost</u> (include cost share AND funding request): $150,000

b. Total un-funded to date (project need/funding request): $120,000
c. Please describe secured funding sources as shown in the second worksheet in Attachment 1A: See budget worksheet
d. How operations and maintenance will be covered: There is no O&M for this project

H. Economic feasibility:

Financial Feasibility

a. The project sponsors are seeking other funding for a larger hydrogeological project of which the IRWMP project would be the first phase, and could temporarily cover project costs if the other funding is received.
b. We do not anticipate ongoing costs.
c. Yes, we believe the project is financially feasible.

Economic Feasibility

Benefits	
Intangible *(Benefits not easily expressed in financial terms)*	• Meets seven IRWMP objectives • Improves long-term water management • Educates the local community about water resources • Provides needed baseline data to evaluate climate change • Provides groundwater monitoring data for the regional CASGEM database plus data on precipitation, spring flow and water quality • Reduces water resources conflicts • Preserves heritage for future generations • Benefits industries such as hydroelectric power generation, agriculture, and California's water providers • Protects habitat • Spiritual and heritage value
Costs	
Capital *(Initial costs to complete the project)*	• $150,000
Operations *(Ongoing costs to sustain the project)*	• Staff/volunteers will be needed for a long-term monitoring program

This project meets seven of the Upper Sacramento Region IRWMP objectives (see the project review factors and work plan for a summary of the objectives that are met). The project will also improve the overall long-term management of California water resources by establishing a robust long-term monitoring program. Other benefits of this project are that it will provide baseline hydrologic data that are currently lacking to evaluate the effects of climate change, and will provide groundwater monitoring data for the regional CASGEM database that the McCloud Watershed Council will develop plus additional data on precipitation, spring flow, and water quality for the region.

The project has significant educational benefits. Public forums will be held to educate the public on the pertinent issues regarding the water resources in this region. In addition, a citizen and volunteer monitoring program will be developed, providing on-the-ground scientific education for local residents.

A better understanding of the connection between the Medicine Lake Volcano and the Fall River Springs will be developed as a result of this project. An enhanced understanding of this groundwater system is essential from an economic perspective because the Fall River Springs is a critical source of water for industries such as hydroelectric power generation, agriculture, and California's water providers.

This project will help reduce public water resources conflicts. Uncertainty about the water resources associated with the Medicine Lake Volcano and Fall River Springs Groundwater System leads to greater risk in land management activities. Conflict currently exists related to water resources because of this uncertainty. Local residents and environmental organizations have opposed the proposed industrial scale geothermal project because of possible water quality and supply impacts. This project will develop a stronger conceptual model of the water resources and remove a degree of uncertainty and associated risk that is leading to that conflict.

The Medicine Lake Volcano provides a rich spiritual and cultural value to communities and Native American Tribes, and this project will help preserve those values. This project also helps to preserve the heritage of the region for future generations and protect habitat for sensitive species.

Based on this cost-effectiveness assessment, we believe the project provides immense value and benefit for the Upper Sacramento Region and for California's water supply given the project's relatively modest cost.

I. Project status: Ready to proceed pending funding
The staff and technical capabilities to execute this project are all in place.

J. Strategic considerations for IRWMP implementation:
MSBEC/MLCFQE are partnering with the McCloud Watershed Council and Trout Unlimited. While the two projects will remain separate proposals, the projects will be under the same umbrella. Some of the proposed baseline monitoring areas in the regional groundwater-monitoring proposal intersect with the Medicine Lake Highlands/Fall River Springs study area. The groundwater data collected in the Medicine Lake region will be included in the region wide CASGEM database.

The geographic region covered by the Project Area already covers an entire groundwater system so widening the geography does not make sense for this study.

K. Contribution of the project in adapting to effects of climate change:
Implementation of a long-term hydrologic monitoring program will provide baseline data that are needed to increase the understanding of impacts of climate change on water supply and water quality in the region.

L. Contribution of the project in reducing GHG emissions:
This project does not contribute to GHG emissions mitigation.

Emissions quantification: Over an estimated two-year implementation period, emissions are projected to be 2.25 million tons of CO_2-equivalent; largely from transportation emissions.

Comprehensive Springs and Groundwater Monitoring Project — *Conceptual; Priority 2*

Sponsor: California Trout
Location: Vicinity of Mount Shasta
Partners: to be determined
Budget: to be determined
Abstract: From 2007 to 2009 CalTrout conducted an initial baseline study on general water quality and geochemical parameters, recharge area, age, and vulnerability of selected Mount Shasta springs, which is summarized in Mt. Shasta Springs 2009 Summary Report. Comprehensive and long-term monitoring of Mt. Shasta's ground and spring water resources is essential to science-based water management decision-making. This will be increasingly important to adapt to and mitigate expected climate variability in the region. The Comprehensive Groundwater and Springs Monitoring Project will build upon the initial study, first refining the data based on the initial findings, then expanding and continuing the initial study to become a set long term and comprehensive monitoring program. Specific additions are to include water supply forecasting, age dating of potable water supplies and springs of biological significance, and to assess the connection between ground and spring water. An initial study plan for Mt. Shasta's glaciers will also be developed (see the glacier study abstract, below).

Existing conditions and issues that show the need for the project: While Mt. Shasta's spring water and groundwater are critical to the region and to the state, there is no comprehensive study or evaluation of these water resources or their vulnerability to climate change. There is a need to compile existing information, refine studies, and to develop a comprehensive monitoring program that will provide decision-makers with science based information for future planning and adaptation and mitigation to climate change.

Project work to address the identified need and the anticipated outcomes/deliverables:

- Tritium analysis to determine age
- Isotope analysis to determine recharge elevation, for Mt. Shasta, Dunsmuir and McCloud's spring water sources

- Established gauges and monitoring protocol on the municipal water supplies and springs of biological significance
- Water supply forecasting/precipitation storm event analysis linked to municipal data systems to evaluate annual snowpack and rain events and time lapse until discharge at the springs
- Analysis of seasonal changes in spring discharge
- Use information to forecast potential drought years
- Quarterly monitoring of flow at springs under study
- Incorporation of piezometers on Squaw Valley Creek into data set for groundwater elevations
- Chart historic snow pack on the mountain within the Mt. Shasta Wilderness Area
- Coordinate with academic institutions and agencies to develop initial design of a glacier-monitoring program
- Update and distribute Springs Vulnerability Index

Review Factors:

A. IRWMP Objectives: Meets Objectives 1, 2, 3, 5, 6, and 7
B. Technical Feasibility: From 2007 to 2009 CalTrout conducted an initial baseline study on general water quality and geochemical parameters, recharge area, age, and vulnerability of selected Mt. Shasta springs, which is summarized in Mt. Shasta Springs 2009 Summary Report.
C. Specific benefits to DACs: Knowledge of the water supply will allow for water planning, especially with water supply forecasting.
D. Project Costs and Financing: Total estimated project cost (include cost share AND funding request): Anticipated cost and schedule: $80,000 labor, $20,000 analysis for a two- to three-year monitoring program

Mt. Shasta Glaciers Long-term Monitoring Project — *Conceptual; Priority 2*

Sponsor: California Trout
Location: Vicinity of Mt. Shasta
Partners: to be determined
Budget: to be determined
Abstract: The Mt. Shasta Glaciers long term monitoring project will bring together a team of climate and glacier scientists from universities, federal and state agencies, and non-profit organizations to partner with the RWMG to develop and fund a long term glacier monitoring program. Since the 2006 University of California Santa Cruz study, there has not been any subsequent study or monitoring of Mt. Shasta's climate or glaciers. People tend to keep referring to the conclusions of the 2006 study that Mt. Shasta's glaciers are growing, and don't refer to the long-term prediction that the glaciers will likely be gone by the end of the century due to warming trends. To adequately study and forecast the potential impacts of climate change on Mt. Shasta's glaciers and the water supply for the Upper Sacramento IRWM region, we need to develop a long-term climate and glacier study for Mt. Shasta. This will benefit the region and downstream regions by understanding how climate change effects

(changes in patterns of precipitation and increased temperatures) will impact the storage capacity of the mountain's glaciers. This information will also help with water supply forecasting. Increased knowledge of the glaciers will also help develop an understanding of the factors leading to the melting of the glacial pool at the bottom of the glaciers that can lead to debris flow events. More awareness and forecasting of this process could help alert regional residents of these potentially hazardous events. Debris flows in the Mud Creek drainage result in water quality issues (sedimentation). It is feasible that the study could address possible mitigation measures for such an event in the Mud Creek drainage.

Review Factors:

A. IRWMP Objectives: Meets objectives 1, 2, 3, 9
C. Technical Feasibility: For the Mt. Shasta Springs 2009 Summary Report study CalTrout convened a group of university, private, and non-profit scientists to collaboratively develop and implement a study. CalTrout has the capacity and relationships to convene processes such as the development of a long-term study and monitoring projects.
D. Specific benefits to DACs: Knowledge of the water supply will allow for water planning, especially with water supply forecasting. It could also benefit DACs in the area of flood awareness (i.e. knowledge of potential debris flow events).
G. Project Costs and Financing: Phase I: Convening appropriate group of scientists and developing initial study and monitoring plan: $60,000. Phase II: implementation – cost unknown.

Hydrologic Study of the Mt. Shasta Watershed —
Conceptual; Priority 2

Sponsor: Mt. Shasta Bioregional Ecology Center
Location: Vicinity of Mt. Shasta
Partners: to be determined
Budget: to be determined
Abstract: The Mt. Shasta Watershed located in the Klamath-Cascade Region of Northern California is a critical resource for California's water supply. The heavy winter snowpack and glaciers on Mt. Shasta infiltrate as snowmelt and glacial melt into the streambeds below the glaciers and recharge the mountain's aquifers, filtering waters through a mostly unstudied system of porous strata, lava tubes and fissures to emerge as springs that feed the Upper Sacramento River and the McCloud River. Water quantity and water quality impacts from threats such as development and climate change could have detrimental effects on the springs, wells, and habitat in this watershed. The susceptibility of this important watershed to potential impacts warrants a more comprehensive understanding of the hydrology this system.

One main objective of the proposed hydrologic study is to better characterize the springs and groundwater resources of this largely unknown system. In addition, this project will contribute to understanding the potential connection between the eastern boundary of the Mt. Shasta Watershed and the western boundary of the Medicine

Lake Volcano and Fall River Springs Groundwater System, two regions that provide significant water to California's supply. This study will address crucial data gaps in the Mt. Shasta Watershed that are needed to better understand climate vulnerabilities and other threats, and the results will be used to develop conservation strategies and approaches to optimally manage this system.

The groundwater monitoring data collected within the Mt. Shasta Watershed from the Regional Groundwater Monitoring Project (McCloud Watershed Council) will be shared with this project. Any additional monitoring data collected in this project will also be included in the regional database that will be developed. In addition, data from this study and the Medicine Lake Volcano project (MSBEC/MLCFQE) will be shared to evaluate the potential connection between the two systems.

Comprehensive Surface Water Monitoring — *Conceptual; Priority 2*

Sponsor: The River Exchange
Location: throughout the USR
Partners: potentially other RWMG members
Budget: not yet determined
Abstract: Project would design and implement comprehensive monitoring of streamflows and water quality parameters across the Upper Sacramento, McCloud, and Lower Pit IRWM region, in coordination with existing monitoring programs and the Regional Water Management Group established under the IRWMP process. While recognizing that available funding may not be sufficient to support a long-term project, the objective is to provide a public-access long-term data set for baseline in future studies of vegetation management and water yield, storm event erosion, and effects of climate change. Recognizing that funding for a long-term project may not be available, this proposal would seek operational and start-up costs for three years.

Review Factors:

A. IRWM Objectives:
The project would support the following objectives: 1, 3, 4, and 6

10.5.3 Education, Outreach, and Regional Partnerships

Grants Specialist(s) — *Ready to Proceed; Priority 1*

Sponsor: Western Shasta Resource Conservation District
Location: Shasta County, unless a partnership can be developed to bring the effort to the rest of the region
Partners: potentially, other RWMG members
Budget: $46,000
Abstract: This program would fund a Grants Specialist to research funding opportunities and develop competitive proposals in order to implement projects identified in the Upper Sacramento IRWM Plan area. This could be a shared position with the Western Shasta Resource Conservation District (WSRCD) focusing within

the southern Upper Sacramento IRWMP area, with another entity focusing within the northern Upper Sacramento IRWMP area. The Grants Specialist(s) would be responsible for all aspects of proposal development including developing project narratives, fostering partner support, generating match and in-kind contributions, budget development, and creating work plan and monitoring deliverables.

This project aims to partner with local and regional groups to seek funding to implement projects that are selected for the Upper Sacramento IRWMP area. There is the potential to help resolve a number of water-related conflicts including improving public perception of climate adaptation strategies, improving water use efficiency, implementing best management practices (BMPs) to improve water quality, developing groundwater basin plans, and many more.

Funding for priority projects included in IRWMPs can be difficult to obtain, and grants are often highly competitive and require extensive research and development that many organizations lack the funding or expertise to complete.

Review Factors:

A. IRWM Objectives:
   Funding a Grants Specialist to research and develop proposals for Upper Sacramento IRWMP projects will effectively promote all aspects of the plan and work towards sustaining the plan over the long term. All nine Upper Sacramento IRWMP objectives could be addressed.

B. Resource Management Strategies:
   Funding a Grants Specialist to research and develop proposals for Upper Sacramento IRWMP projects will effectively promote all aspects of the plan and work towards sustaining the plan over the long term. All Upper Sacramento IRWMP resource management strategies (RMSs) could be addressed.

   This project aims to partner with local and regional groups to seek funding to implement the projects that are selected for the Upper Sacramento IRWMP. There is the potential to help resolve a number of water-related conflicts including improving public perception of climate adaptation strategies, improving water use efficiency, implementing BMPs to improve water quality, developing groundwater basin plans, and many more.

C. Technical Feasibility:
   Over the last 13 years, the WSRCD has been awarded 230 grants from 45 local, state and federal agencies for a total of $16,918,014.81. WSRCD staff have a strong background in natural resource management and possess the knowledge and experience in planning, developing and implementing grant projects ranging from education and outreach to floodplain restoration to watershed management. The WSRCD is familiar with working with others

through Cooperative Agreements and could effectively share a position with another entity as identified by the Upper Sac IRWM group.

D. Specific benefits to critical DAC water issues:
The objective of this program is to pursue funding opportunities to implement programs and projects consistent with the Upper Sacramento IRWMP. Potential projects will include critical water issues as defined above. Projects identified through the IRWMP will have incorporated consideration of DAC as a requirement to be included in the plan, and the Grants Specialist will ensure that DAC considerations are incorporated into related project proposals.

The Grants Specialist would use the unique perspective of the WSRCD and cooperating organization and their existing networks of partners to enhance communication and coordination among federal, state, tribal, and local governments, and other stakeholders. The increased communication and coordination will promote effective working relationships between tribal and other stakeholders.

E. Specific benefits to critical Native American water issues:
The objective of this program is to pursue funding opportunities to implement programs and projects consistent with the Upper Sacramento IRWMP. Potential projects will include critical water issues as defined above in addition to additional projects identified by Upper Sacramento IRWMP tribal interests. The Grants Specialist would use the unique perspective of the WSRCD and cooperating organization and their existing networks of partners to enhance communication and coordination among federal, state, tribal, and local governments, and other stakeholders. The increased communication and coordination will promote effective working relationships between tribal and other stakeholders.

F. Environmental justice considerations:
The objective of this program is to pursue funding opportunities to implement programs and projects consistent with the IRWMP. Projects identified through the IRWMP will have incorporated consideration of Environmental Justice as a requirement to be included in the plan, and the Grants Specialist will ensure that Environmental Justice considerations are incorporated into related project proposals.

G. Project costs and financing:
This project could begin immediately upon securing funding for the WSRCD Grants Specialist position. Project duration to be one year and would increase to multi-year if supported.
    a. Total un-funded to date (project need/funding request): $46,000
    b. Please describe secured funding sources: none as yet
    c. How operations and maintenance will be covered: no traditional O&M.

H. Economic Feasibility:

Financial Feasibility Assessment

The Western Shasta Resource Conservation District (WSRCD) is a special district of the State of California in operation since 1957. The District has a diverse workload funded through contracts as well as grants. Despite the economically challenging times, the WSRCD is fiscally sound. This is demonstrated by the number and value of Service Agreements increasing from 17, valued at $1,528,123 on July 1, 2009 to 34, valued at $2,389,582 on June 30, 2012. The WSRCD's diverse portfolio of projects is funded by varied local, state and federal agencies, non-profits, and foundations all with their own reporting requirements and reimbursement schedules. The District has experience in working within this financial framework and has a reputation of completing projects on-time and within budget.

Economic Feasibility Assessment

While the Grants Specialist project will provide obvious tangible benefits to the region through acquiring dollars for projects, there are additional tangible and intangible benefits. These benefits are tied to the projects that result from the funds acquired. As proposals will be developed for projects included in the Upper Sac IRWMP, regional objectives will be addressed. As the nature of this Grants Specialist project requires on-going communication and collaboration with stakeholders within the region, the project will contribute to the sustainability of the IRWMP process.

The benefits and costs associated with the project are included in the table below:

Benefits	
Tangible	• The actual number of dollars generated by this project will be determined by the types of project proposals that the grant writer is tasked with. Because of this, an actual dollar amount is unknown. According to American Grant Writer's Association, rates for researching and writing proposals are between $40 and $100 an hour. Costs for this project easily fall into the low end of this range. Additional value will be realized with the benefit of the writer being affiliated with the Upper Sac IRWMP, and having knowledge of local conditions, and experience with diverse stakeholders.
Intangible	• By seeking funds for projects that have been vetted through the Upper Sac IRWMP, this project has the potential to meet all nine Objectives identified in the IRWMP. • This project will support the sustainability of the Upper Sac IRWMP effort by facilitating ongoing communication and collaboration among members through the term of the project.
Costs	
Capital *(Initial costs to complete the project)*	• Estimated project cost is $45,339.85. Please refer to Attachment 1 budget summary submitted for the project.

I. Project Status: Ready to proceed pending funds

J. Strategic considerations for IRWMP implementation:
Through conversation it became evident that the project could benefit from being a "shared position" to cover the entire Upper Sacramento IRWMP area. By having the WSRCD focus on the southern area, and another entity that is more familiar with that geography focus on the northern area, a more efficient proposal development process may arise. In addition, a shared position would allow the separate specialists to develop close working relationships with their local stakeholders while a larger regional outlook could be developed through the partnering of the two individual specialists.

K. Contribution of the project in adapting to the effects of climate change:
The objective of this program is to pursue funding opportunities to implement programs and projects consistent with the IRWMP. Projects identified through the IRWMP will have incorporated consideration of climate change adaptation and mitigation strategies as a requirement to be included in the plan, and the Grants Specialist will ensure that climate change considerations are incorporated into related project proposals.

L. Contribution of the project in reducing GHG emissions:
The Grants Specialist will ensure that GHG considerations are incorporated into related project proposals.

Annual emissions: Due to the nature of this project, the greenhouse calculation worksheet is not applicable. While there are no direct construction-related activities involved in this project, the WSRCD recognizes that all activities do have an environmental footprint. To reduce greenhouse gas emissions, travel will be kept to a minimum. Telephone, teleconferencing, web meetings, and email communication will be used as appropriate to reduce unnecessary travel. On site group meetings will be scheduled at a location with a consideration of the number of travel miles. Greenhouse gas emissions generated through office activities will be controlled through keeping printing at a minimum, and the use of paper derived from at least 30% recycled materials.

Climate Stewardship Coordinator —
Ready to Proceed; Priority 1

Sponsor: Western Shasta Resource Conservation District
Location: Shasta County portion of the USR
Partners: potentially, other RWMG members
Budget: $89,000
Abstract: The proposed project will provide a Climate Stewardship Coordinator for the purpose of expanding and leading a Climate Adaptation Team currently active in Shasta County, perform climate education activities, and research available grants and funding to implement climate change risk reduction measures. While the primary

focus would be Shasta County, the project could be used as a model for the rest of the Upper Sacramento IRWM area.

The goal of this project will be to consolidate the needs of individual watersheds (of the hydrologic unit code (HUC) level 8) into a broader scope and increase ecosystem resiliency to climate change. This process will help to eliminate duplicative efforts while establishing new partnerships and combining resources throughout the Upper Sac IRWMP area. By sharing resources and combining efforts, the HUC 8 watersheds in the region can accomplish more together than they would individually. The regional effort would benefit both the resources and stakeholders by:

- Better assurance that the activities of diverse stakeholders compliment each other's common goal of maintaining and improving water quality and quantity in the region
- Facilitating information exchange to allow stakeholders to learn from each other, reduce redundancy and increase efficiency of individual group efforts
- Assuring consistency with education and outreach messages
- Facilitating identification and obtaining funding for projects

Review Factors:

A. IRWM Objectives:
Funding a full time Climate Stewardship Coordinator will effectively promote all aspects of the plan and work towards sustaining the plan over the long term. All nine Upper Sacramento IRWMP objectives could be addressed.

Major adaptation goals of this project include:
- Reducing the risk and manage the effects of catastrophic wildfire
- Reducing erosion from areas disturbed by wildland fires and roads
- Reducing the potential for infestations of pests and invasive species
- Maintaining healthy fish and wildlife species and improve accessibility to potential habitats
- Maintaining a clean, sustainable supply of water for social, public health, economic, and environmental purposes
- Reducing the risks and prepare for consequences associated with flooding and drought
- Ensuring a local voice is heard in regards to federal and state water and land use policies
- Promoting resilience within watersheds and communities to better adapt to the effects of climate change.

B. Resource Management Strategies:
Funding a full-time Climate Stewardship Coordinator will effectively promote all aspects of the plan and work towards sustaining the plan over the long term. All Upper Sac IRWMP RMS's could be addressed.

Climate change can be difficult to grasp and is often viewed as controversial by the public. The intent of this proposal is to work with agencies, local officials, and scientists to develop regional messaging strategies through multiple venues and vehicles, such as fact sheets, brochures, public service announcements (PSAs), interpretive signage, and any other method deemed appropriate. This will provide those attempting to convey climate change adaptation strategies to the public, a comprehensive unified description on the effects of climate change in the Upper Sacramento IRWMP area.

C. Technical Feasibility:
The region is experiencing unpredictable weather, a rise in average ambient temperatures, periodic large storm events, and increased periods of drought due to impacts from climate change. This, in turn, jeopardizes the health of our forests and water resources and the economy that are dependent on them. Wildland fires, erosion, pest and invasive plant species infestations are expected to worsen and wildlife habitat will become additionally stressed. Water supply may become less predictable, and flooding and drought periods more frequent. This creates added risk to fishery resources, hydroelectric power generation, and local control of our precious water. To address these risks, many efforts are already being undertaken on a federal, state and local level to mitigate for, and react to, the changing climate.

As a result of community interest in climate change, the WSRCD formed a stakeholder team that includes representation from forestry, education, and federal, state and local governments. This team participated in the Climate Solutions University one-year assessment and planning process of webinars, meetings and telephone calls to gain a common base of understanding of how climate change is likely to affect the counties' resources and what gaps in information are present. The team performed literature searches and interviews with local experts regarding related economic, forest, and water resource issues. Through team meetings, email exchanges and telephone calls, the team collaboratively assessed these resource issues and developed a forest and water resources climate adaptation plan for Shasta County.

D. Specific benefits to critical DAC water issues:
While there are no critical water issue benefits as described in DWR's Guidelines, the project will focus on enhancing climate stewardship communication and coordination among federal, state, tribal, and local governments, and other stakeholders. The increased communication and coordination will promote effective working relationships between stakeholders. Successful implementation will lead to greater protection of critical forested watersheds, more healthy streams and aquatic habitat, maintenance of economic stability through disaster risk management, healthy timber and tourism economies, and adequate water supply and water quality to meet community and ecosystem needs. These benefits would be provided to DAC's and the entire watershed community.

E. Specific benefits to critical Native American water issues:
While there are no critical water issue benefits as described in DWR's Guidelines, the project will focus on enhancing climate stewardship communication and coordination among federal, state, tribal, and local governments, and other stakeholders. The increased communication and coordination will promote effective working relationships between Native American and other stakeholders. Successful implementation will lead to greater protection of critical forested watersheds, more healthy streams and aquatic habitat, maintenance of economic stability through disaster risk management, healthy timber and tourism economies, and adequate water supply and water quality to meet community and ecosystem needs. These benefits would be provided to Native Americans and the entire watershed community.

F. Environmental justice considerations:
No environmental justice issues in regards to implementing this project have been identified. The collaborative nature of this project lends itself to ensuring environmental justice issues are considered.

G. Project costs and financing:
This project could begin immediately upon securing funding. Project duration to be one year and would increase to multi-year if supported. As permitted, attachments will be included later.
   a. Total un-funded to date (project need/funding request): $90,000
   b. Please describe secured funding sources: none as yet
   c. How operations and maintenance will be covered: no traditional O&M.

H. Economic Feasibility:
Financial Feasibility Assessment
The WSRCD is a special district of the State of California in operation since 1957. The District has a diverse workload funded through contracts as well as grants. Despite the economically challenging times, the WSRCD is fiscally sound. This is demonstrated by the number and value of Service Agreements increasing from 17, valued at $1,528,123 on July 1, 2009 to 34, valued at $2,389,582 on June 30, 2012. The WSRCD's diverse portfolio of projects is funded by varied local, state and federal agencies, non-profits, and foundations all with their own reporting requirements and reimbursement schedules. The District has experience in working within this financial framework and has a reputation of completing projects on-time and within budget.

Economic Feasibility Assessment
The Upper Sac IRWMP region's economy and environment are interdependent. The area's quality of life draws people to visit as well as reside, both which generate income for the region. By collaboratively managing natural resources in response to the changing climate, the area can

proactively care for the related economic system dependent on those resources. The benefits and costs associated with the project are included in the table below:

Benefits	
Tangible	• Updated Forest and Water Climate Adaptation Plan — estimated value $50,000 • Preliminary Ecosystem Services Assessment Report — estimated value $20,000 • Development and distribution of climate adaptation outreach brochure — estimated value $5,000 • Project information and products publically available on the Climate Stewardship website — estimated value $1,000 • Presentations to community — estimated value $1,000
Intangible	The project will benefit the Upper Sacramento IRWMP region as it will meet all nine Objectives. The benefits are intangible as dollar amounts are not easily identified. • Objective 1 will be met through distribution of the climate adaptation plan and outreach materials developed through this project. • Objective 2 will be met through enlarging and facilitating the climate adaptation team. • Objective 3 will be met through inviting indigenous people to participate in the climate adaptation team which will collaboratively develop and implement strategies to reduce negative impacts to forest and water resources and related health and safety risks due to a changing climate. • Objective 4 will be met through collaboratively developing and implementing appropriate strategies such as reducing the risk of catastrophic fire and the resulting erosion. • Objective 5 will be met by the climate adaptation team considering disadvantaged communities and cultural values of existing communities while developing and implementing strategies in the adaptation plan. • Objective 6 will be met through refining the adaptation plan to reflect additional local needs and distributing it as appropriate to decision makers and land managers. • Objectives 7 and 8 will be met through collaboratively developing and implementing appropriate strategies to maintain a clean sustainable water supply for social, economic and environmental purposes. • Objective 9 will be met through collaboratively developing and implementing appropriate strategies to reduce the risks and prepare for consequences associated with large storm events.
Costs	
Capital *(Initial costs to complete the project)*	• Estimated project cost is $88,954.80. Please refer to Attachment 1 budget summary submitted for the project.

I. Project Status: Ready to proceed pending funds

J. Strategic considerations for IRWMP implementation:

If implemented, this project would integrate multiple issues at multiple levels. While the project would focus on Shasta County primarily, all Upper Sacramento IRWMP members would be invited to participate. The plan and processes could be used as a model for the IRWMP areas that is outside of Shasta County. The WSRCD explained the project briefly during a proposal development meeting and other participants expressed interest in the climate adaptation plan that was developed for Shasta County. A web link to a copy of the plan is being made available. The project has also been submitted to the Northern Sacramento Valley IRWMP effort for inclusion is the region's plan and as such there is potential to integrate inter-regionally.

K. Contribution of the project in adapting to the effects of climate change:
The Shasta County climate adaptation team and plan (to be used as a model) focuses on bringing climate resilience by addressing forest, water and economic risks with adaptation strategies and opportunities in voluntary, collaborative initiatives. This project is intended to supplement existing planning and management efforts, and assist in moving the community toward more coordinated climate resiliency. As federal, state and local agencies have developed, or are developing action or adaptation plans in relation to their interests, the project attempts to recognize these disconnected efforts and identify opportunities to forge collaboration and fill gaps.

L. Contribution of the project in reducing GHG emissions:
Efforts contributed by the climate coordinator will help to reduce emissions through education and outreach, coordination of transportation planning and implementation, and other activities.

Annual emissions: Due to the nature of this project, the greenhouse calculation worksheet is not applicable. While there are no direct construction related activities involved in this project, the WSRCD recognizes that all activities do have an environmental footprint. To reduce greenhouse gas emissions, travel will be kept to a minimum. Telephone, teleconferencing, web meetings, and email communication will be used as appropriate to reduce unnecessary travel. On site group meetings will be scheduled at a location with a consideration of the number of travel miles. Greenhouse gas emissions generated through office activities will be controlled through keeping printing at a minimum, and the use of paper derived from at least 30% recycled materials.

Water Talks and Coordinated Educational Water Management Programs Project —

Conceptual; Priority 2

Sponsor: California Trout
Location: Throughout the USR
Partners: to be determined
Budget: to be determined
Abstract: Water Talks are a series of informational and educational presentations to provide the public with a place to learn about water-related topics in our region. Since 2008 California Trout has facilitated 22 programs regionally involving 63 volunteer local and regional expert presenters with an overall attendance of over 900 people. California Trout will continue to offer six programs a year on relevant water-related topics.

Currently many regional groups (CalTrout, River Exchange, Siskiyou Land Trust, Shasta Valley RCD) have specific educational programs (Water Talks, Sustainable Watershed Series, Slideshow series, Sustainable Forestry Workshops). There is minimal coordination among these efforts (just checking to make sure not to schedule on the same dates). We will develop coordinated educational 'learning outcomes' to expand and enhance these existing educational programs on watershed conditions and management.

Existing conditions and issues that show the need for the project: By providing a place to learn about water-related topics from a diversity of perspectives in a professionally facilitated environment, the Water Talks program facilitates relationships of trust and understanding among people in the region.

Project work to address the identified need and the anticipated outcomes/deliverables:

- Facilitate six Water Talks programs per year
- Coordinate the four existing watershed condition and management programs to have complimentary learning outcomes
- Share best practices
- Develop measurement protocols for planning future programs

Review Factors:

A. IRWMP Objectives: Meets overarching goals for climate change and Native American values, and Objectives 1 and 2
B. Technical Feasibility: Since 2008 California Trout has facilitated 22 programs regionally involving 63 volunteer local and regional expert presenters with an overall attendance of over 900 people.

McCloud 9 — Renewable Retrofit of a Retired Mill Site — *Conceptual; Priority 2*

Sponsor: McCloud Watershed Council (MWC)
Location: Abandoned mill site in McCloud, CA
Partners: Potential partners include the McCloud Local First Network, the Winnemem Wintu, Siskiyou Land Trust, and US Forest Service
Budget: $60,000
Abstract: McCloud 9 ~ Climate Community is a rural sub-division that aims towards the biological restoration and solar renovation of a retired mill site. Designed around the retired McCloud River Mill site and adjacent rail yard, McCloud 9 has a few potential attributes that, if well-executed, could powerfully catalyze our regional efforts towards climate mitigation and statewide mandate to reduce GHG emissions 80% by 2050.

In the creative phase of our design process, primary objectives include:

- Remediating contaminated soils using biological (plants and mushrooms) methodologies
- Cleaning-up, reusing and/or recycling scrap wood, metals and other junk scattered about
- Restore habitat to support indigenous flora and fauna (invasive species eradication and wildlife corridor)
- Riparian restoration (daylight creeks and refill ponds)
- Existing building rehabilitation to establish non-toxic-affordable-solar housing, as well as community and educational facilities.
- Solar thermal, photovoltaic, micro-hydropower and biomass energy generation
- Forest and arable land management to maximize carbon sequestration
- Organic food & fiber cultivation, preparation & distribution
- Waste reuse & recycling facility
- Climate education, outdoor recreation and ample opportunities for local/public participation

Currently owned by Nestle Waters North America, the 250+-acre property (comprised of five parcels) has reportedly been on the market since 2009 when Nestle cancelled their contract to erect a massive water-bottling facility on the retired mill site. During this time, the MWC investigated enduring concerns about residual toxins and potential groundwater contamination from prior operations. Sure enough, we found mill-site closure documents absent from the public domain. Upon inquiry, the Regional Water Quality Control Board did eventually require Nestle to reveal the documents that indicate where and what contaminants have been identified (http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL0609337593).

According to recent inquires, Nestle has their property listed for $1.2 million. This, however, was the listing price back before Nestle revealed their previously undisclosed mill site closure reports. We are uncertain how this disclosure may affect the property value. We are, however, aware that Roseburg deeded their contaminated mill site to the City of Mt. Shasta for $1. Regardless of financing, the MWC is very interested in the productive revitalization of this particular property, as it is located in the heart of our community and has the potential to resuscitate a vital community and enduring economy for our region.

Because this project is so big and has the capacity to serve many different ecological and cultural interests in a mutually beneficial fashion, we would like to involve interested community members in the design phase and acquisition process. As this pertains to the Upper Sacramento IRWMP, we sense that a feasibility study might be a good place to start? We gratefully solicit any insight and guidance this particular circle of watershed stakeholders has to offer.

Building Relationships of Trust and Understanding — *Conceptual; Priority 2*

Sponsor: California Trout
Location: Vicinity of Mt. Shasta
Partners: to be determined
Budget: to be determined
Abstract: There are many "challenge" issues that have been identified in the Upper Sacramento IRWM plan, Objective 2 is to build relationships of trust and understanding among stakeholders with the desired outcome of people understanding each other's interests better and with the hope of being able to work together to meet the shared objectives of the IRWM plan. This project will convene meetings of stakeholders interested in the various "challenge" issues to have productive dialogues and conversations with the hope that trust, understanding and potential collaboration goals can be met. An example would be convening interested stakeholders in the potential reintroduction of salmonids above Shasta Dam with the goal of being able to understand the interests, concerns etc. and to come up with a shared set of guidelines/interests of regional stakeholders to be able to give to NOAA fisheries related to the potential reintroduction. The process of convening stakeholders interested in the RWMG's "challenge" issues will also aid in project integration and in the feasibility of meeting plan objectives.

Review Factors:

A. IRWMP Objectives: Meets overarching goals for climate change and Native American values, and Objectives 1 and 2. It supports all of the objectives by helping overcome the hurdles to implementing challenge projects in all of the objective areas.
B. Technical Feasibility: California Trout has a history of being a participant and convener of diverse collaborative groups focused on conservation issues and can serve as a facilitator for dialogues to generate understanding.

Shasta Climate Initiative — Curriculum Development & Implementation — *Conceptual; Priority 2*

Sponsor: McCloud Watershed Council
Location: throughout the USR
Partners: to be determined
Budget: to be determined
Abstract: Shasta Climate Initiative endeavors to develop and deliver curriculum tailored to engage industry, government, students and community leaders in climate mitigation and adaptation best suited for the Upper Sacramento headwaters region. Integrating a broad base of experience and knowledge gleaned from sources both local and abroad, the curriculum would be place-based and experiential, designed to build practical skills and transfer knowledge into action.

Incorporating various dimensions of environmental stewardship and governance, Shasta Climate Initiative would focus upon the common goal of restoring atmospheric carbon dioxide concentrations to 350 ppm. Our mission to comply with or exceed California's AB 32 mandate would require broad public and private sector participation and ultimately achieve the global imperative of reducing greenhouse gas emissions 80% by 2050 at the local level.

Headwaters Stewardship Fund — *Conceptual; Priority 2*

Sponsor: McCloud Watershed Council
Location: Throughout the USR
Partners: any USR RWMG member
Budget: $60,000
Abstract: The Headwaters Stewardship Fund is a collaborative endeavor to generate public interest and investment in the biological resources and ecological integrity of the Sacramento Headwaters region. Our primary goals are to 1) Finance restoration, conservation and clean energy in the Mount Shasta area; 2) Stimulate sustainable economic opportunities in the community service industries; and 3) Increase public awareness and participation in equitable natural resource management in the region.

Three primary streams of revenue would serve, initially, as matching funds for IRWM projects:

Headwaters Stewardship Fund – three revenue streams:

- $3 voluntary surcharge on Mt. Shasta City, City of Dunsmuir, McCloud Community Service District monthly utility bills — investing residents
- $3 voluntary surcharge at participating accommodations and businesses such as hotels and restaurants — investing patrons
- Voluntary 3% net profits / operating budgets from natural resource industries (scaled appropriately for 501c3, LLC, municipal and county incorporations)

HSF partners and stakeholders invest a nominal fee on a monthly, annual or one-time basis to generate matching funds for select ecosystem restoration, conservation and climate mitigation projects in the region. Area residents and patrons who pay into the fund have the option of becoming informed about and participating in constructive dialog surrounding natural resource issues of common concern, as well as submitting proposals for reducing GHG emissions and/or restore ecosystem integrity. Participating residents may vote on fund allocation.

10.5.4 Restoration and Conservation

Rainbow Ridge Collaborative Forest Stewardship —
Ready to Proceed; Priority 1

Sponsor: Shasta Valley RCD
Location: Rainbow Ridge
Partners: Siskiyou Land Trust, Natural Resource Conservation Service, Mt. Shasta Trails Association, Mt. Shasta Chapter of the Audubon, College of the Siskiyous
Budget: $50,000 for planning and implementation; 20% cost share
Abstract: This project is the short- and long-term forest management portion of a larger Rainbow Ridge landscape stewardship program. Forest stewardship encompasses the various aspects of forest management as they pertain to forest health, habitat, fire resiliency and water quality and is essential to resolving many of the issues that have developed as a result of decades of fire suppression. On Rainbow Ridge, forest stewardship on a landscape level requires collaboration and participation by several adjacent landowners as this residential area has almost 200 property owners. We are working with groups of these landowners who are interested in collaborating to meaningfully restore the forests they live in.

This project is being carried out in two phases; planning and implementation. Phase 1 will utilize the methodology of Dr. Eric Knapp of the USFS Pacific Southwest Research Station to develop collaborative and cooperative management plans for landowners of two pilot project areas encompassing over 600 acres of forest land and nine or more landowners. Dr. Knapp is the Research Ecologist of Fire and Fuels and has been working the 1,700-acre Stanislaus-Tuolumne Experimental Forest on the Stanislaus National Forest to emulate natural disturbance through fuel treatments and study the effect of fire on the habitat of plant and animal species.

Phase 2 of this project is being guided by the forest management plans. Forest management will utilize a heterogeneous clumping restoration technique that matches treatment to historic and current forest conditions. These activities will improve forest health, wildlife habitat, protection of water resources, fire resiliency and will improve the ability of fire crews to prevent ecological and property damage in the event of a catastrophic fire. Implementation will include light, specifically defined thinning, ground and ladder fuel removal and chipping and/or pile burns. Areas treated around the springs landowners depend on for water supply will be managed to protect the water quality and quantity.

Review Factors:

A. IRWMP Objectives:
   Objective 2: Encourage, improve and maintain an environment that fosters cooperation, facilitates collaboration, and builds relationships of trust and respect among water resource stakeholders and community members with respect to water management efforts within the region.

   By working together with the landowners in the creation of forest management plans, we will combine landowner knowledge with the latest fire ecology and forest health research utilizing the research of Dr. Eric Knapp and others.

   Objective 5; Ensure support for and foster success of water management efforts for disadvantaged communities including Indigenous Tribes and Nations while respecting the cultural values of existing communities.

   Implementation activities will improve forest health, protect wildlife habitat and water resources and improve forest resiliency to fire, infestation and disease.

   We will consider the impacts of climate change throughout this project. The impacts of climate change include an increased risk of catastrophic fire, will widen the geographic range and lengthen the season of native and invasive insect attacks and increase the vulnerability of trees to disease through heat and drought stress. Healthy forests will be more resilient to fire, disease and infestation, thereby mitigating some of these negative consequences in the long term.

B. Resource Management Strategies:
   Ecosystem Restoration: Heterogeneous forest management and the break of fuel continuity work restores the natural make-up of ecosystems through allowing for a clearer, more productive forest that provides additional shelter and food resources for a more varied number of species.

   Forest Management: This project will specifically address the Forest Management RMS, which calls for stakeholders to “[p]rotect regional forests from catastrophic fire through strategic fuels management programs.”

   Watershed Management: Fuels control efforts help to protect terrestrial, aquatic, and human habitation resources. Catastrophic fires impact all facets of a watershed; ecologically intense fires can result in habitat degradation, soil erosion and sedimentation of water sources, while destroying property and endangering lives. In addition, effective fuels control usually requires a collaborative approach for task and economic efficiency; this is a specific component of the watershed management strategy identified in this Plan.

Land Use Planning and Management: The USR is a diffuse, largely rural area, with many wildland-urban-interface (WUI) areas. These are dangerous places for catastrophic fire, and are expensive to defend against it. This project will help to protect these WUI areas, as well as the viewshed and character of the region.

C. Technical Feasibility:
The Natural Resource Conservation Service, a partner in this project, participated in dozens of fire and fuels control projects, and anticipates that this project will be no different. The Shasta Valley Resource Conservation District is implementing a demonstration project utilizing this forest management strategy, however heterogeneous forest management have been thoroughly researched and implemented throughout the state and the west coast. No experimental technology or techniques are being employed; all strategies are tested and proven.

D. Specific benefits to critical DAC water issues:
Clearing for fuels control on Rainbow Ridge will result in protection of the homes and infrastructure in the neighborhood while safeguarding habitats and water sources.

E. Specific benefits to critical Native American water issues:
This project will not specifically address critical Native American water issues.

F. Environmental justice considerations:
Fuels control activities will create temporary noise and some air pollution that may affect neighbors in the immediate vicinity. Because the negative effects are temporary and the benefits substantial to these same residents, there are no long-term environmental justice considerations.

G. Project costs and financing:
   a. Total estimated project cost (include cost share AND funding request): $50,000
   b. Total un-funded to date (project need/funding request): $50,000; we expect to have matching funding identified and secured in the next six months.
   c. Please describe secured funding sources as shown in the second worksheet in Attachment 1A: A National Forest Foundation grant represents $10,000 of the total cost of the project.
   d. How operations and maintenance will be covered: The RCD has funding in place to revisit fuels control sites periodically to do regular maintenance. Monitoring of forest conditions and wildlife will be included as a part of the project.

H. Economic feasibility:
Financial Feasibility Assessment

Financial Capacity
The Shasta Valley Resource Conservation District (SVRCD) does have the financial capacity to cover the incurred project costs until reimbursement is received. SVRCD has over 20 years of experience in completing projects up to and exceeding one million dollars in the Shasta Valley.

Ongoing Costs
This project will be taking place on the properties of private land. For the short term, the SVRCD will be responsible for conducting monitoring forest treatment activities before, during and after implementation over the next two years. The SVRCD and NRCS will work with landowners to develop long term plans for forest maintenance. Due to the nature of the treatment activities, costs associated with long-term management will be minimal and will likely be recoverable via the sale of merchantable timber; however the responsibility for long-term management will lie with the landowners.

Financial Feasibility
The proposed Forest Stewardship project is financially feasible. The SVRCD is confident that we can have the financing in place to complete the project with reimbursable grant funds from the state and we have written agreements with the private landowners to provide funding to cover the on-going conservation easement stewardship monitoring costs.
Economic Feasibility Assessment

Benefits	Tangible/Intangible	Private/Public
Water Supply and Watershed Protection: Several studies indicate a correlation between catastrophic fires and increased sedimentation due to a reduction in ground cover. Forest Stewardship activities will decrease the risk of catastrophic fire, reducing the risk of sedimentation in water-ways. Additionally, removal of trees and brush to restore overstocked forests will reduce water demands by biota, leaving more to flow to streams.	Intangible: This benefit is mostly an intangible benefit. Studies have shown that improved forest management increase water supply and quality, and that catastrophic fires increase sedimentation in water systems, however exact quantities of water and sedimentation are variable	Public Benefit: Improved water supplies and quality is a public benefit that would benefit both the downstream communities and aquatic wildlife.
Increased interest in Forest Stewardship treatments and management: By hosting field tours and conducting forest stewardship on visible portions of the Mount Shasta Viewshed, other forest landowners will be encouraged to implement similar projects	Intangible benefits involve the visual impact of forest stewardship that will encourage other landowners to similarly manage their forests.	Public/ Private Benefit: Forest stewardship beyond the project area will improve the health and fire resiliency of private forests while improving the community's resilience to fire and protecting the viewshed.
Enhanced Wildlife Habitat and Ecological Health: Thinning	Tangible: Portions of the project will be monitored	Public Benefit: conserving wildlife habitat t benefit special

Benefits	Tangible/Intangible	Private/Public
overstocked forests can improve diversity of flora and fauna species by creating openings where conifer encroachment has diminished them, and reducing competition among sun-loving and shade-tolerate species.	before and after treatment to observe changes in forest usage by avian species.	status species is considered a public benefit.
Avoiding loss of public and private forestland due to catastrophic fire: This project will reset overstocked forest conditions to historic levels of biomass and reduce pathways for fire to travel by breaking up fuel continuity.	Tangible: 50 acres of forested land will be restored utilizing local skills and efforts.	Public Benefit: Reducing biomass in overstocked forests will help to slow or stop a wildfire. This will protect the lives, homes, and property of those living in this area.
Enhanced Carbon Sequestration for Climate Change Mitigation: properly managed forests are excellent carbon sinks, while overstocked forests reduce the ability for forests to absorb more carbon	This is still an intangible benefit due to the fact that there is not an established market for the additional carbon sequestered and that carbon capture will not be monitored throughout the duration of this project.	Public Benefit
Enhanced Recreational/Scenic Benefits: Rainbow Ridge is situated west of Mount Shasta City and is a very visible location along the Interstate 5 corridor.	Intangible: this project will enhance the viewshed of a town that is highly reliant on nature-based tourism.	Public Benefit

Costs	
Capital Costs	• NSO survey and Notice of Operations under Non-Industrial Timber Management Plan
Operational Costs	• Contract with a Registered Professional Forester and Licensed Timber Operator, Pre- and Post-project monitoring, educational field tours
Externalities	• This project does not have any externalities.

Cost-effectiveness Analysis

There are several benefits to be gained through collaborative forest stewardship both on the public side and the private side. Public benefits include protecting the water quality and supply, restoring wildlife habitat and forest health, improving forest and community resilience to fire, protecting scenic viewsheds, enhanced carbon sequestration, and encouraging interest in forest stewardship throughout the landscape.

This project is being made cost-effective through partnership with the College of the Siskiyous, the Natural Resource Conservation Service and the Audubon to complete field prescriptions and monitoring.

Continued management will be the responsibility of the landowner. However, forest stewardship gives landowners the opportunity to reset their forest conditions. Forest management on many parts of Rainbow Ridge have been delayed for an extended period of time that a significant amount of time and energy is required to return them to a manageable state. Investing in these initial collaborative forest treatments will reduce the cost of long term management while providing an immediate benefit through improvements to forest health, a reduction in the risk of destructive fire and protection of the community viewshed.

I. Project status: ready to proceed pending financing
The RCD has already secured the right to go onto private property to complete the fuels control effort. All tools and crews have been identified and only the funding is required to proceed.

J. Strategic considerations for IRWMP implementation:
As described in the sections above, the project is well integrated with and satisfies multiple IRWM objectives and resource management strategies. The accomplishment of this fuels control project would contribute significantly to the IRWMP implementation on levels of habitat, watershed management, and ecosystem services. It is a significant issue for the region on a long-term level, as catastrophic fire occurrence is projected to increase with changing hydrologic regimes due to climate change. This is a high-priority issue and is a necessary public good for the region.

K. Contribution of the project in adapting to effects of climate change:
As identified in Chapter 9, Climate Change, catastrophic wildfire is one of the concerns of highest risk and urgency in the region. This project directly addresses that concern through the mitigation of fire risk on Rainbow Ridge.

L. Contribution of the project in reducing GHG emissions:
Fuels control efforts will enhance forest carbon stores and mitigate for potential emissions from catastrophic fire. This helps the State to meet its reduced GHG emissions targets through: 1) ensuring continued CO_2 sequestration through productive forest growth; and 2) mitigating potential catastrophic fire, and thereby negating those emissions.

Emissions quantification: Over a 15-year life, the project is expected to emit an annual average of 0.14 MT of CO_2e.

Upper Sacramento and McCloud Watershed Working Forest Conservation Easements —

Ready to Proceed; Priority 1

Sponsor: The Pacific Forest Trust, Inc.
Location: throughout the USR
Partners: to be determined — likely made up of private forestry businesses
Budget: $22,500,000 (estimated 78% match)
Abstract: Private forestland owners are faced with many economic and regulatory pressures that force them to subdivide and sell their forested property for development,

and forgo practicing voluntary management techniques that would benefit watersheds, wildlife habitat, and public recreation. Due to these pressures, important forested watersheds are being fragmented and converted, losing the many public benefits they provide to our local communities and the State of California.

This project will acquire working forest conservation easements (WFCEs) on approximately 25,000 acres of privately owned forestland in the Upper Sacramento and McCloud Watersheds. These WFCEs will prevent the conversion of these private lands out of forests and will meet multiple goals outlined in the IRWMP including:

Water Supply and Watershed Protection: The WFCEs will ensure long-term protection of regional water quality and supplies through forestry restrictions, road management BMPs, riparian buffers that are more restrictive than state regulations and conservation of stream flows.

Enhancing Wildlife Habitat and Ecological Health: The WFCEs will conserve and restore habitat for multiple species through encouraging greater structural diversity and other enhancements. Additionally, the WFCEs will conserve rare and unique habitats within the conifer forests such as wet meadows, aspen stands, and hardwoods.

Supporting Timber Management & Local Economies: The WFCEs will conserve the private land as working forestland permanently ensuring its availability for sustainable timber harvest and supporting the local, resource-based economy.

Enhanced Recreational Opportunities: The WFCEs will open up private lands to daytime public access for uses such as hiking, biking and wildlife viewing.

Review Factors:

A. IRWMP Objectives:

Objective 3 Maintain and Enhance Ecological Health: The acquisition of the proposed WFCEs will directly meet one of the measurements for Objective 3 by implementing a project that would improve/protect ecological health of the basin at the landscape level while sustaining the local economy. Such WFCEs will provide permanent protection to wildlife habitat diversity and key structural elements, including riparian areas and wet meadows on private, commercial timberland meeting conservation goals for ecosystem functionality across multiple public and private ownerships. The projects will provide long-term water quality protection to significant portions of the McCloud and Upper Sacramento watersheds while encouraging continued commercial timber management that supports the local, resource-based economy.

Objective 4 Support and Improve Ongoing Forest Management: The acquisition of WFCEs on private, commercial timberlands will implement land use restrictions that directly support forest management for healthy forests, reduce fire risk and enhance water quality. The WFCEs will prevent development of forestland that would increase the WUI areas with associated hydrologic impacts and increased fire threats to local communities. They will ensure sustainable management of forest resources to establish and maintain a complex, native forest ecosystem on the properties. Additionally, the WFCEs will require that streams and springs on the property be protected through riparian management buffers that are more stringent than state regulations, limitations will be placed on road construction and other activities that can lead to disturbances and sedimentation of the watercourses, and water will be dedicated to on-property uses and in-stream flows. As described further in Section K, below, forest management will be guided to contribute to implementing the state's climate adaptation strategy.

B. Resource Management Strategies:
Ecosystem Restoration: The land use restrictions in the WFCEs will enhance and protect the ecosystem functionality on strategic private timberland in the Upper Sacramento and McCloud watersheds. The easement restrictions will:

- Prevent the subdivision and conversion of these forested, watershed properties to developed uses that would negatively impact watershed function.
- Promote sustainable, commercial timber harvest that is compatible with the conservation of other ecosystem values across the property with specific goals to manage the forests to restore a more native, complex forest ecosystem.
- Maintain and enhance sensitive and rare habitat types such as wet meadows, springs, aspen groves, and oak stands through the designation of Special Habitat Management Zones focused on habitat enhancement.
- Limit road construction and other activities that increase habitat disturbance and watercourse sedimentation.
- Designate riparian management zones that are wider and more restrictive than state regulations to protect water quality and supply.

Forest Management: This project will specifically address the Forest Management RMS, which calls for the identification of opportunities to acquire conservation easements to prevent the conversion of the property out forestland. The conserved properties have been selected to improve cross-ownership ecological functionality.

Watershed Management: These WFCE projects strategically link to adjacent public lands that are managed for watershed benefits and as late-successional reserves. The WFCEs will allow for the protection of terrestrial and aquatic habitats that create an interconnected network of public and private lands that are collaboratively managed for habitat and watershed values.

C. Technical Feasibility:
The Pacific Forest Trust (PFT) is a recognized national leader in the development of working forest conservation easements. Over the past 20 years we have successfully completed 23 conservation easements on over 50,000 acres of land (with over 17,000 acres of those projects being located in

the McCloud/Upper Sacramento Watersheds). We currently have an additional 18,000 acres of WFCEs under option in the McCloud watershed. We work collaboratively with a number of state and federal agency partners to best assure the effectiveness of our conservation easement restrictions in accomplishing the desired habitat and watershed protection goals. As a third-party accredited land trust, PFT has been recognized for our high standards in project development, implementation and our permanent commitment to stewarding and enforcing the land use restrictions agreed to in our conservation easements.

With over 10 years of experience doing working forest conservation easement projects in the McCloud/Upper Sacramento Watersheds, we are intimately familiar with the forest and habitat types, watershed conditions, and the forest management techniques on both public and private lands. We have a network of other local, regional and state partners that we work with to develop these projects in a way that utilizes the best available science in developing land use restrictions that achieve measurable, on-the-ground conservation of water quality, wildlife habitat, recreational opportunities, and continued sustainable forest management.

D. Specific benefits to critical DAC water issues:
The acquisition of these WFCEs will result in protection of the natural infrastructure that helps to sustain the upper watersheds of Dunsmuir's (a DAC) water supply. The easements will conserve riparian buffers and water quality as well as wet meadows that provide natural water storage. These protections to the natural infrastructure in the upper watershed will augment the City of Dunsmuir's water conveyance systems to help protect water quality and supply to the town's population.

E. Specific benefits to critical Native American water issues:
This project will not specifically address critical Native American water issues; however, the WFCEs will help conserve and restore overall watershed functioning and water flows that benefit Native American uses. Cultural sites and resources will continue to be protected pursuant to Siskiyou County policy and state law.

F. Environmental justice considerations:
The act of acquiring WFCEs will not require any physical work on the property and therefore will not create any noise, pollution or other negative impacts that would impact any neighboring communities or landowners. The benefits of the project would be widespread. The additional water quality protection measures would enhance both local and state water supplies. The enhanced recreational access to the properties would be open to the general public and protection of scenic resources could be enjoyed by the general public from public highways and adjacent US Forest Service lands. Based on

the lack of negative impacts and the widespread public benefits from these projects, we fulfill the equitable goals of environmental justice.

G. Project costs and financing:
   a. Total estimated project cost (include cost share AND funding request): $22,500,000.00
   b. Total un-funded to date (project need/funding request): $22,500,000.00 This project is in the early stages, and we would expect to have matching funding identified and secured at the time that an IRWM grant would be moving forward.
   c. Please describe secured funding sources as shown in the second worksheet in Attachment 1A: Matching funds have not been secured to date, but we do have interest in the project from the California Wildlife Conservation Board and the Federal Forest Legacy Program.
   d. How operations and maintenance will be covered: PFT will have agreements in place where the landowners will provide donations to PFT's Stewardship Fund at the time of the project closing. These stewardship funds will allow PFT to conduct its annual monitoring duties for the conservation easements as further described in the Cost/Benefit Analysis Attachment.

H. Economic feasibility:
Financial Feasibility Assessment

Financial Capacity
The Pacific Forest Trust (PFT) does have the financial capacity to cover the incurred project costs until reimbursement is received. PFT has 20 years of experience in completing these types of working forest conservation easement projects, and we have successfully conserved over 50,000 acres. Through these various transactions we have developed partnerships with multiple public and private funding sources, which are willing to do Program Related Investment (PRI) loans for these types of projects. The PRI would be providing funding at a low or no interest rate to cover the project costs between closing and the reimbursement for expenses by the IRWM grant program.

Ongoing Costs
The long-term management of the forestland will remain the responsibility of the private landowner, whose goal is to maintain the property as a productive working forest consistent with the conservation easement terms. Pacific Forest Trust staff will be responsible for stewardship monitoring in perpetuity to ensure that the easement terms are being upheld. We will prepare a stewardship monitoring plan specific to the property, conduct annual site visits, review available aerial images of the property, meet with the landowner regularly, conduct pre- and post-harvest site inspections and review property management plans for consistency with the conservation easement. PFT's

stewardship policies and procedures have been recognized as exceeding the Land Trust Alliance's standards and practices and are reviewed as part of our Land Trust Accreditation. At closing, the landowner will be making a donation to PFT for our Stewardship Fund that will cover the costs associated with these monitoring, stewardship and easement enforcement responsibilities.

Financial Feasibility
The proposed working forest conservation easement projects are financially feasible, PFT is confident that we can have the financing in place to complete the project with reimbursable grant funds from the state and we have written agreements with the private landowners to provide funding to cover the on-going conservation easement stewardship monitoring costs.

Economic Feasibility Assessment

Benefits	Tangible/Intangible	Private/Public
Water Supply and Watershed Protection: The conservation easements will ensure long-term protection of regional water quality and supplies through forestry restrictions in riparian areas and road management BMPs.	Intangible: This benefit is mostly an intangible benefit. Studies have shown that improved forest and road management increase water supply and quality, but we do not have conclusive data as to how to calculate these benefits	Improved water supplies and quality is a public benefit that would benefit both the downstream communities as well as aquatic wildlife.
Maintaining Land in Timber Production: This project will maintain approximately 25,000-acres of highly productive lands in timber production.	Tangible: Continued timber production will support the timber industry in Siskiyou County. Management of these lands supports over 200 jobs within the region.	Public Benefit: The working forest conservation easements will ensure that these 25, 000 acres are available for sustainable timber management to support the local-resource based economy. Private Benefits: There will be some private benefit to the landowners that receive payment of appraised fair market value for the conservation easements.
Enhanced Wildlife Habitat and Ecological Health: These easements will conserve and restore rare and unique habitats for multiple species.	Intangible: It is difficult to put a value on wildlife habitat.	Public Benefit: Conserving wildlife habitats benefit special status species is considered a public benefit.
Avoiding loss of public and private forestland due to catastrophic fire: The	Tangible: If we move forward on a full application, we can provide estimates as to the potential costs	Public Benefit

Benefits	Tangible/Intangible	Private/Public
conservation easements will prevent development and promote sustainable forest management on private lands that are adjacent to public lands. These easements will prevent the increase of the WUI and promote management that will reduce fuel levels to help prevent landscape scale catastrophic wildfires.	avoided.	
Enhanced Carbon Sequestration for Climate Change Mitigation: The forest management restrictions in the working forest conservation easements will avoid the conversion of these properties from forestlands, which would release carbon and they will promote the growth of older forests and the sequestration of additional carbon over baseline conditions.	This is still an intangible benefit due to the fact that there is not an established market for the additional carbon sequestered.	Public Benefit
Enhanced Recreational/Scenic Benefits: The conservation easements will open up additional access for hiking, biking, and wildlife viewing on private lands.	Tangible: These projects will provide additional lands available for recreation and scenic viewsheds that will support the local service industries.	Public Benefit
Costs	**Tangible/Intangible**	**Private/Public**
Capital Costs	Tangible: The appraised fair market value of the conservation easements.	Private
Operational Costs	Tangible: Annual monitoring and stewardship of the conservation easements by the Pacific Forest Trust.	Private
Externalities	Intangible: This project does not have any externalities.	Public

Cost-effectiveness Analysis

Through the terms of the conservation easement, we will be able to provide multiple public benefits that have been identified as important by the citizens of the region and the state of California including water quality and supply protection, maintenance and restoration of unique wildlife habitat for special status species, supporting continued timber management and the local economy, enhanced carbon sequestration, scenic viewsheds, and new recreational opportunities and private lands.

Cost-effectiveness and economic efficiency will be achieved on multiple fronts through this project. The purchase of conservation easements on these lands will cost only 45–60% of the full fee value of the land, while both achieving the key resource conservation priorities listed above and maintaining the contribution of productive forestlands to local and regional economies. Further, in securing a conservation easement on the property rather than conserving the land through a fee acquisition, the landowner becomes the lead partner collaborating with PFT in the long-term stewardship of the property, shouldering the majority of the ongoing management costs.

Easement acquisition of landscape-scale forestlands is also an economically efficient method for buffering public reserves and enhancing the functionality of ecosystems across ownerships, including the neighboring Shasta-Trinity National Forest (with its Late Successional Reserves) and as well as the Mt. Shasta and Castle Crags Wilderness areas.

I. Project status: ready to proceed pending financing
PFT is in discussions with private landowners to develop the specific land use restrictions in these WFCE projects. By the time there is an opportunity to apply for DWR funding in 2014, these easement negotiations will be completed with option agreements in place for their acquisition. At that stage, we will be working with funders to put together the necessary financing for acquisition.

J. Strategic considerations for IRWMP implementation:
As described above, the project is well integrated with and in furtherance of multiple IRWM goals, is situated centrally within the basin, and its accomplishment would contribute significantly to the IRWMP implementation. While effectively addressing central IRWM issues at the property management level, acquisition of WFCEs at this landscape scale is a low-cost approach to achieve key conservation priorities of this IRWMP while maintaining the contribution of the watersheds' productive forestlands to local and regional economies. The purchase of a WFCE allows the public to achieve the watershed protection goals at approximately half the cost of fee-title acquisitions, and with none of the financial burden of on-going property management. Additionally, conservation of these strategic private lands provide essential connections with existing public reserves and will enhance ecosystem functionality across public and private ownerships allowing for long-term conservation partnerships and true collaborative management of water resources and wildlife habitat at a watershed-wide scale for greater climate resiliency.

K. Contribution of the project in adapting to effects of climate change:
The California Climate Adaptation Strategy identifies the need to create a "large-scale, well-connected, sustainable system of protected areas" to facilitate adaptation and migration of species. These WFCEs will provide more adaptive capacity by permanently conserving wildlife habitat corridors between public and private lands, and enhancing key habitat elements, providing easier migration and allowing species to move up and down elevational gradients and adapt to potential climate change impacts. Further, consistent with the National Wildlife Adaptation Strategy, the projects will "Conserve large blocks of contiguous, un-fragmented forest and aim for representation and redundancy of all forest types, vegetation mosaics, and natural disturbance regimes… Help maintain ecosystem function and processes and resiliency to climate change… [and] restore degraded habitats to support diversity of species assemblages and ecosystem structure and function."

Additionally, protecting the natural forest infrastructure and associated riparian areas and wet meadows in the upper watersheds will allow for continued natural storage and water quality filtration for the region through these natural ecosystem services. These natural forest services can provide a lower-cost alternative to building additional water storage and treatment facilities while also supporting the local economy through continued timber harvests.

L. Contribution of the project in reducing GHG emissions:
The terms of the proposed WFCEs provide the public benefit of enhancing forest carbon stores and thereby helping the State meet its reduced GHG emissions targets through: 1) ensuring that the properties are not converted out of forests; and 2) requiring that the forest be managed according to parameters that will generally increase forest carbon sequestration on the property.

Emissions quantification: No emissions that will come from the implementation of this project.

McCloud / Moosehead Trail Crossing Stabilization — *Conceptual; Priority 2*

Sponsor: The River Exchange
Location: former rail crossing on the "rails to trails" trail
Partners: Great Shasta Rail Trail, US Forest Service (possible)
Budget: to be determined
Abstract: Under a process called railbanking, a partnership of local non-governmental organizations (NGOs) has proposed to convert the former McCloud Railroad line to a regional trail, called the Great Shasta Rail Trail, which will stretch nearly 70 miles from just east of McCloud to Burney. The proposed trail crosses numerous rivers, streams, and small swales. In the McCloud watershed alone there are over 60 such crossings, which range from 8-inch culverts to bridges spanning over 30 feet. The

River Exchange recently completed an inventory and assessment of all of the crossings along the proposed trail in the McCloud watershed. At several of these crossings there are impacts to water quality due to poor design, inadequate maintenance, or a combination of these factors. Working with partners, the River Exchange is identifying priority projects to reduce impacts to streams, restore riparian habitat, and reduce barriers to fish and aquatic species passage. Two areas identified as priorities are the McCloud River crossing and Moosehead Creek crossing.

At the McCloud River crossing the river flows through two 12-foot culverts in a large section of fill. The crossing at this section has failed multiple times in the past 50 years and is at risk of doing so again. Failure would result in significant inputs of sediment into the McCloud River as well as making the trail impassable at this location. Project work at this location would involve either 1) stabilization of the existing infrastructure and instream improvements to improve fish passage or 2) replacement of the existing infrastructure.

At the Moosehead Creek crossing, when the railroad was established the alignment of Moosehead Creek was modified, diverting the flow along upstream side of the tracks for ~1/4 mile. This resulted in erosion in the newly created channel along the tracks as well as de-watering of a wetland area directly downstream of the crossing before Moosehead Creek joins the McCloud River. Project work would include re-establishing the crossing in line with the historical stream channel and rehabilitating habitat along the modified section of the creek resulting in reconnection of the creek with the downstream riparian wetlands, improved fish passage, and reduced long-term risk to trail infrastructure.

Review Factors:

A. IRWMP Objectives: this project meets Objective 3: Maintain and enhance the ecological health of the basin to:
    a. Support the local economy;
    b. Ensure public health and safety;
    c. Respect and support indigenous cultures; and
    d. Improve recreational infrastructure and opportunities for both tourism and the local economy.

Upper Sacramento Headwaters "Green Infrastructure" Conservation Project: Phase 1 — *Conceptual; Priority 2*

Sponsor: Siskiyou Land Trust
Location: throughout the USR
Partners: possible partners include the Shasta Valley RCD, Natural Resource Conservation Service (NRCS),
McCloud Watershed Council and Pacific Forest Trust
Budget: between $1 and $5 million
Abstract: A landscape scale network of permanently conserved forest, wetland, and grassland landscapes is needed to protect, enhance, and restore Upper Sacramento

watershed resources in order to keep this areas vast resource base — that is locally, regionally, and globally significant — intact.

Project Goal: Acquire 1,000 acres of land and/or conservation easements in the Upper Sacramento IRWM planning area watershed for the purpose of protecting the quality and quantity of California's water resources in this region that has been identified by the State as a statewide area of importance (DWR).

Project Implementation Tasks: 1) Convene project partners and interested stakeholders; 2) establish acquisition priority criteria to meet primary and secondary resource conservation needs (e.g. Protecting water quantity through acquisition or easement overs of significant springs or wetland complexes); 3) determine stakeholder roles and capacity for project support (lead and support/ holder of title or easement); 4) identify known willing landowners in the watershed who have completed inquiries with project partners to donate or sell land or conservations easements; 5) rank potential acquisitions according to project criteria; 6) initiate landowner outreach to secure landowner participation via letter of intent and project agreement; 7) negotiate easement if relevant or land sale transaction terms; 8) secure project funding and close transaction; 9) initiate/implement public outreach activities

Timeline: Project planning and development: six months to one year.
Implementation: six months to one year.

Project schedule will be decreased in the case of a "Ready-to-Go" acquisition that is simply waiting for funding.

Anticipated Costs: $1 – 5 million or less. Estimate is highly-dependent on type of property to be acquired, the property location, and the transaction agreement (i.e: donation, partial donation, and acquisition of fee title vs. conservation easement). If a specific project budget range is the target, the proposed land/easement acquisition could be determined accordingly. Estimate is based on a 1,000-acre objective

Review Factors:

A. IRWMP Objectives:
   - Objective 2: The project is designed to pull from a diverse group of project partner expertise and experience through collaboration. It also leaves room for and encourages a diverse group of stakeholder participation and collaboration as the project develops.
   - Objective 3: The project purpose meets the objective of ecological health through its ultimate result of permanently conserving lands that are considered to have high conservation value. The project also meets the objective of maintaining and enhancing ecological health of the basin while supporting local economies by contributing funds for purchase of land — money that is being directly invested in our local community.
   - Objective 4: The project will likely support and improve ongoing forest management efforts, if forestland is chosen for easement or fee

acquisition. Considering the amount and location of forestland in the watershed, we anticipate acquisition(s) to include forested area.

- Objective 5: The project will likely support success of water management in a disadvantaged community through acquisition of land or water resources that are critical to municipal or tribal water supplies and to surface flows in the Upper Sacramento basin.
- Objective 7: The acquisition project ensures water supply and quality while maintaining regulatory compliance through the permanent protection of lands and associated water supplies and filtering functions (i.e. Wetlands). The project also directly addresses adaptation to climate change through permanent protection of resources lands that provide vital carbon sequestration, clean air, and clean water functions.
- Objective 8: The project facilitates development of sustainable water infrastructure by investing in natural systems to compliment and provide rather than relying solely on concrete structures to capture and deliver secure, clean water supplies.
- Objective 9: Through investment in headwaters “green” infrastructure, flood peaks can be attenuated and more water preserved as groundwater resources.

Panther Creek Riparian Zone Invasive Species Removal —
Conceptual; Priority 2

Sponsor: Shasta Valley Resource Conservation District
Location: Panther Creek corridor in McCloud, CA
Partners: to be determined
Budget: $45,000
Abstract: Scotch broom is an invasive species native to Europe that is becoming increasingly very prevalent in the community of McCloud. It is an opportunistic species that easily colonizes disturbed lands and waterways. It propagates easily along riparian zones by outcompeting native species. Scotch broom may increase the intensity of wild fires in an area due to its high flammability and its properties as a ladder fuel.

As a tributary of the McCloud River, the scotch broom infestation of Panther Creek poses a threat to downstream waters throughout the IRWMP area and beyond. We aim to halt the spread of scotch broom downstream by aggressive mechanical removal from areas within the riparian zone and immediate vicinity of approximately 1.5 miles of Panther Creek. Educational workshops will be held to educate the community on the impacts of scotch broom and removal methods including a demonstration workshop at the local Elementary and High Schools where scotch broom is present.

Up to 76 acres will be treated along Panther Creek utilizing work crews to complete the scotch broom removal objectives over two years. Anticipated costs are $40,000. For workshops to be held at the Elementary and High Schools, $5,000 is being requested. This will be utilized to develop workshops, obtain presenters, cover venue space and outreach and advertise to the community. Additionally, we will purchase two Extractigator tools that will be used at the workshops and for cost free loan to local landowners interested in removing invasive species from their properties.

Review Factors:

A. IRWMP Objectives: 2, 3, and 4

Lakehead Area Fuels Reduction Project — *Conceptual; Priority 2*

Sponsor: Western Shasta Resource Conservation District
Location: 500 square miles along Interstate 5 and Shasta Lake
Partners: not yet determined
Budget: not yet determined
Abstract: The WSRCD is seeking funding for implementation of on-the-ground projects identified in the Lakehead Area Strategic Fuels Reduction Plan Update 2010. These projects were identified and prioritized by the Lakehead Fire Safe Council (FSC) with input from the community, and federal, state, and local agencies. The 24 recommended projects are described in Attachment A (to be provided) and equate to approximately 51 acres of fuel reduction.

The area covered by the Lakehead FSC is about 25 miles long, 20 miles wide, about 500 square miles or approximately 320,000 acres. Access to the area is via Interstate 5, Shasta Lake, and several Forest Service roads. Communities within the Lakehead FSC Area include: Gregory Creek, Obrien Mountain, Northwoods, LaMoine, Vollmers, Delta, Lakehead, Lakeshore, Statton, Skyline Drive, Lakeview, Sugarloaf, Gibson, Highland Lakes, and Gilman Road area. The area has a population of about 1,618 permanent residents (Sperling's Best Places, 2009), and about 256 seasonal/recreational residences spread throughout the planning area. With the presence of Shasta Lake National Recreation Area, the area is heavily used for recreation. Land ownership is 56% public and 44% private.

Review Factors:

A. IRWMP Objectives:
The proposed fuels reduction project supports Objectives 3 and 4 of the Upper Sacramento IRWMP, as well as the overarching goal of preparedness for climate change.

Objective 3: Fuels control helps to maintain ecological function

Objective 4: Maintaining a healthy forest is an outcome of controlling invasive species.

B. Resource Management Strategies:
Reducing heavy fuels is important for Resource Management Strategies **l.** *Ecosystem Restoration*, **m.** *Forest Management*, and **p.** *Watershed Management*. Heavy fuel loads pose a threat to any enhancement strategy

whether it is focusing on **l**, **m**, or **p**. Wildfire, having the intensity typical here in the West, destroys the building blocks essential to most strategies, such as soil, water quality and quantity, wildlife habitat, and forest management.

Fuel reduction is the key to successful resource management strategies for all three categories. It is the first step, especially here in the arid West. Activities on-the-ground increase the wildfire risk, so fuel reduction is the practice to apply at the beginning of any enhancement project.

C. Technical Feasibility:
The U S Department of Agriculture (USDA) Forest Service has been implementing fuel reduction projects within the WUI around Lakehead and Lakeshore for the past several years. These fuel reduction projects have ranged from mastication, to prescribed fire. The initial projects in the Lakehead area were supplementary to the fuel-break constructed around the west side of Lakehead by Western Shasta RCD in 2006.

The limiting factor in fuels reduction for the watershed is funding. Fuel reduction projects have been identified by a fairly large group of concerned citizens and agency personnel, and these projects have been prioritized by this group. Both the Forest Service and the RCD have the technical capacity to put fuel reduction on-the-ground if the funds are available.

The WSRCD works in collaboration with many federal and state agencies as well as business owners and private landowners on projects that enhance Shasta County's communities. The WSRCD is governed by a five-member volunteer Board of Directors with the support of two associate directors appointed by the Shasta County Board of Supervisors. Over the past 13 years, the WSRCD has implemented 41 fuels reduction projects covering 94 miles at a cost of over $2 million.

D. Specific benefits to critical DAC water issues:
No effects to critical DAC water issues have been identified.

E. Specific benefits to critical Native American water issues:
No effects to critical Native American water issues have been identified. The project may positively affect additional Native American concerns by promoting the conservation and restoration of native vegetation.

F. Environmental justice considerations:
No environmental justice concerns have been identified. Landowners are not required to have work done on their property. All landowners will be approached and asked for permission to implement activities. Activities and the related noise, etc. will be relatively short-term. The community will benefit from the additional health and safety benefits that the project provides.

G. Project costs and financing:
More precise costs will be determined when funding opportunities arise. While currently there is a need for complete project funding, funding requests will be revised to include inflation and available cost share if any are identified.

H. Economic feasibility:
Wildland fire is a common occurrence in the county. Costs associated with fires include direct costs for suppression activities and immediate damage to property. There are also indirect costs that include, but are not limited to, loss of property value, negative impacts to health, and reduction of ecosystem services that are important to water quality, quantity, and recreation. Combined, these costs can be very significant to individuals, the county, state and nation. The 2009 report The True Costs of Wildfire in the western United States by the Western Forestry Leadership Coalition highlights that the total cost resulting from wildland fires in the western United States can be twice to thirty-times the amount of reported suppression costs.

I. Project status: Ready to proceed pending permitting and funds availability.

J. Strategic considerations for IRWMP implementation:
Conversations have identified interest of fuel reduction throughout the IRWMP area among other Upper Sacramento IRWMP stakeholders. Coordination and management strategies that are used in this project will be generously shared among those interested. The WSRCD would like to encourage on-going conversation on how to implement and maintain fuel reduction activities on a regional basis.

K. Contribution of the project in adapting to effects of climate change:
In 2012, the WSRCD led a group of stakeholders in assessing risks to forest and water resources in Shasta County from climate change. The group reported its findings in the January 2013 document titled "Forest and Water Climate Adaptation: A Plan for Shasta County" in which reducing the Risk of Catastrophic Wildfire was identified as a priority goal. As documented in the plan, the risk from wildfire in Shasta County is expected to increase substantially. As reported in the California Climate Adaptation Policy Guide, Shasta County wildfire risk could grow six to ten times by the end of the century (California Emergency Management Agency, 2012).

Northern Sacramento IRWMP area watersheds are increasingly susceptible to catastrophic wildfire due to high levels of hazardous fuels. Where housing development has encroached into woodlands, the problem is compounded, as many residents fail to employ practices that would lessen the chances of catastrophic wildfires. When catastrophic fire does occur, the erosion that can occur with storm events can be a serious issue. This project would promote climate adaptation strategies through reducing the risk of catastrophic fire in the project area.

L. Contribution of the project in reducing GHG emissions:
Wildfire reduces CO_2 into the atmosphere. This project will reduce the risk of catastrophic wildfire and the risk of associated release of CO_2.

Emissions will be quantified when the project is ready to go.

Control of Broom —
Conceptual; Priority 2

Sponsor: Western Shasta Resource Conservation District
Location: Interstate 5 Corridor from Packers Bay to the Shasta County Line
Partners: USDA Forest Service, California Department of Transportation (CalTrans), Shasta County Road Department, California Department of Forestry and Fire Protection (CAL FIRE)
Budget: $90,000
Abstract: The USDA Forest Service has a current project to remove French Broom, Scotch Broom and Spanish Broom (the brooms) from National Forest land in the Packer's Bay area. This project proposes to expand the treatment area onto private land and state highway rights-of –way.

The brooms are present in the Interstate 5 right-of-way, as well as the rights-of-way of many of the county roads and private roads in the area from Packer's Bay north. The broom infestation is especially crucial within the Interstate 5 right-of-way immediately north on Lakehead. There is also a large infestation in the county road right-of-way along Riverview Drive in Lakehead. There are additional infestations needing treatment, but these are the more pronounced.

There is an opportunity to collaborate with the USDA Forest Service, CalTrans, Shasta County Road Department, CAL FIRE inmate crews, and WSRCD. The more effective way to treat the problem is to cut and remove the existing plant skeletons, and chemically treat the sprouts. The chemical treatment should be repeated at least three times, with the option to add a fourth and fifth treatment.

The cost of the project will be about $90,000.00. This cost can be reduced if the collaborating agencies are able to contribute to the project either in direct funding, or in-kind labor, equipment, or chemical.

Preservation of Springs, Biological, and Cultural Resources —
Conceptual; Priority 2

Sponsor: McCloud Watershed Council
Location: Throughout the USR
Partners: Potential partners include the Siskiyou Land Trust, timber companies, and the Winnemem Wintu
Budget: undetermined at this time

Abstract: Through this project, the McCloud Watershed Council (MWC) would like to acquire select lands and waterways by deed or grant of conservation easement. Goals associated with this project include securing habitat for carbon sequestration, flood mitigation, protection of biodiversity in the region and increasing human appreciation for our shared environment. Objectives include wetland preservation, ecosystem restoration, noxious weed abatement and facilitating opportunities for humans to interact meaningfully with their environment through the establishment of low-impact recreational infrastructure and educational opportunities. Some of the methods we intend to employ to achieve these goals include, but are not limited to installing interpretive signage and engaging students and volunteers in water quality monitoring, indigenous flora recovery, ecosystem surveys and habitat/riparian restoration. Currently in the investigative phases of this project, potential sites we have identified that we think conservation easements would yield mutual benefit for all stakeholders involved including the California Conservation Corps Camp, Indian Springs, and Soda Springs.

Keystone Species Reintroduction for More Resilient Habitats — *Conceptual; Priority 2*

Sponsor: Winnemem Wintu Tribe
Location: throughout the USR
Partners: proposed partners include the US Fish and Wildlife, fish-centered organizations, environmental groups, Siskiyou County, timber companies, and private landowners
Budget: undetermined at this time
Abstract: Beaver are identified as a keystone species for many habitats throughout North America, and were once an integral component of the USR watersheds' habitats. These mammals can increase infiltration of surface water into groundwater aquifers, contribute to fish abundance and diversity, can stabilize stream incision, and can reduce nitrogen, phosphorus, and sediment loads into fragile water bodies. As climate change alters the hydrologic regime throughout California, it is important to create a more robust and resilient environment for all species; beaver are an important component of this.

This project will work with other interested stakeholders (proposed partners include the USFS, fish organizations, environmental groups, Siskiyou County, timber companies, and private landowners) complete an evaluation of available research regarding beaver presence in the USR and possible reintroduction processes, and will identify at least three key locations for reintroduction to occur. Participating project collaborators will prioritize these locations. Monitoring of the effects of the beaver reintroduction will be key to project success, and the reintroduction site must be identified with the importance of baseline data in mind.

McCloud River Restoration —
Conceptual; Priority 2
Sponsor: Winnemem Wintu Tribe
Location: McCloud River riparian areas
Partners: proposed partners include the USFS, Cal Trout, private landowners, and other organizations
Budget: undetermined at this time
Abstract: The McCloud River is the heart of the Winnemem Wintu Tribe's (WWT) aboriginal territory, and they have maintained this resource from time immemorial. Before Shasta Dam (completed in 1944) blocked the return of anadromous fish, the McCloud River was one of the most productive salmon and steelhead waters in the Sacramento Watershed. Some of the challenges faced by the McCloud River, aside from the inability of anadromous fish to return to their birthplace to spawn, include threats to flow from climate change and diversion to the Pit River, and the extreme dependence of the river on springs as source water for its base flow. In the face of these water quantity threats, it is important to maintain the habitat viability for the species present. In addition, with the plans of federal agencies to reintroduce anadromous fish to the region, it is important to ensure that viable habitat exists to ensure the best chance of success. The WWT will work with project partners (expected to include the USFS, Cal Trout, private landowners, and other organizations) to identify areas most likely to provide good habitat, will develop habitat goals collaboratively and design a restoration project to meet those prioritized goals.

Panther Meadows Tourist Education —
Conceptual; Priority 2
Sponsor: Winnemem Wintu Tribe
Location: Panther Meadow, in the Shasta Trinity National Forest
Partners: proposed partners include the Forest Service, Siskiyou County Resources Advisory Council, private foundations, and Mt. Shasta Bioregional Ecology Center
Budget: undetermined at this time
Abstract: The Project Sponsor proposes to work cooperatively with Shasta Trinity National Forest, the Mt. Shasta Bioregional Ecology Center and local businesses to implement a component of on going restoration that addresses the impact of tourism to the WWT 20-acre Historic Property, Panther Meadow. To-date, the Forest Service, Siskiyou County RAC, private foundations, and Mt. Shasta Bioregional Ecology Center have combined efforts with the WWT for meadow restoration and visitor education.

Panther Meadow is a rare high alpine meadow within the Mt. Shasta Ranger District. For more than 30 years the meadow has undergone degradation from increased visitor use. The local economy benefits from the presence of the meadow on Mt. Shasta as it has become a popular international tourist destination in Siskiyou County. Visitors and local residents value the site for the meadow's meditative nature. The Winnemem Wintu still practice their traditions on this historic property and continually work to preserve and protect its pristine historic values and archeological resources. All parties are interested in protecting the delicate ecology of the meadow and water quality of the on-site spring. The trail is being upgraded and a new spring barrier is being installed to protect the source-point of the spring; the remaining task is to include educational signage to direct tourists on a loop around sensitive areas in the meadow and the spring source. This signage will include directions for the trail, as well as information regarding location history and pre-history, ecological value, and water resources information about springs and Mt. Shasta.

Salmonid Habitat Restoration and Economic Activity Protection — *Conceptual; Priority 2*

Sponsor: Winnemem Wintu Tribe
Location: The Upper Sacramento and McCloud Rivers and tributaries
Partners: proposed partners include federal agencies (USFS, US Fish and Wildlife Service, National Marine Fisheries Service, the Bureau of Reclamation, Siskiyou County, private timber companies, and interested fish advocacy groups
Budget: undetermined at this time
Abstract: Announced in August of 2013, the BOR Shasta Dam Fish Passage Evaluation Pilot Implementation Plan, projected for completion in late 2014, is the first effort to evaluate the feasibility of the reintroduction of winter run and spring run Chinook Salmon above Shasta Dam. As seen in other regions, anadromous fish reintroduction can carry with it regulatory burdens for many parties involved, including jurisdictional entities (NPDES permits, NEPA, NHPA, Wild and Scenic, ESA permits and regulations, etc.) private businesses (forestry and recreation-based industries) and individual landowners. The Winnemem Wintu propose cooperative research into and implementation of “early-action” habitat restoration and preservation in exchange for “hold harmless” agreements. This would require the participation and validation of the federal agencies with regulatory oversight, but could result in collaborative and mutually beneficial outcomes throughout the Upper Sacramento and McCloud watersheds.

10.6 Project Integration with USR IRWMP Objectives and Resource Management Strategies

As described above, the timing of the project development process led to projects developed in response to identified issues, objectives, resource management strategies, and regional gaps in knowledge. Accordingly, the proposed project suite addresses each of the objectives identified by stakeholders early in the Plan development process.

Table 10.3: Objectives met by proposed project suite

	Proposed Projects	Goal: Climate Change	Goal: Native American Values	Obj 1 - Basin Characterization	Obj 2 - Cooperation and Trust	Obj 3 - Ecological Health	Obj 4 - Forest Management	Obj 5 - Water Management for DACs and Tribes	Obj 6 - Water Quality	Obj 7 - Regulatory Compliance	Obj 8 - Infrastructure	Obj 9 - Flood Management
1	Dunsmuir Water System Improvement - phase 1							x	x		x	
2	Dunsmuir Water System Improvement - phase 2							x	x		x	
3	Mt. Shasta Wastewater Treatment Plan Upgrade	x		x		x		x		x	x	
4	Lower Elk Springs Rebuild	x		x		x						
5	Elk Springs Transmission Line Replacement	x		x		x						
6	*Intake Springs Hydroelectric Project*	*x*						*x*			*x*	
7	Upper Sac, McCloud, and Lower Pit Rivers Groundwater Monitoring Project			x	x	x		x	x	x	x	
8	Hydrological and Climate Change Evaluation of the Medicine Lake Volcano and its Connectivity to the Fall River Springs and Potential Connectivity to the McCloud River	x	x	x	x				x			
9	*Comprehensive Springs and Groundwater Monitoring Project*	*x*		*x*	*x*	*x*		*x*	*x*	*x*		
10	*Mt. Shasta Glaciers Long-term Monitoring Project*	*x*		*x*	*x*	*x*						*x*
11	*Hydrologic Study of the Mt. Shasta Watershed*	*x*		*x*	*x*	*x*		*x*	*x*	*x*		
12	Grants Specialist	x	x	x	x	x	x	x	x	x	x	x
13	Climate Stewardship Coordinator	x	x	x	x	x	x	x	x	x	x	x

14	*Water Talks and Coordinated Educational Water Management Programs Project*	x	x	x	x							
15	*McCloud 9 – Climate Community*	x				x		x	x	x	x	
16	*Building Relationships of Trust and Understanding*	x	x	x	x							
17	*Shasta Climate Initiative - Curriculum Development & Implementation*	x		x	x							
18	*Headwaters Stewardship Fund*				x							
19	Rainbow Ridge Collaborative Forest Stewardship	x			x		x					
20	Upper Sacramento and McCloud Watershed Working Forest Conservation Easements	x				x	x					
21	*McCloud / Moosehead Trail Crossing Stabilization*					x						
22	*Comprehensive Surface Water Monitoring*	x	x	x	x				x			
23	*Upper Sacramento Headwaters "Green Infrastructure" Conservation Project: Phase 1*	x			x	x	x	x		x		x
24	*Panther Creek Riparian Zone Invasive Species Removal*				x	x	x					
25	*Lakehead Area Fuels Reduction Project*	x				x	x					
26	*Control of Broom*	x				x	x					
27	*Preservation of Springs, Biological, and Cultural Resources*	x			x	x	x	x		x		x
27	*Keystone Species Reintroduction for More Resilient Habitats*	x	x		x	x	x					
29	*McCloud River Restoration*	x	x	x	x	x						
30	*Panther Meadows Tourist Education*		x		x	x	x					
31	*Salmonid Habitat Restoration and Economic Activity Protection*	x	x		x	x				x		
	Objectives met:	**24**	**10**	**15**	**20**	**21**	**11**	**12**	**10**	**10**	**8**	**5**
	Percent met by proposed projects:	**77 %**	**32 %**	**48 %**	**65 %**	**68 %**	**35 %**	**39%**	**32 %**	**32 %**	**26 %**	**16 %**

NOTE: Projects in *italics* are considered conceptual as of November 25, 2013

Due to its orientation and size, please find Table 10.4, the RMS met by the project suite, at the end of this chapter.

10.7 Critical Water Needs of Disadvantaged and Native American Communities

Critical water needs have been at the highest priority for the RWMG. As has been noted, all of the communities in the region are considered DACs, and some are considered severely disadvantaged. Throughout the process RWMG have emphasized their support for efforts of

DACs to address their water needs. The suite of projects listed includes a number of critical needs for local communities. The City of Dunsmuir and the McCloud CSD constantly deal with the need to upgrade their aging and failing water supply systems. The City of Mt. Shasta is under a mandate from EPA to increase the quality of effluent discharged from their wastewater treatment facility. To the extent possible this plan includes concerted effort to address these critical issues.

While Native American tribes have been active in the development of this IRWMP and of many of the projects listed above, because of the narrow definition DWR assigns to "critical water needs", none of the projects addresses those needs of Native American tribes specifically. However, several of the projects described above do address issues of great significance to Native Americans, including the reintroduction of native species, activities promoting a healthy forest, and the monitoring of ground and surface water resources. These are projects considered "critical" to many participating tribes, though not acknowledged as such under DWR's definition.

For individual Native Americans, those critical water needs that fall under the DWR definition will mostly be covered by upgrades to the municipal infrastructure. There are some areas in the Lower Pit River watershed where members of the Pit River Tribe have inadequate water resources; while there are no projects submitted directly addressing this issue for the tribe, it is a topic of which all RWMG members are aware.

10.8 Project Status and Strategic Implementation

The status for each individual project is identified in project descriptions in Section 10.5, above, regarding their ready-to-proceed versus conceptual status, as well as any additional detail identified in DWR Review Criteria I (Project Status) for those projects submitting a full project application. As stated above in Section 10.3 (Project Prioritization), project status was considered when prioritizing projects, but if a project was not identified as "ready to proceed", it was not automatically excluded from the IRWMP project list. Early on, stakeholders identified conceptual projects as essential to the future development and evolution of the document, and established an acceptable form of the application process and accommodated conceptual projects in the process for prioritization. It is expected that these approaches will further evolve as the technical advisory committee (TAC), identified in Section 10.3, Project Prioritization, convenes to discuss process and implementation topics.

The discussion of project status and readiness, as well as objectives, resource management strategies, and general project topic, were key in stakeholder conversations regarding project synergies and restructuring. As identified in review Criteria J for those projects submitting a full project application in Section 10.5, above, there are some cases in which projects were restructured to address stakeholder concerns voiced by one or more entities participating in the development process. In some cases, project partnerships added to the way in which projects met IRWMP objectives, increasing the "robustness" of the project and adding to the project's projected regional benefits when implemented. As relationships between stakeholders and RWMG members participating in USR IRWM implementation develop and grow, it is likely that additional project development — identification of new projects as well as restructuring and integration of previously identified projects — will occur. The process that stakeholders have identified for project development, submittal, review, and inclusion into the IRWMP (Section 10.11, below) allows for, and even encourages, this ongoing development process.

Single-topic and, in some cases, single-sponsor projects were allowed for RWMG consideration for two reasons:

1. Stakeholders felt that some projects, by their nature, were best left as stand-alone projects. This doesn't mean that other entities and stakeholders won't be expected to participate in the development process, but that the project will be overseen by a single entity responsible for the successful implementation and operation of the project. In most cases, these projects represent infrastructure needs for USR community water and wastewater systems.
2. In many cases, these single-sponsor infrastructure projects would be eligible for funding sources outside of the IRWM program. Many of these alternative-funding sources require particular financing, rates levels, project components, or have other restrictions. In this way, keeping these infrastructure projects as stand-alone considerations would preserve their capacity to apply for and successfully receive these funds.

10.9 Economic Feasibility and Analysis

Each project has identified the specific benefits accruing to the region and the state if and when that project is implemented (see the project write-ups in Section 10.5). However, RWMG participants have identified a general, overarching, and vast benefit to all projects implemented in headwaters areas throughout California, and that is the very fact that these stakeholders act in and manage the very top of California's water system. This benefit is described below.

When considering the overarching objective of the IRWM program, the protection of water quality and quantity in a headwaters area provides a common benefit that applies to entities within and outside of the region, and even throughout California. Though difficult to quantify the benefits to downstream users, these benefits are real and apply to a wide range of interests. Recreationalists benefit from improved fisheries, cleaner water in which to swim and raft, higher base flows, and improved conditions in headwaters areas frequently visited by tourists. Agricultural interests in the highly productive Sacramento Valley benefit from improved water quality and quantity from the water supply sources in the Upper Sacramento, McCloud, and Pit River watersheds. Water contractors benefit from greater consistency in the quantity and availability of these water resources. Power companies benefit from maintained and consistent flows in the USR watersheds that feed Shasta Reservoir and other downstream facilities. Benefits accrue to downstream household urban users who depend on surface water or groundwater recharged from surface water to maintain water supplies.

This region boasts some of the best water in the nation (e.g. City of Mt. Shasta's third place finish in a 2007 national water competition) and its residents work hard to keep it that way. The value of these efforts should be recognized outside the region because of their proactive nature. Efforts to conserve water and protect water quality can translate into reduced efforts for downstream users to find new sources or improve water quality and preserve the scenic, historical, and cultural value of the area for those in or outside the region.

10.10 USR Project Response to Climate Change Adaptation and Mitigation

As stated in Chapter 9, Climate Change, projected effects on the region may result in high-profile vulnerabilities to groundwater (because the resource status is unknown), and catastrophic wildfire occurrence. In response to this knowledge, project sponsors have brought forth five projects addressing groundwater and surface water resources monitoring and research for connectivity. They have also identified five additional projects addressing issues of fuels control and/or invasive species removal. These projects represent direct responses to identified climate vulnerabilities, and will help the USR to be more flexible and resilient in the face of projected climate change effects of longer dry seasons, more precipitation coming as rain than snow, and more extreme weather events. Additional vulnerabilities identified in Chapter 9 are also addressed, and these are noted in the individual project summaries available in Section 10.5, above.

Mitigation activities for the emissions coming from project implementation are described for each of the projects in Section 10.5, above, but largely are minimized through the identification of local labor and expertise, as well as consolidated trips, in the case of the monitoring projects.

10.11 Project Submittal For Ongoing IRWMP Implementation

As the RMWG moves forward, it is anticipated that additional projects will be developed for inclusion in the Plan, and current projects will be modified. Four project submittal scenarios are anticipated: 1) new project submittals as a response to immediate funding opportunities; 2) new project submittals as part of regular Plan updates; 3) conceptual projects being advanced to priority 1; and 4) a change in project sponsor for those projects already included in the IRWMP. These scenarios and the associated submittal process are described below, and shown in Figure 10.1:

1. <u>Immediate funding opportunity</u>: It is anticipated that as individual groups identify funding opportunities, they may seek the support of the RWMG to improve their application's competitiveness for funding. Such a request may be for inclusion in the Plan for the purpose of obtaining a letter from the RWMG providing support. The process is as follows:
    a. The project proponent contacts the designated point of contact for the RWMG and makes an initial request for consideration of the specific project.
    b. The RWMG provides to the project proponent directions regarding required application information. For projects to be added to the plan, this application information is anticipated to include the same general information that was provided for each of the projects included in the original plan (abstract, budget, how the project addresses plan objectives, etc.). For entities requesting a letter of support, the extent of information to be submitted will not be as extensive. Selection of minimum information requirements and/or application

format will be by a Technical Advisory Committee (TAC) established by the RWMG.

  c. The information will be reviewed and prioritized, with the opportunity for input and questions from the RWMG. The process may include a meeting at the discretion of the RWMG or the information and input may be distributed and collected through electronic means.
  d. Following RWMG review and prioritizing, the RWMG will make a decision utilizing the governance strategy outlined in Section 10.2.2, above. The point of contact will then provide a letter to the project proponent(s) stating the decision of the RWMG.
  e. Time frames for submittal, review, and response are anticipated as follows
      i. A request of this type may be submitted at any time during the year, and
      ii. RWMG review period will typically be less than two months. However, this time may have to be adjusted based on RWMG schedule at the time a request is received or based on the time required to obtain the information necessary for review. Project proponents should not expect a last-minute support request to be fast-tracked if the RWMG does not have a scheduled meeting coming up.

2. Regular Plan update: It is anticipated that as the projects are implemented and conceptual projects are further developed, that the RWMG will update the current project list and seek additional projects for inclusion. The anticipated process will include the following:
  a. The current RWMG administrator will, on an annual basis (with the next process expected to occur in summer or fall of 2014), notify RWMG members of the scheduled process. RWMG members will be notified of the intent to solicit new or modified projects for consideration for IRWMP inclusion. The anticipated project submittal process is as follows:
      i. Advertise to all RWMG members that new or modified projects are sought for consideration for inclusion in the IRWMP.
      ii. Request a submittal of the first page of the project application (contact information and project abstract) within 1 month of advertisement. These materials may be submitted through the website or submitted to the current RWMG administrator; this will be indicated in the advertisement.
  b. Submitted abstracts will be reviewed by the RWMG and clarification sought on project or project components as applicable and needed. Each project will be presented to the RWMG at a regularly scheduled meeting. Within one month of initial submittal (possibly at the RWMG meeting), the RWMG will notify the applicant as to the project’s acceptance status as follows:
      i. If the project sponsor only wants their project included as “conceptual”, the RWMG will notify the applicant that the project will or will not be accepted into the IRWMP. No further action is required at this time.
      ii. If the project proponent would like their project included as “ready-to-proceed”, the RWMG will notify the applicant that the project will or

will not be considered further for acceptance into the IRWMP. If it will be further considered, all required submittal information (as established by the TAC) will be submitted. These remaining application materials will be submitted within one month of notification by the RWMG that the project will be considered further and the full application will be reviewed.

1. It is possible that the RWMG may require a full application for a project about which they are uncertain. In this case, these same deadlines apply.

iii. Submitted information will be reviewed and scored by the RWMG using the prioritization principles described above, in Section 10.3 or as amended by the RWMG. Within one month of full application submittal, the RWMG administrator will notify the applicant if the RWMG has determined to accept the project into the IRWMP, and its ranked status. If consensus is not reached regarding project approval, the time frame for approval will depend on the time required to come to a decision in accordance with the governance methods outlined in Chapter 16, Governance.

3. Projects Advancing from Conceptual to Priority 1: Conceptual projects have been included in the plan which represent anticipated future projects that may be developed for implementation. As new information is gathered and project budget and planning is developed, the proponents can seek to elevate the status of their project listed within the plan to Priority 1. The anticipated procedure is as follows:
    a. Project sponsor will notify the RWMG administrator of the intent to advance a conceptual project. It is recommended, but not required, that such notification be given as early as possible in the process so that questions regarding submittal requirements can be coordinated throughout the development of such information.
    b. The submittal review process will be as described in Section 10.11.1 except that the project will be considered for acceptance as a ready to proceed project rather than being considered for acceptance into the plan.
    c. Upon acceptance as a Priority 1 project, the modified project will be considered with all other Priority 1 projects for implementation.
4. New Project Sponsors: Given the number of promising projects and the fluctuations in entity workload and funding, the RWMG welcomes new project sponsors willing to advance project ideas that have been put forward in this plan. The anticipated process is as follows:
    a. The potential new sponsor works with the original sponsor to seek approval to move ahead with the proposed project. It will be at the discretion of the RWMG to decide if a new project proposal should receive the approval of an original sponsor or not. Cooperation is anticipated between a proposed new sponsor and the original sponsor.
    b. Upon approval from the RWMG, the new sponsor will submit updated application information. Requirements for updated information and application format will be determined by a TAC established by the RWMG.

Figure 10.1: Flow Chart for Project Development, Review, and Adoption

1. Projects submitted (all stakeholders)	
2. Projects assigned to a category per their level of development (project development committee)	Projects identified as Priority 2 or 3 ("conceptual" or "purely conceptual") may only progress in level of prioritization if they are further developed, per the guidelines identified in tables 10.1, 10.2, and 10.3
3. Projects reviewed for integration potential (project development committee)	
4. Project list and materials submitted to stakeholder group for review (all stakeholders)	Stakeholder comments submitted to project sponsors for consideration (stakeholders and project sponsors)
5. Draft recommendation submitted to the RWMG, including prioritization categories (per step 2) (project development committee)	
6. Projects considered and, as appropriate, adopted into the IRWMP (RWMG members)	At this point, stakeholders not happy with the RWMG decision may protest via the governance structure, making use of the FIR and Coordinating Committee (see Chapter 16, Governance). Revised recommendations will go back to the project development committee and through the RWMG for final inclusion and prioritization approval.
7. Project list published to the website and emailed to all stakeholders (RWMG members)	Following acceptance into the IRWMP, projects may be further prioritized for implementation funding priority. This will be a separate process from the plan, as project development is more fluid and projects may change in priority specifically for a grant opportunity (see Section 10.11, Option 1). Implementation projects will only be taken from the USR Region's current Priority 1 list.

Table 10.4: RMS met by proposed project suite

	Proposed projects	a. Conveyance - local	b. System Reoperation	c. Water Transfers	d. Conjunctive Mgmt.	e. Recycled Water	f. Surface Storage - CALFED	g. Surface Storage – regional / local	h. Quality to Use	i. Ag WUE	j. Urban WUE	K. Irrigated Land Retirement	l. Ag. Stewardship	m. Ecosystem Restoration	n. Forest Management	0. Recharge Area Protection	p. Precipitation Enhancement	q. Watershed Management	r. Land Use Planning and Management	s. Water-dependent Recreation	t. Pollution Prevention	u. GW Remediation	v. Drinking Water Treatment and Distribution	w. Urban Runoff	x. Wastewater Treatment (USR RMS)	y. Flood Risk	z. Economic Incentives	aa. Education (USR RMS)
1	Dunsmuir Water System Improvement - phase 1										x							X					X					
2	Dunsmuir Water System Improvement - phase 2										x							X					X					
3	Mt. Shasta Wastewater Treatment Plan Upgrade					x			x					X						X					X			
4	Lower Elk Springs Rebuild		x															X					X					
5	Elk Springs Transmission Line Replacement		x															X					X					
6	*Intake Springs Hydroelectric Project*		*x*						*x*										*X*								*X*	
7	Upper Sac, McCloud, and Lower Pit Rivers Groundwater Monitoring Project													X	X	X		X										
8	Hydrological and Climate Change Evaluation of the Medicine Lake Volcano and its Connectivity to the Fall River Springs and Potential Connectivity to the McCloud River				x									X		X		X			X							
9	*Comprehensive Springs and Groundwater Monitoring Project*				*x*									*X*		*X*		*X*			*X*							
10	*Mt. Shasta Glaciers Long-term Monitoring Project*				*x*									*X*		*X*		*X*			*X*							
11	*Hydrologic Study of the Mt. Shasta Watershed*				*x*									*X*		*X*		*X*			*X*							
12	Grants Specialist	x	x	x	x	x	x	x	x	x	x	x	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
13	Climate Stewardship Coordinator	x	x	x	x	x	x	x	x	x	x	x	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
14	*Water Talks and Coordinated Educational Water Management Programs Project*	*x*	*x*	*x*	*x*	*x*	*x*	*x*	*x*	*x*	*x*	*x*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*
15	*McCloud 9 – Climate Community*										*x*			*X*				*X*	*X*		*X*	*X*		*X*		*X*	*X*	*X*
16	*Building Relationships of Trust and Understanding*																											*X*
17	*Shasta Climate Initiative - Curriculum Development & Implementation*																											*X*
18	*Headwaters Stewardship Fund*	*x*	*x*	*x*	*x*	*x*	*x*	*x*	*x*	*x*	*x*	*x*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*
19	Rainbow Ridge Collaborative Forest Stewardship													X	X			X	X									
20	Upper Sacramento and McCloud Watershed Working Forest													X	X			X									X	

	Conservation Easements																											
21	*McCloud / Moosehead Trail Crossing Stabilization*																	X	X	X								X
22	*Comprehensive Surface Water Monitoring*													X	X			X	X	X	X			X				
23	*Upper Sacramento Headwaters "Green Infrastructure" Conservation Project: Phase 1*														X	X		X	X		X					X		X
24	*Panther Creek Riparian Zone Invasive Species Removal*													X	X			X										
25	*Lakehead Area Fuels Reduction Project*													X	X			X										
26	*Control of Broom*													X	X			X										
27	*Preservation of Springs, Biological, and Cultural Resources*													X	X	X		X			X							X
27	*Keystone Species Reintroduction for More Resilient Habitats*													X	X	X		X		X						X		X
29	*McCloud River Restoration*													X				X										X
30	*Panther Meadows Tourist Education*																			X								X
31	*Salmonid Habitat Restoration and Economic Activity Protection*						x							X				X		X	X						X	X
	RMS met:	**4**	**7**	**4**	**8**	**5**	**5**	**4**	**6**	**4**	**7**	**4**	**4**	**21**	**14**	**12**	**4**	**26**	**10**	**10**	**13**	**5**	**8**	**6**	**5**	**7**	**8**	**14**
	Percent met by proposed projects:	**13%**	**23%**	**13%**	**26%**	**16%**	**16%**	**13%**	**19%**	**13%**	**23%**	**13%**	**13%**	**68%**	**45%**	**39%**	**13%**	**84%**	**32%**	**32%**	**42%**	**16%**	**26%**	**19%**	**16%**	**23%**	**26%**	**45%**

NOTE: Projects in *italics* are considered conceptual as of November 2013

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11. Impacts and Benefits

Impacts and benefits of the Upper Sacramento, McCloud, and Lower Pit Region (USR) Integrated Regional Water Management Plan (IRWMP) may be assessed in two ways: 1) on a regional level according to the effectiveness of implementing Plan objectives while satisfying the two overarching priority goals, and 2) on the basis of individual projects as they are implemented, and their associated impacts and benefits on and to the natural ecosystems and to all stakeholders, including disadvantaged communities (DACs) and local tribes.

The impacts and benefits to the region of the planning process and the Plan itself are more difficult to define than those of individual projects, though likely more important on a lasting level. The advantages of a regional effort over individual efforts have been made clear by the demonstrable increase in collaboration amongst USR stakeholders between the start of the planning process and today. Both planning- and project-level impacts and benefits are described below.

The communities that are affected by this IRWMP will decide the ultimate measure and success of implementation. It is important to note that impacts and benefits are usually interpreted according to a value system; there are several value systems represented in the regional water management group (RWMG) membership under which the impact and benefits and goals and desired future conditions are formulated and developed. On the whole, the state requires that an IRWMP be developed and implemented according to an agency model of water as commodity and implementation, or management, of that commodity as traditional infrastructure. While this model may be changing (see the Defenders of Wildlife white paper Nature's Benefits: The Importance of Addressing Biodiversity in Ecosystem Service Programs), it is important to USR stakeholders to acknowledge that diversity in value systems and priorities held by various members of the RWMG and respect these viewpoints as contributing to a larger whole. This topic is discussed further in Chapter 12, Performance Measures.

With respect to the variety of viewpoints represented in the USR stakeholder group, the goals and objectives identified in Chapter 7 are meant to acknowledge — and even embrace — the changing environment in terms of climate change, regulatory structure, and community values and priorities represented by the RWMG. The relative success of this effort will be measured through the evaluation of performance measures as identified in Chapter 12.

11.1 Potential Benefits and Impacts from Implementing the Plan

The creation of a forum for identification of jointly held values, mutually agreed upon goals and objectives, and project development and evaluation has already resulted in the identification of a number of collaborative efforts between agencies, non-profit organizations, and private entities. The advantages of the regional approach include opportunities to share knowledge and expertise; access to a variety of data, studies, plans, and management strategies; avoiding duplicative efforts or overlapping projects; allowing for consolidation of costs, effort and labor; identification of issues which can be better addressed regionally (e.g. climate change, groundwater issues, and cross-watershed collaborations on fish passage); the ability to work on point and non-point source pollution strategies (pollutants do not respect political boundaries); and an evaluation of projects from a fresh perspective through multiple points of view and experiences. The IRWM process allows for addressing multiple issues through multiple strategies simultaneously in one project and/or enabling cross-jurisdictional, cross-organizational collaborations. All of these things contribute to how the USR interacts with its neighbors, as well. The region is largely made up of disadvantaged communities, Native American groups, and small non-profit entities. Having a common platform from which to speak will help stakeholders to coordinate with neighboring regions as well as communicate better with state and federal agencies.

The requirements of plan preparation have mandated a level of increased regional understanding that did not exist prior to the formation of the USR RWMG. The ongoing dialogues, regular meetings, and creation of work groups have resulted in the ability of organizations to realize an economy of scale through the increased and in-depth knowledge gained in the process. It has also increased the ability of agency and non-profit entities to engage in policy level collaboration, and by so doing has fostered support of and empowerment amongst small grass-roots organizations. For example, though the project development process, a straightforward wastewater treatment upgrade for City of Mt. Shasta was further developed to meet additional objectives and regional needs through their collaboration with other project sponsors in project development workshops. Through this interaction, participants discussed the project during and the city incorporated recommendations for integration of other project aspects, which included:

1. Education and outreach;
2. Consideration of inclusion of in line hydropower generation in the outfall; and
3. The consideration of including a wetland-based tertiary treatment system to save money, energy, and expand riparian habitat.

The planning process (as the implementation process is likely to do) has also helped entities in the region to understand the importance of the region to the rest of the state, and that implemented projects can and do provide benefits that extend beyond the needs of the region. Some of these are described in Table 11.1, below.

Importantly, the design of projects by diverse stakeholders will help to increase public acceptance of water management strategies as they see projects proposed and supported by agencies and organizations that have not traditionally cooperated. This also has fostered an increasing sense of project-based altruism that continues to develop; once regional needs are known and understood it becomes easier to determine the relative importance of individual organizational issues.

Potential impacts on a general scale may include a perception of “giving up” power in terms of jurisdictional responsibility. This was a major concern by some USR stakeholders early on in the planning process and continues to be an issue for some stakeholders with regard to tribal sovereignty (more on this topic is shown in Section 11.5, below). RWMG members respect this viewpoint and have worked hard to address is through the governance model.

Most stakeholders see this as an ongoing conversation as the document is implemented, updated, and revised through the next 20 years.

In addition, the process of identifying, refining, and prioritizing projects can lead to hard feelings when specific projects are prioritized above others. Most agency participants in this IRWM process have represented a feeling of "being here for the long haul," indicating that funding isn't the sole focus of their participation. However, there are some serious needs represented by DACs in the USR, and the sooner these are fulfilled, the more these resource planners and managers will be able to participate more actively and fully in the non-project components of IRWM.

11.2 Advantages of Integrated Regional Planning and the Need for IRWM in the Region

Implementation of this IRWMP will have significant benefits to all stakeholders, including disadvantaged communities and local tribes (though there is some disagreement by one local tribe as to the benefits — or even authority — of the IRWM process in ancestral lands. More can be read about this issue in Section 11.5, below). As discussed in the governance chapter (Chapter 16), the USR stakeholder outreach efforts and governance structure allows representatives to actively participate in the development and implementation of the IRWMP. Through this open process, the potential for grant funding, partnership, and matching funds will be available to communities that previously may have been overlooked by regional planning efforts.

The need for IRWM has been represented in many ways throughout this document. One key area where IRWM will be able to fill a gap is in the area of groundwater knowledge. As California pursued groundwater measurement and tracking, it is even more important for stakeholders to understand the issues of connectivity and recharge. In order to build a more sustainable management structure for the future of the region (including enhanced adaptation capacity to climate change effects), it is important to enhance stakeholders' knowledge of how water works in the region and who uses it.

Another need that IRWM fills is that of a forum for discussion. The many resource planning and management efforts in the region have had varying outcomes in a multitude of stakeholder opinions, but there has thus far been no forum for discussion and integration of those efforts. In addition, some stakeholders have felt left out of these processes that affect their livelihoods, cultural history or, in some cases, basic human right to adequate amounts of clean water. RWMG members have voiced the hope that this process will continue on into the future as a forum for discussion of project design, funding, and implementation, as well as a forum for more general topic issue discussions of water storage, groundwater recharge, population and recreational growth and use, and many other topics of mutual concern.

11.3 Impacts and Benefits for Disadvantaged Communities

As discussed in the Region Description (Chapter 3), the USR includes many communities identified as disadvantaged per the public resources code section 75005(g) (80% or less of median household income).

Potential impacts of plan implementation on DACs could result from short-term physical changes during plan construction such as increased sediment, increased traffic congestion, and disrupted recreational access. The measures to ameliorate both short- and long-term negative project-related impacts should be identified through the required California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) processes. While it is the responsibility of individual agencies to implement the CEQA and NEPA environmental and cultural review processes when appropriate, stakeholders have noted that these processes have notoriously failed to reach out to DACs, minority groups, and indigenous tribes. Accordingly, some of these processes have failed to eliminate, minimize, or mitigate negative impacts on these communities. The USR RWMG will continue to reach out to DACs and involve them in the IRWM planning and implementation process to be sure that these communities are fully involved and empowered in what appears to be the mechanism by which the state will be using in the future to direct infrastructure funds to where they are needed.

If the plan is not implemented there is the potential for the deepening of conflicts for disadvantaged communities if aging and/or inadequate infrastructure is not invested in, public health hazards continue and/or increase, and water and recreational standards decline within the region. USR stakeholders seek to remedy these potential ills before they become acute, through the implementation of this IRWMP.

11.4 Impacts and Benefits for Native American Tribes

Recognizing the special status of Native American populations, the USR has developed and continues to invest in productive and inclusive relationships with regional tribal organizations.

As with DACs, the greatest impacts of the IRWMP will be determined by how the IRWMP functions within the region as the main conduit of state infrastructure funds to local projects and if the RWMG remains open to the views and needs of indigenous communities. The record of other regions and their current relationships with indigenous communities demonstrates that the IRWM process can be variable in its success in reaching out to and incorporating these communities and their priorities.

Their level of involvement and empowerment throughout the IRWM process will determine benefits to indigenous communities. Capacity building will be a key task within these communities; through the RWMG, members will have the opportunity to provide resources and expertise that can enhance the ability of indigenous communities to access funding. Involvement in the planning process will also give these communities a voice in the development, funding, and implementation of policies and projects that benefit the region as a whole.

Potential impacts of plan implementation on tribes could be similar to those felt by DACs, but tribes also have a unique concern with regard to sacred sites. Because of much of the history of land use in the region, many of the locations traditionally sacred to indigenous peoples have been made part of the United States' — and sometimes California's — public land management network. While this can aid in the education of recreationalists regarding

Native American issues and history, it also puts these locations at risk to irresponsible and/or irreverent activities, including defacing places of great ancestral value and interrupting private spiritual ceremonies.

While the implementation of the IRWMP is not expected to worsen this situation, the hope is that one of the benefits of implementing this IRWMP will be that through increased outreach and education efforts, negative effects can be reduced and that the sacred sites can continue to be to today's tribes what they have been to their many generations of ancestors.

In addition, there are a host of federal and state laws that at least nominally protect sites. The IRWM process can help members to educate their respective agencies and the public regarding these laws and their required mandates.

The main benefit of IRWM for indigenous communities must be empowerment of these communities within the funding and policy-making arenas of local, state, and federal agencies.

One of the tribes in the USR, the Shasta Nation, sees the IRWM planning process as a distinct threat to tribal sovereignty, and has made repeated requests to halt the planning process completely by order of the tribe as a sovereign nation, identifying most of the USR area as ancestral tribal lands. This statement excludes other tribes holding ancestral claims to lands within the USR. (Note: The statements and opinions of the leaders of the Shasta Nation in this regard are not shared by the Shasta Indian Nation, which also represents the people of the greater Shasta culture, nor do other tribes in the region concur with those opinions.) The challenge in addressing this statement is complicated by the fact that the treaties for many — if not most — of the tribes in California have never been formally ratified, or even rejected, by the federal government. This leaves tribes' status undetermined and complicates the relationships between tribes, local governments, private landholders, and the federal and state government.

USR stakeholders have been reticent to halt the planning process for several reasons:

1. There has been no explanation of how a planning document without regulatory or implementation enforcement capabilities affects the ongoing sovereignty of the Shasta Nation, especially when this concern doesn't seem to be shared by other participating tribes;
2. DWR has provided no direction as relates to tribal sovereignty and the IRWM program, and thus far has encouraged the continuation of the planning process, with respect to decisions made by the RWMG through the established governance structure; and
3. Discontinuing the planning process would severely hamper — if not explicitly disqualify — USR stakeholders from applying for implementation grant funds when they become available.

The choice made by the USR stakeholders is to acknowledge this as an issue for the region at large and the negative impact of the document on the Shasta Nation, as they perceive it. As stated previously, stakeholders expect that this discussion will be ongoing throughout the implementation of the IRWMP.

11.5 Project-level Impacts and Benefits

While the impacts and benefits identified in the table below represent a simple "screening level" assessment, project-specific impacts and benefits will be identified in more detail as they're brought forward for implementation through the USR IRWMP. An assessment of these values will be part of the RWMG's decision-making process for prioritizing projects and compiling project implementation packages.

Table 11.1, attached at the end of this chapter, portrays potential impacts and benefits based on USR objectives. Multiple issues and interests are addressed through each objective, so using objectives as the organizational principle indicates a variety of impacts and benefits that may or may not be related to each other directly. These impacts and benefits are projected based on possible projects that may be implemented as associated with these objectives.

11.6 Interregional Impacts and Benefits

The USR is an upper-watershed, source-water area. While the region supplies water to much of the state, its infrastructure for water delivery is primarily local and rural in nature, with long extensions of pipe relative to the number of people served. Frequently, projects improving water conveyance and treatment, local habitat, and water quality result in increased benefits to downstream users outside of the USR. The benefits of alternative energy projects alone can help the entire state to meet AB32 greenhouse gas emissions reduction goals. The benefits of project implementation extend far beyond Plan-specific boundaries and serve to enhance and emphasize the region's status as a source water area.

11.7 Benchmarking — Assessing Progress

Identifying potential impacts and benefits, then following up with a process for assessing those assumptions, will allow the RWMG to better tailor projects and plan-level programs to meet regional needs. Assessing progress must be done on a regional basis, but it's also possible that interregional collaboration could help in early identification of potential pitfalls. A process for undertaking a regional assessment, as well as an integration of lessons learned and how this work will be reported and recorded, is described below.

11.7.1 Regional Assessment

Assessing the RWMG's achievement of the benefits described in this chapter while avoiding identified or unanticipated impacts will largely be tracked on a project-specific basis. Each project, prior to implementation, will be required to present a list of impacts and benefits specific to the individual project. This list will be reviewed by the RWMG with any questions answered prior to implementation (and likely prior to funding, as well). Identified impacts will include a description of how the impact may be minimized or avoided completely. Following the completion of a project, the RWMG will request a report from the project sponsor regarding the listed and unanticipated impacts and benefits. A short discussion may ensue regarding specific successes or breakdowns in process or outcome, the effects of this — long- and short-term — and how they either might be built into future projects or avoided using specific, identified measures.

11.7.2 Interregional Assessment

USR stakeholders and grantees meet periodically with other RWMGs from around the state. Through these meetings, RWMG leadership is able to identify potential challenges, discuss how to structure processes for success, and further investigate opportunities for collaboration between regions. Through the past work of many of these regions, current IRWM benefits have been expounded and impacts have been minimized. This can be seen through some of the outreach strategies used and adapted since the mid-2000s, as well as project structure and approach. The USR will continue to participate in these interregional meetings, and will likely also have region-to-region meetings with surrounding RWMGs, including the Upper Pit, North Coast, and North Sac Valley IRWM groups.

11.7.3 Recording and Reporting Findings

As stated above, most of the impacts and benefits assessment will be made up of a project sponsor report and RWMG discussion. This discussion will be recorded in the meeting notes of the RWMG, but the outcome also must be reported in a formal way. It is expected that a formal performance measures tracking process will be implemented, and that the impacts and benefits will be reported through this, as well. Please see Chapter 12, Performance Measures, for more information regarding this process.

11.7.4 Incorporating Lessons Learned

It is through the RWMG discussion surrounding impact and benefit outcomes that stakeholders will share successes and avoid pitfalls. The RWMG discussions are integral to this process. In addition, however, the formal tracking mechanism described above will make this information available to any interested party at any time. Proposed projects similar to those that have already been implemented and assessed for impacts and benefits will be expected to review and incorporate the findings and successes of those projects.

Table 11.1: Regional and interregional impacts and benefits of IRWMP implementation project types

USR Issue	Potential Regional Impacts	Potential Regional Benefits	Potential Interregional Impacts	Potential Interregional Benefits
Objective 1: Increase knowledge of basin characteristics and raise public awareness and understanding of fractured rock aquifers, watershed dynamics, existing water rights, water resource allocation, and existing management authorities to inform and develop support for IRWM planning and projects.	→ Investigation into water rights can sometime be cause for temporary conflict → It is difficult to show the benefit of educational efforts, though expected benefits are extensive	→ Increased stakeholder participation and coordination → Increased regional investment and understanding → Increased regional cohesiveness → Public support could be galvanized through increased resource understanding → Increased awareness on a State level of source water areas and the resources provided → Increased investment in source water areas → Increased measures to protect groundwater → Increased resources allocated to understanding and preserving ecological function and integrity	None	→ Increased awareness on a State level of source water areas and the resources provided → Increased investment in source water areas → Increased interregional coordination efforts for cross-boundary issues and resources
Objective 2: Encourage, improve and maintain an environment that fosters cooperation, facilitates collaboration, and builds relationships of trust and respect among water resource stakeholders and community members with respect to water management efforts within the region.	→ Political discussions/ decisions can be hard on relationships in the short term due to conflicting and competing values and perspectives on water management → Requirement for additional stakeholder time and resources → Can increase the level and cost of regulatory compliance in the short term through increased time spent in coordination and communication	→ Will likely decrease regulatory compliance costs in the long term because of coordination efforts → Political discussions/ decisions regarding positions will build regional relationships in the long term → Increased regional cohesiveness → Synergies with K-14 curriculum → Increased level of investment of regional residents in regional watersheds	None	→ Increased in-region investment → Preserves regional self-determination and responsibility → Interregional coordination on education/ outreach efforts can save money → Education of recreational visitors can help improve stewardship in other regions → Provides information to all stakeholders and regions regarding indigenous communities' history, rights,

Table 11.1: Regional and interregional impacts and benefits of IRWMP implementation project types				
USR Issue	**Potential Regional Impacts**	**Potential Regional Benefits**	**Potential Interregional Impacts**	**Potential Interregional Benefits**
	→ Perceived negative impact on tribal sovereignty (specific to certain tribes)	→ Increased number of people reached in diverse communities		and sovereignty
Objective 3: Maintain and enhance the ecological health of the basin to: 6. Support the local economy; 7. Ensure public health and safety; 8. Respect and support indigenous cultures; and 9. Improve recreational infrastructure and opportunities for both tourism and the local economy.	→ Temporary, site-specific construction impacts → Increased mandatory compliance measures to avoid species and habitat impacts → Conflicting definitions on watershed health and function could lead to conflict within the region or group → Imbalance between stakeholder perspective regarding economic and ecological considerations → Sensitive cultural and ecological areas could be impacted by increased recreational opportunities	→ Increased coordination between water users and environmental groups → Improved species habitat and population → Return of previously extirpated species → Increased species diversity and makeup → A more robust, healthier ecosystem → Reduced surface water contamination → Greater landscape water holding capacity → Increase substrate available for species/habitat use → Increased level of investment of regional residents in regional watersheds → Increased in-region economic opportunity and benefit → Sites of importance to indigenous cultures are protected → Increase in the number of small natural-resource-dependent businesses → Increased Native American representation in water management discussions → Increased regional awareness of tribes' presence and history	None	→ Improved species habitat and population → Return of previously extirpated species – more robust statewide populations → Increased species diversity and makeup → A more robust, healthier ecosystem → Increased in-region investment → Preserves regional self-determination and responsibility → Sites of importance to indigenous cultures are protected → Increased interest in regional tribes and collaboration efforts

Table 11.1: Regional and interregional impacts and benefits of IRWMP implementation project types

USR Issue	Potential Regional Impacts	Potential Regional Benefits	Potential Interregional Impacts	Potential Interregional Benefits
		→ Increased protection of resources important to the Native American way of life		
Objective 4: Support and improve ongoing forest management efforts with regard to local water quality and supply, including fire management, within existing regulatory frameworks.	→ Temporary, site-specific construction impacts → Competition between user groups and interests → Recreation uses can harm site of traditional and cultural Native American value → Increased emissions from fuels management activities → Conflicting views of healthy forests and effective management	→ Increased headwaters water retention → Improved recreation opportunities → Decreased water treatment costs → Increased watershed resiliency → Increased water supply → More stable water temperature and base flow → Improved habitat for native plants and animals → Cost savings due to avoided contamination problems → Decreased emissions from catastrophic fire → Improvement in landscape-level response to climate change → Increased regional adaptation and mitigation to projected climate effects → Increased number of green jobs in region → Healthy, fire-resistant forests	→ Recreation uses can harm sites of traditional and cultural Native American value → Increased emissions from fuels management activities	→ Improved species habitat and populations → Increased headwaters water retention → Improved recreation opportunities → Increased watershed resiliency → Increased water supply → More stable temperature and base flow → Greater control over invasive species spread → Improvement in landscape-level response to climate change → Increased regional adaptation and mitigation to projected climate effects → Decreased emissions from catastrophic fire → Greater landscape water holding capacity → Lower cost to the state for catastrophic fire fighting → Increased number of green jobs
Objective 5: Ensure support for and foster success of water management efforts for disadvantaged communities including Indigenous Tribes and Nations while respecting the cultural values of existing	→ Political decisions regarding funding choices can be difficult for a stakeholder group → Requires a formal, long-term structure for funding and	→ Increased investment in the region → Increased integration of stakeholders results in a better overall understanding of issues	→ Not all grant opportunities are appropriate for all entities/communities; partnering will be an essential component of moving the region forward together	→ Increased in-region investment → Preserves regional self-determination and responsibility

Table 11.1: Regional and interregional impacts and benefits of IRWMP implementation project types

USR Issue	Potential Regional Impacts	Potential Regional Benefits	Potential Interregional Impacts	Potential Interregional Benefits
communities.	follow-up (staff and funding requirements) → Resources don't go towards other programs and projects	→ Increased level of investment of regional residents in regional watersheds → Increased number of people reached in non-traditional cultural groups		
Objective 6: Support local participation in development and implementation of water quality standards that reflect local conditions and implementation of projects that maintain and enhance the basin's existing water quality. Identify point source pollution and problem areas.	→ Political discussions/ decisions can be hard of relationships in the short term → Requirement for additional stakeholder time and resources → Can increase the level and cost of regulatory compliance → Could result in lower standards within the region, negatively affecting recreational, cultural, and other important values	→ Political discussions/ decisions regarding positions will build regional relationships in the long term → Increased regional cohesiveness → Collaborative efforts can increase regulatory compliance rates → Increased regulation and water quality monitoring	None	→ Increased in-region investment → Preserves regional self-determination and responsibility → Interregional coordination on education/ outreach efforts can save money → Efforts can increase compliance rates on a statewide level
Objective 7: Ensure adequate water supply and quality while maintaining regulatory compliance, minimizing conflict, and recognizing and respecting existing water rights and other water users.	→ Efforts to protect water supply could cost participants financially and with staff time and resources → Prioritizing projects/issues may be a difficult task → Temporary, site-specific construction impacts → Additional contamination sites could be discovered → Negative feedback from recreation groups due to increased restrictions → The health and environmental effects of weather modification are not well understood and could be detrimental within the region	→ Stakeholders protect and invest in regional resources → Have a greater understanding of regional water supply needs now and into the future → Increase regional understanding of potential hydrologic changes → Increased available water supply → Decreased treatment costs → Decreased number of health advisories → Increased protection of threatened/ endangered species → Adequate supply for fish and wildlife, as well as for	→ More water kept in the USR through additional storage/reservoirs could change the hydrologic pattern and timing for water going into Shasta Reservoir, and could result in additional evaporative losses → The health and environmental effects of weather modification are not well understood and could be detrimental within the region and beyond	→ Higher base flow could result from water supply conservation → Increased populations of threatened/ endangered species

Table 11.1: Regional and interregional impacts and benefits of IRWMP implementation project types				
USR Issue	**Potential Regional Impacts**	**Potential Regional Benefits**	**Potential Interregional Impacts**	**Potential Interregional Benefits**
		communities in the region		
Objective 8: Facilitate development of sustainable water/wastewater infrastructure to ensure public health, protect ecological integrity, and support economic stability. Research, facilitate and support alternative waste/waste water treatment technology that also protects public health, ecological integrity and economic stability.	→ Political decisions regarding funding choices → Requires a formal, long-term structure for funding and follow-up (staff and funding requirements) → Resources don't go towards other programs and projects → Water quality degradation during construction → Habitat/species affects during construction → Potential effects on DACs/EJ communities → Temporary or permanent reduced in-stream flow	→ Increased investment in the region → Increased integration of stakeholders results in a better overall understanding of issues → Increased level of investment of regional residents in regional watersheds → Increased in-stream flow → Increased supply reliability → Improved in-stream water quality → Increased recreational opportunities → Increased system redundancy → Better preparation for an altered hydrology → Decreased spill violations	→ Water quality degradation during construction → Habitat/species affects during construction → Potential effects on DACs/EJ communities → Temporary or permanent reduced in-stream flow	→ Increased in-region investment → Preserves regional self-determination and responsibility → Increased in-stream flow → Improved in-stream/downstream water quality → Increased recreational opportunities → Increased supply reliability → Decreased spill violations
Objective 9: Address flooding concerns through infrastructure improvements and support ongoing flood management efforts. Research history of flooding in the region including the different landscape and water conditions that naturally decreased flooding.	→ Temporary site disturbance → Possible temporary or permanent habitat loss, depending on the infrastructure identified	→ Increased regional capacity to adapt to climate change → Increased number of green jobs in region → Decreased in-region costs due to flood damage, including insurance costs → Possible gain in habitat, depending on the infrastructure identified	→ Possible temporary or permanent habitat loss, depending on the infrastructure identified	→ Increased regional adaptation and mitigation to projected climate effects → Increased number of green jobs in region

12. Plan Performance and Monitoring

Monitoring and assessment is a critical management component to implementing the Integrated Regional Water Management Plan (IRWMP). This chapter focuses on the performance and monitoring of individual projects, as this represents the bulk of how the IRWMP will be implemented on the ground. While most performance measures and monitoring activities will be related to project implementation, there are a couple of measures identified in order to better track regional water management group (RWMG) success. It is important for stakeholders to identify what they hope success will look like for the collaborative process because this will then help them to define the path forward after the planning grant comes to a close. Stakeholders are interested in continuing the RWMG for reasons beyond grant funding; some stakeholders have discussed the potential for the RWMG to be an organizing entity within the region to develop collaborative approaches to issues affecting the entire region. Some of this is discussed in Chapter 15, Finance.

12.1 Monitoring and Evaluation

While the process for monitoring and evaluation is outlined below, the responsibility for the effort is two-fold. Project sponsors — and collaborators, as decided by the project sponsor — are responsible for identifying and tracking performance measures specific to their projects. It may be true that they have performance measures in mind that are not included in the Upper Sacramento, McCloud, and Lower Pit Region (USR) list; those may be tracked as they wish, however, the measures specific to the USR IRWMP must be tracked and reported on at least an annual basis. The RWMG is responsible for beginning the evaluation process and assigning that task to member groups and/or RWMG staff, as available. More about this process is described below.

12.1.1 Performance Measures

All USR projects can be linked to at least one objective. USR stakeholders identified measurement strategies for each objective based on the topic and the issues addressed. These measurements will become the performance measures, and are shown in Table 12.1, below.

Table 12.1: Performance Measures based on Objectives and Issues

Objective	Measurements
7. Increase knowledge of basin characteristics and raise public awareness and understanding of fractured rock aquifers, watershed dynamics, existing water rights, water resource allocation, and existing management authorities to inform and develop support for IRWM planning and projects.	1. Map all groundwater basins by 2018 2. Understand the dynamics of groundwater in the Medicine Lake Highlands by 2025 3. Create and implement a public education and outreach campaign on watershed conditions and management by 2020 by supporting existing outreach efforts as well as developing additional strategies 4. Develop a better understanding of implications of climate change on this region and create a strategy for this by the end of 2014 5. Develop and support a basin hydrologic inventory including water sources, uses, features, and critical management areas for both ground and surface waters by 2018
2. Encourage, improve and maintain an environment that fosters cooperation,	1. Continue to meet as a RWMG through the life of the IRWMP (at least twice a year for the next 20 years)

Table 12.1: Performance Measures based on Objectives and Issues

Objective	Measurements
facilitates collaboration, and builds relationships of trust and respect among water resource stakeholders and community members with respect to water management efforts within the region.	2. Continue outreach to both current and potential members on an annual basis 3. Complete a basic ethnographic section for the 2012-2013 IRWMP and working to collaboratively implement recommendations developed in that assessment 4. Two public presentations or newspaper articles about regional water management issues in the USR annually 5. Develop and maintain a glossary of terms specific to the USR IRWMP by 2014 6. Track implementation success on a bi-annual basis 7. Track the number of projects involving more than one entity and the success of those collaborations 8. Include stakeholder survey indicating level of support by stakeholders in project review criteria (five star collaborative project) 9. Implementation of video project in 2013 10. Equitable governance structure demonstrated in post-planning process
3. Maintain and enhance the ecological health of the basin to: a. Support the local economy; b. Ensure public health and safety; c. Respect and support indigenous cultures; and d. Improve recreational infrastructure and opportunities for both tourism and the local economy.	• Implement at least three projects by 2020 that improve/protect ecological health and are compatible with the local economy • Document the economic impacts of restoration projects as they are implemented • Track and document economic benefits that can be linked to water infrastructure improvements as they are implemented • Quantify beneficial ecological results of projects (habitat improvements, water storage/infiltration, etc.) as they are implemented
4. Support and improve ongoing forest management efforts with regard to local water quality and supply, including fire management, within existing regulatory frameworks.	11. Reduce fuel load on at least 5,000 acres on an annual basis through 2020 12. Document the number of projects implemented by forest management entities on an annual basis
5. Ensure support for and foster success of water management efforts for disadvantaged communities including Indigenous Tribes and Nations while respecting the cultural values of existing communities.	• Document support for the participation of DACs in the IRWM process on an annual basis • Implement at least three projects with a DAC project proponent by 2017
6. Support local participation in development and implementation of water quality standards that reflect local conditions and implementation of projects that maintain and enhance the basin's existing water quality. Identify point source pollution and problem areas.	5. Work collaboratively to develop a method to locally track and document conditions on an annual basis 6. Develop a process to track locally-managed water quality for critical streams by 2015 7. Complete a local water quality assessment of the Upper Sacramento River by 2017
7. Ensure adequate water supply and quality while maintaining regulatory compliance, minimizing conflict, and recognizing and respecting existing water rights and other water users.	• Identification and quantification of water rights in the region by 2017 • By 2018, complete a projection of regional water needs into the next thirty years • Assessment of adequate area-of-origin water rights

Table 12.1: Performance Measures based on Objectives and Issues	
Objective	**Measurements**
	projections for the region by 2020 • Develop a regional capital improvement plan that identifies key deficiencies with proposed actions by 2016 • Better coordination and communication of land use planners and those regulating or managing water through an active coordination program designed by RWMG members by 2015
8. Facilitate development of sustainable water/wastewater infrastructure to ensure public health, protect ecological integrity, and support economic stability. Research, facilitate and support alternative waste/waste water treatment technology that also protects public health, ecological integrity and economic stability.	• Implementation of at least three projects protecting and/or improving water/wastewater infrastructure by 2020 • Identify and develop a strategy to address non-municipal water and wastewater supply and quality concerns including individual wells and septic systems by 2015 • Projections of water needs into the next thirty years by 2018 • Understanding connections between spring water and groundwater by 2018
9. Address flooding concerns through infrastructure improvements and support ongoing flood management efforts. Research history of flooding in the region including the different landscape and water conditions that naturally decreased flooding.	5. Identify flood control and management deficiencies and develop an infrastructure improvement plan by 2015 6. Address critical flooding threats to communities by 2020

12.1.2 Responsibility and Timing

As stated in the Section 12.1, above, the RWMG is responsible for completing an assessment of performance for the IRWMP. This will be done through the collection of individual project sponsors' monitoring efforts and results, as well as some internal RWMG effort tracking.

Collecting project sponsor results will consist of an annual targeted outreach effort to those sponsors who have had projects funded in the last year through the IRWMP. The entity doing the tracking will likely use some type of data collection tool, such as a Microsoft Excel spreadsheet, to quantify both the objective measurement as well as the total effort toward the measurement goal. This will get baseline information into the tracking system.

A secondary effort will be a call to the entire RWMG to report any project efforts completed in the past year that have contributed to at least one of the USR objective measurements. These efforts will be tracked in the same way, through the data tracking tool. The reason these additional efforts are to be tracked is because the RWMG acknowledges that not all projects will go through the USR, but knows that most projects implemented in the region will likely satisfy at least one objective. In addition, it's likely that the IRWMP will begin to be used as a guidance document for a variety of planning and implementation processes (since it is designed by a variety of participating entities), and that it will begin to be incorporated into those implementation efforts.

While an annual evaluation of success is projected, formal plan revisions due to these reviews are not anticipated more often than every five years due to the time and cost associated with formal revisions. Temporary revisions will be done through a process of addendum development.

12.1.3 Project Completion: Tracking Success and Integrating "Lessons Learned"

As stated above, the measurements obtained from projects sponsors will be recorded in a tracking tool. While the appropriate tool is to be determined, it is likely to be simple spreadsheet that is easy to use for a variety of member entities. The RWMG will identify, on an annual basis, the responsible entity for this tracking effort. The choice may be made on a voluntary basis, or possibly based on the situation of the member. It may be desirable that the tracking entity be a neutral party, or an entity with significant history in running the IRWM process, such as the River Exchange (which is managing the 2011-13 IRWM Planning Grant). It could be a responsibility that goes from entity to entity, alphabetically or in some other way throughout the next 10-20 years. In any case, it will be a task managed by the RWMG that will need to be covered through in-kind efforts if no direct financing is available.

The results of the tracking will be reported in a list or spreadsheet manner so that all members and the general public will be able to understand the results. It will be posted on the USR website and made available in hard copy at the next meeting immediately following its preparation.

The results of the evaluation will help to define the direction of the group as it continues through implementation. It is possible that the assessment will show a higher-than-expected result in some measurements and possibly a slower implementation pattern in others. The RWMG must, at that point, decide what to do with the results. They may choose to further focus on the successful endeavors, or perhaps put greater emphasis on the factors that seem to be lagging behind expectations. This choice could affect the projects put forward and accepted by the RMWG in the future.

In addition, the results of the evaluation and assessment could affect the IRWMP directly through implications in resource management strategies (RMS) used and/or the efficacy of specific objectives and/or measurements. If these need to be changed, the governance put in place will allow for those changes to be discussed, negotiated, and made when the time comes.

12.1.4 Project-specific Responsibility

Primary responsibility for project-specific monitoring plans and activities is with the individual project sponsor and its collaborators. These plans will likely be developed when the project has been accepted as a "ready to proceed" project in the IRWMP. All project monitoring plans will be made available via the RWMG website along with all other project materials. Making these plans publically available increases regional organizational capacity by creating a pool of monitoring resources available to all RWMG members and the general public. In this way, regional project monitoring expertise and consistency is elevated.

A typical monitoring plan for USR RWMG projects includes the following:

1. A brief description of the project and GPS-based location of either a) the project center if it is a large project or b) the actual project location if it's location-specific;
2. A description of the monitoring that will be done for the project and the specific, GPS-based location of that monitoring (see Table 12.2, below, for a list of possible monitoring activities based on project type);
3. The protocols and frequency of the monitoring done; if it is to be done in compliance with an established regulatory framework, that framework will be referenced;
4. The individual and/or entity responsible for monitoring is identified and a contingency plan described in the case that the individual or entity is unable to complete the responsibility;
5. A plan for tracking the data and how it will be used; also, how the data will be made public and how the public will benefit from the information made available and whether any interpretation will be necessary and done in order to convey particular messages to the public;
6. Reference to both the Data Management System (DMS) for performance measures monitoring as well as to applicable state databases and tracking tools; if a state database is referenced, the protocols for state database reporting (available in Chapter 13, Data Management) should be referenced and any additional contact/coordination completed; and
7. A description of the funding and/or volunteer coordination efforts needed to complete the monitoring task and how, if applicable, the work will be funded if scheduled to be complete after grant funds expire or are used in full on project implementation

Table 12.2: Potential monitoring activities based on project type.

Project Type	Potential Project-level Monitoring Indicators
Environmental Work/restoration	a. Extent of flooding b. Linear feet of channel bottom and bank erosion repair c. Linear feet of vegetated swale created d. Miles of riparian corridor restored e. Stabilization of severe bank erosion f. Number and distribution of native species g. Development of a low-flow threshold for (fill in) population h. Development of method to distinguish and characterize at-risk populations for the purpose of targeting risk-reduction and impact-mitigation efforts i. Distribution of non-native species j. Re-grading of channel complete
Water Quality	a. Number of certified water testers b. Number of homes sampled/tested c. Quality of on-site stormwater runoff d. State or federal protocols or standards for water quality testing or measurements e. Salinity, organic carbon, turbidity, nutrients, and pathogens in local or regional discharges and runoff f. Reduced inflow of contaminants to treatment plant g. Removal of water body from 303(d) list

Recreation	a. Square miles of watershed access b. Number of access points to (fill in) river c. Linear feet of new trails
Land Conservation and Stewardship	a. Number of acres of forest protected b. Cost per acre of forest protected c. Amount of voluntary land conservation d. Acres of land protected e. Linear feet of fire road stabilized f. Sediment delivery to adjacent creek channels g. Quality of water in adjacent creeks
Infrastructure Projects	a. Quality of on-site stormwater runoff b. Flow rate/capacity c. Percent of CIP implemented d. Frequency of infrastructure issues/problems e. Stabilization of the (fill in) dam/canal/intertie/etcetera f. Capacity of existing plant g. Stormwater infiltration area established h. Number of active monitoring wells
Water Supply	a. New wells drilled b. (Number) years of supply projected c. Quantity of recycled water produced d. Cost per household of supply augmentation (can be used for both supply- and demand-side management)
Education and Outreach	a. Number of individuals educated b. Decrease in the amount of pesticides/herbicides applied on residential properties c. Number of viewing platforms erected d. Decrease in per-capita water demand e. Number of participants in region-wide technical committees for discussing data collection, management, disbursement, coding, presentation techniques f. Removal of properties from FEMA flood insurance rates g. Development of a manual/guidebook h. Placement of (number) signs
Planning	a. Model completed b. Vulnerabilities assessed c. Development of feasibility assessment d. Development of methods for identifying contaminants e. Percent of stakeholder/public input considered and/ or included in the project implementation design

13. Data Management

Quality data and effective data management are critical to well informed decision-making, long-range planning, and cooperative efforts. An effective data management approach supports informed decision making by providing efficient access to critical information and, through cost-effective cooperative data collection, provides access to more and higher quality data than participants might obtain individually. An effective approach also supports long-range planning and adaptive management by documenting results of watershed projects for effective adjustment of program objectives. It also fosters clearer understanding and agreements between cooperating entities and ensures integration of future data collected.

Data management is included in the Integrated Regional Water Management Plan (IRWMP) Guidelines as one of the Plan Standards and requires that the IRWMP describe:

> *"…the process of data collection, storage, and dissemination to IRWM participants, stakeholders, the public, and the State."* (Propositions 84 & 1E IRWM Guidelines page 22)

This section describes how data are collected, validated, and shared in the region. It also includes recommendations that will result in effective sharing of existing data and protocols for collection of future data that will maintain/improve data integration. It is organized to discuss regional data needs, the proposed means and protocols for management of existing data, integration of future data, and plans for regional data sharing.

It is important to clarify that for this section the term "data" will be used in a general sense to describe all information collected to support decisions, carry out plans, and document results. These data may describe such things as conditions of infrastructure or natural systems, operational issues, project or program effectiveness. The general term refers to three types of information; (1) field/lab data which represents quantitative, scientific observations and measurements; (2) reports which may include studies, references, and evaluations; and (3) plans which may include designs, drawings, maps, or other spatial information.

13.1 Overview of Data Needs in the Region

The proposed data management system will provide a means of managing available and future data. The recommended management system should consider the following data needs, as described below.

13.1.1 Specific Data Needs Identified by the Regional Water Management Group

In development and review of issues and interests, the members of the regional water management group (RWMG) identified the following data needs for the region:

- Description of the hydrologic cycle of the region. Specifically RWMG members noted limited information describing the hydrology and hydrogeology around and under Mt. Shasta and in the Medicine Lake Highlands area
- Historical water resources and watershed conditions
- Description of ground and surface water interactions
- Climatologic field data and patterns
- Description of potable water supply (spring and groundwater sources) timing, discharge, age
- Documentation of water quality conditions throughout the region and specifically within the Upper Sacramento River

13.1.2 Other Potential Data Needs

In addition to these specific needs, the following data may be needed to support project development and implementation:

- Municipal water use, reuse, and discharge
- Water rights information
- Industrial water use, reuse, and discharge
- Population information and trends
- Regional economic information
- Biological and physical habitat condition indicators
- Watershed condition indicators
- Information regarding available education and outreach programs and facilities
- Existing infrastructure condition and future needs
- Fuels management programs/protocols/studies
- Fire protection requirements
- Silvicultural practices
- Project effectiveness relative to basin objectives (future projects for monitoring the IRWMP effectiveness)

13.1.3 Data Management Needs

A data management approach will be designed and implemented in order for the aforementioned data to be effectively used by the members of the RWMG. Some data listed above already exist, but need to be curated (reviewed and managed to ensure a certain level of data set quality and reliability) and made discoverable (be in a location and format that can be searched efficiently and used effectively). Some data have yet to be gathered. In general, information should be collected and stored to maximize discoverability. Field/lab data should be collected in a manner that is consistent with current collection standards so as to make it reliable and compatible with existing databases.

13.2 Data Management Approach

As efforts are made to find existing or collect new data, management of that data is imperative. Inaccessible data (dark data) are no better than data that don't exist, and proper qualification of data is important to their proper use. This section describes some principles and elements to be incorporated into the overall data management approach to ensure the most reliable and accessible data. To clarify, the data management approach refers to a holistic method of planning for, collecting, and managing data. As a tool within the approach, the RWMG will utilize a Data Management System (DMS) that will include some combination of Internet links, web portal(s), data library, and/or GIS interface. The data management approach includes the following components:

- Use of the Environmental Protection Agency (EPA) Data Quality Objectives (DQO) process for collecting new or assembling existing data and for evaluating the utility and reliability of that data
- Standardized techniques for collecting new reports, plans, and field/lab data
- Protocols for stakeholder data contribution
- Selection and implementation of a DMS
- Data validation and Quality Assurance/Quality Control (QA/QC) measures
- Protocols for sharing data collected for project implementation, for data distribution and maintaining compatibility with state databases.

13.2.1 EPA Data Quality Objectives Process

Data management is more than just a library list of documents or quality control of field samples. For an overall data management approach this plan will follow the EPA DQO methodology (see Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA/240/B-06/001, Feb 2006). It is a systematic means of collecting new data or assembling existing data to support a decision (e.g. project to fund) or a finding (e.g. quantity of water available). As participants plan for and implement data collection and management efforts, the principals of Performance Criteria and Ranking/Prioritizing Criteria will be utilized to enhance efficiency.

Performance Criteria: Outlining performance criterion prior to data collection and management provides a framework to guide these efforts. For collection of new data, it provides the basis for setting protocol and limits on data collection. Even for existing information, it provides guidelines for deciding what to use and how to use it. Adherence to these principles provides defensible products and decisions utilizing available resources through:

1. Logical project development: project needs and objectives are clearly defined and data management efforts are tailored to these objectives;
2. Selection of compatible data collection protocol: review existing database(s) to which the data could be submitted and plan data collection/management accordingly;
3. Target quality data: based on project needs and database protocol, appropriate data quality is targeted (to avoid over or under defining the item of interest) for the task and available resources (for existing data, an appropriate ranking of data quality, applicability, and compatibly is assigned);
4. Maintain transparency of intent and direction: by providing clear and accessible records of this process, confidence in the integrity of data is maintained;
5. Support sound conclusion: data are utilized to support sound conclusions, which may include peer or regulatory review of data use; and
6. Maintain proper documentation: efforts to plan for data management, including decisions, assumptions, and recommendations will be appropriately documented to support confidence in the outcomes and information for future modification.

Rating / Prioritizing Criteria: As noted under Item 3 of the Performance Criteria, there is a need for a system of ranking and/or prioritizing data collected for this process. Data will be collected from a variety of sources, will come in varying degrees of compatibility, and may have a wide range of data quality. The Ranking/Prioritizing Criteria will be utilized to properly annotate the data so that users have a clear sense of their appropriate use. Existing and new data will be evaluated according to the following:

1. Applicability and Utility for a proposed project. This criterion refers to means of categorizing data to identify to what extent they may be useful to support findings regarding a specific project or process. This applicability may be functional or geographical.
2. Clarity and Completeness of data presentation. Ultimately, the objective of data collection and management is to provide a basis for decision making and planning. There needs to be some indication of the clarity and completeness of field/lab data, a report, or a plan set when it is being relied on to make decisions. The intent of this criterion is not to exclude data, but to provide an understanding of how representative the data set is and where there might be data gaps.
3. Uncertainty and Variability of submitted data. An evaluation of the uncertainty and variability associated with submitted data, although similar in nature to clarity and completeness, provides another means of understanding how to use data. A data set may extensively and clearly characterize a particular condition, but due to the nature of the information desired, there may still be significant uncertainty. For example, a stream

gage field data set might be extensive (100 years of information) and clear (based on United States Geological Survey (USGS) protocol with clearly defined accuracy of individual measurements) but may still have a fairly high level of uncertainty regarding a specific field data need (e.g. What will be the instantaneous peak flow on March 2, 2015?). Coupling these two criteria provides a more robust understanding of how the data should be used.

13.2.2 Description of Typical Data Collection Techniques

As noted in the description of process framework, part of the data management approach will include evaluating existing database protocols to assure compatibility. Stakeholders will evaluate state programs for applicability on specific items (e.g. Surface Water Ambient Monitoring Program (SWAMP) field data collection and submittal protocols for surface water field data). Specifics of data collection techniques will depend on the project and the type of data being collected but the techniques will follow those outlined in the data collection plan of each applicable state database. If a project seeks to accomplish objectives that do not include the collection of data that would fit into a particular state database, the best principles approach will be used, along with discussions with the project technical advisory committee, to ensure that effective, efficient, and defensive methods are identified and employed.

A number of different databases are described below, categorized by data type. This list is not exhaustive, but includes all databases described in the Department of Water Resources' (DWR) November 2012 IRWM Guidelines. The last category includes searchable databases that don't accept direct data entry. Data available through these sources must be entered through an alternate pathway. However, they represent significant data sources that can be useful when designing a project or assessment.

General Databases:

Sacramento River Watershed Information Module

The Sacramento River Watershed Information Module (SWIM) is a data management tool managed by the Sacramento River Watershed Program (SRWP) as a network for coordinating and utilizing Sacramento River Watershed information. This site provides a clearinghouse and is not necessarily intended to set protocol for data collection. The RWMG may consider utilizing the SWIM as a data management system for the region or at least linking data managed through the IRWMP to the SWIM system. The Upper Pit IRWM Region utilizes the SWIM as its data management system and there is a baseline of data in this tool for the Upper Pit IRWM Region. Instructions on use of this website are available at: www.sacriver.org.

California Environmental Data Exchange Network

California Environmental Data Exchange Network (CEDEN) is a system designed to facilitate integration and sharing of data collected by many different participants. The system allows for both finding and submitting data. The CEDEN data templates are available on the CEDEN website: http://www.ceden.org.

California Environmental Information Catalogue

The California Environmental Information Catalogue (CEIC) is a statewide metadata clearinghouse for geospatial data. Entering field/lab data and information into SWIM (above) automatically enters it into the CEIC. This database can be accessed at http://ceic.resources.ca.gov/.

Water Quality Databases:

Surface Water Ambient Monitoring Program

The State Water Resources Control Board created the Surface Water Ambient Monitoring Program (SWAMP). This database offers protocols for quality assurance and offers guidelines for standard operating procedures. Any group receiving state funds for surface water quality work must ensure collection of their field data is done in coordination with SWAMP standards. The website for SWAMP is: www.swrcb.ca.gov/water_issues/programs/swamp/about.shtml.

Groundwater Databases:

Groundwater Ambient Monitoring and Assessment program

Groundwater Ambient Monitoring and Assessment program (GAMA) provides a comprehensive assessment of water quality in water wells throughout the state. If you are going to complete a project that will have a groundwater quality component, it's very important that you contact the GAMA program manager before you design the field/lab data output format to enable easier transfer of field/lab data and information into the GAMA database. The preferred format is GeoTracker ESI (www.waterboards.ca.gov/ust/electronic_submittal/); simple Excel files can be problematic. Additional information on the GAMA program, as well as staff contact information, is available at www.swrcb.ca.gov/gama.

California Statewide Groundwater Elevation Monitoring

California Statewide Groundwater Elevation Monitoring (CASGEM) builds on many long-term monitoring programs and anticipates the entry of new data from recently initiated monitoring programs. Monitoring is done by local jurisdictions; there is an extensive user guide available, as well as program staff contact information. Data entry requires a monitoring entity to create a login for entering field/lab data and information into the database. CASGEM is available at www.water.ca.gov/groundwater/casgem/.

Reference-only Databases and/or Data Management Systems:

Water Data Library

This Water Data Library (WDL) collects field/lab data and information from other sources to house it all in one place. It is a good place to go for information, but primary data must be added in another place (SWIM, GAMA, SWAMP, or CASGEM). The information can be accessed at www.water.ca.gov/waterdatalibrary/.

Integrated Water Resources Information System (IWRIS)

DWR maintains this data management tool for water resources data. It is a web-based application that allows access to data in GIS-thematic layers and includes entries from the WDL. Map data can be accessed by users at www.water.ca.gov/iwris.

California Environmental Resources Evaluation System

California Environmental Resources Evaluation System (CERES) was developed to facilitate access to a variety of electronic data describing California's rich and diverse environments through a focus on three related components: technology, data, and community. It incorporates several other state databases and, as such, has found data standards to be an important consideration; it has several examples of data standards and data transfer/exchange formats. The database is available at http://ceres.ca.gov.

California Data Exchange Center

California Data Exchange Center (CDEC) installs, maintains, and operates an extensive hydrologic data collection network including automatic snow reporting gages for the Cooperative Snow Surveys Program and precipitation and river stage sensors for flood forecasting. The database provides a centralized location to store and process real-time hydrologic field data and information gathered by various cooperators throughout the state. CDEC also operates a data exchange program with various federal, state, and other public agencies. Information on the tool is available at http://cdec.water.ca.gov/intro.html.

California Irrigation Management Information System
The California Irrigation Management Information System (CIMIS) is a program in the Office of Water Use Efficiency in DWR that manages a network of over 120 automated weather stations in the State of California. The primary purpose of CIMIS has always been to make real-time weather field data and information — useful in estimating crop water use for irrigation scheduling — publically available. CIMIS information is available at www.cimis.water.ca.gov/cimis/welcome.jsp.

13.2.3 Protocol for Stakeholder Data Contribution

Part of the integration of resources in the region will be through shared use of data. As part of the IRWM process a website has been developed as a means of sharing data and to serve as a central location for participants to seek data and keep track of the IRWM process. This website will serve as an access point for project data. The website would function as a web portal for shared access to existing state and local databases. If a local entity does not have an electronic database, information would be submitted to the entity managing the website [currently River Exchange (REX)] for curation and addition to the database. This website includes a searchable library of available data. The website will maintain a password protected section for data that have limitations on distribution. In the future, the website could also link data to the SWIM web portal or IWRIS data management tool. A proposed future enhancement to the website would be the integration of a GIS-based mapping component, e.g. ESRI GeoPortal (information on this tool may be found at http://www.esri.com/software/arcgis/geoportal), for spatial reference to available data.

When stakeholders submit data or links to data for inclusion in regional or state database, the RWMG utilizes the following protocol.

1. Data submitted for inclusion in the IRWM database must be accompanied by metadata for tracking the submitted information. Required information includes:
   - Location
   - Contributing entity
   - Contact information
   - Type of data (field/lab data, report, plan)
   - Title of submittal
   - Author/publisher of information
   - Limitations on distribution
   - QA/QC information [Peer reviewed journal, data collection protocol followed, rating /prioritizing criteria (applicability/utility, clarity & completeness, uncertainty & variability)]
   - Keywords/document reference: for improved searchability of the database.
2. The information is reviewed to ensure that complete metadata is provided for acceptance in accordance with DQO principles discussed in Section 13.2, above.
3. Web portal access is as follows:
   - Web address: http://www.uppersacirwm.org/
   - Password requirement: there is no password required for plan viewing or basic data access. The administrator may grant a username and password for data uploading or access to password-protected areas.

- Upload instructions:
    - Obtain login and password from program administrator;
    - Select “login” button on website;
    - Enter login and password; and
    - Follow website instructions for the desired upload.

4. Special provisions for data sharing: Some data may include limitations on its use. Because the database is intended for data sharing, it will be the responsibility of the contributor to ensure that data published for use by the RWMG is appropriate for that purpose.

Note that this protocol is for data sharing within the region. Participants are encouraged to also publish data to state and other databases in accordance with their established protocols (as described in Section 3.2, above).

13.2.4 Proposed Data Management System

As noted, there are additional opportunities and options for data management that should be explored as part of this planning process. This section provides guidelines for development of a long term, robust data management tool. Based on plan development and proposed projects, the following phased approach to data management is recommended.

Phase 1: DMS Maintenance

At a minimum, the RWMG should implement plans to maintain the IRWM website as a data repository and sharing tool. Since the website has been developed through the IRWM planning project, this is the most cost- and time-effective means to provide a basic repository and accessible system for collection and sharing of information. It provides a central location for reports from projects so that RWMG members have a central location to get information to evaluate project success and inform the next round of prioritization. The group knows the location as well as the protocol for data and document upload. In addition, the website has built in levels of function (general public info as well as password protected) that allows for varying levels of access.

RWMG responsibility would be to commit to maintaining the website and data library. This could be accomplished through volunteer staff time or minimal investment of entity funds for staffing. Standardizing data collection (e.g. to conform to state database requirements) at this stage will be the responsibility of project sponsors. They will provide data to the library and separately provide data to state databases. Efforts to enforce data collection protocols would be limited.

This approach initially is best because it is simple. RWMG members are resource-limited, have project details to develop, and are likely to support the continuation of the IRWM process through in-kind efforts. For the entities that make up this RWMG, staff time is a precious commodity typically not available to manage an extensive and complex DMS.

Phase 2: Basic DMS

As the RWMG develops and projects progress, the group may look to adding dedicated staff. As mentioned, funding may be sought for a plan administrator or director to help take on this role. A plan administrator would take over the duties of maintaining the website and library. This management approach, however, would likely include an objective to develop a basic DMS as opposed to simply maintaining a repository. The administrator would take over the responsibility of some data curating (reviewing, organizing, possibly soliciting data). This would include a more active application of the data collection and organizing protocols outlined in this chapter. The administrator would also take a more active role in working with project sponsors to standardize data collection, although it will still be the responsibility of project sponsors to assure compliance and submit to state databases.

This approach would be implemented either through additional financial support of RWMG members, or in concert with funding for a specific project. For example, projects proposed within this plan relating to staff positions could include an element of data management. For other types of projects, there will be a need to manage some data to meet funding agency reporting requirements. There would likely be enough overlap so the position could be at least partially funded through a project. This phase would build on and improve the existing website library. If done systematically, improvements in the database could be made incrementally as funding is available.

Phase 3: Expanded DMS
Continued collaboration or expansion of data collection could lead to a need for an expanded DMS. This may be a region specific software package or may utilize other web-based data management tools such as the SWIM web portal or IWRIS data management tool in lieu of the IRWM website. Also, as tracking of geospatial data becomes more important, this tool may also include a GIS mapping component — either through SWIM or through a region-specific development. In this phase, a program manager would seek funding to support an active DMS. Project sponsors could utilize the program manager and staff for data collection in compliance with state database protocols. The program manager would also actively evaluate existing data and support the RWMG in collecting project monitoring and report information for evaluation of project success. Such a program would also support a broader evaluation of regional success in implementing plan objectives. The program would actively pursue data collection and fully utilize the protocols outlined in this chapter.

As an example, this type of DMS may be developed in conjunction with the region-wide groundwater-monitoring project that is being developed. A DMS would be integral to providing transparency and data sharing for such a project, and could be developed to benefit the rest of the region in conjunction with project specific tasks. The following elements should be part of the expansion/transition to maintain the database developed for the project and for connection with state databases:

1. Acquire and launch new or coordinate with existing GIS-based web interface for data acquisition
   a. Update existing website access
   b. Develop data sharing agreement
   c. Develop connections to watershed scientific data
2. Target expansion of internet access for DACs to facilitate data availability
3. Expand data portal to include project monitoring data
4. Expand data portal interface to connect with state databases (listed in Section 3.2)
5. Continue to encourage data submission to databases listed in Section 3.2

13.2.5 Entity Responsible for Maintaining Data in the DMS
Currently, REX has contracted the development of the IRWM website. REX will manage the web links, and acquisition, management, and evaluation of data through the completion of the IRWMP. Upon IRWMP completion it is recommended that a plan administrator be utilized as a data curator to manage existing data, receive and review new data, and maintain the system so new data can be added and stakeholders can continue to access the available data. A plan administrator has not yet been identified. Potential funding options for this role are described in the Finance section of the Plan.

13.2.6 Data Validation and Quality Assessment and Control Measures

Data to be utilized in the IRWM process will undergo a QA/QC process including:

- Verification that required metadata (as listed in Paragraph 3.3) is provided with submitted information to document original data collection/preparation conditions
- Submittal of QA/QC documentation for the given data generation effort will be requested. This documentation may include reference to QA/QC for an existing database or project specific quality assessment protocol (QAP). The data will be rated relative to its verifiable level of QA/QC as part of the evaluation process described in Section 3.1.
- The entity submitting the data may provide additional documentation of data validation or QA/QC measures employed.
- The QA/QC rating of data will be regularly available for comment

13.2.7 Sharing Collected Data

Data sharing will be through the IRWM website or by regular email distribution to the RWMG group. Information currently anticipated for sharing includes:

- RWMG meeting information (e.g. participant information, meeting summaries, outreach efforts)
- IRWM Plan section drafts, completed sections, and project proposals
- Reference materials supporting and/or cited in the IRWM Plan sections
- Photos, videos, and maps
- Contact information for participating groups and their representatives
- GIS / geospatial data
- Plans, reports, studies completed by participating entities

The RWMG is committed to data sharing and the DMS will be an important part of that in multiple ways. First it provides a means by which RWMG can access data that might not otherwise be available to them. Second it provides a protocol for maintaining and documenting the quality and applicability of data and therefore improving the value of data shared.

As noted previously, efforts will be made to assure proper access to data. Different levels of website access and security will be assigned to individuals. For example, most entities will be allowed to upload data to the portal. A select few will be given access to remove or edit data placed there. In every case, data utilized on the project will be backed-up locally by REX during the plan preparation phase. A database administrator may be needed after the project to maintain the data backup. The plan will direct participants to make data compatible with applicable state agencies. The data management approach will maintain data compatibility by systematically documenting the compatibility of existing data and requiring compatibility for new data that becomes part of the system.

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14. Technical Analysis

14.1 Framework and Scope of Technical Analyses

As required by Integrated Regional Water Management (IRWM) guidelines, this chapter illustrates the breadth of data and information used to prepare this Plan; presents a summary of technical analysis related to the proposed plan; discusses analysis methods used to better the regional understanding of water needs over the planning horizon; and the methodology used for some of the more integral data analyses. Plan guidelines assert that the planning horizon is 20 years; therefore, information was gathered and analyzed to illustrate water management needs over that time period when possible. In the case of climate change, data was assessed through the end of the century.

Over the course of Plan preparation, numerous individuals were involved in preparing this document including the project team and technical workshop committee members. These entities conducted extensive data gathering, assessment, and submittal of ideas and suggested text for the process. Table 14.1 lists the primary sources of data used to prepare various Plan sections, analysis methods used in the planning process, and references such as source information. One data component not included in this table is that used for the climate change analysis. These data and the process are described below, and there is extensive information on that work and data sources in Chapter 9, Climate Change.

14.2 Technical Data, Information, Methods, and Analyses used in Plan Development

The project team, with Upper Sacramento, McCloud, and Lower Pit Region (USR) stakeholders, used the information available to understand the water management needs over the planning horizon, including assessments of climate change impacts and other projected changes in the region, pursuant to IRWM program guidelines. Being a rural watershed in northern California, the USR doesn't have the large number of assessments and data sets that some other regions can claim. However, the information used in the development of this IRWM process is significant because of its relevance directly to the region. In-region stakeholders did most of the studies within the region; very few studies were identified where inference was required. This adds to the validity and relevance of the information and, in some cases, to the more timely updates that have occurred. Some important data sources are cited below, with a description of their content and how they were used.

14.2.1 Climate Change Assessment

The growing concern over global and local climatic changes has necessitated the development of massive amounts of data and technical information. This need includes not only past weather and climate trend observations but output from climate models projecting future climate and hydrological patterns. The USR has only begun to discuss climate change analysis and projections, but already a great deal of information has been generated for the region (see Chapter 9, Climate Change). To date, the analysis has focused on a vulnerability assessment and a climate impacts analysis for the region[25]. Future analysis may require additional functions of the modeling tool; there are several options available for this type of analysis and, when the time comes, an assessment of these options and the region's needs can be made. The advantage of continued use of the Coupled Model Intercomparison Project Phase 3 (CMIP3) projections is that they are the same projections as those used for the climate impacts analysis for the USR and they are available to the user at no cost. It is also expected that new analytic tools and models to assess climate change will be developed and may be considered for use in the future.

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[25] Utilizing the bias-corrected and downscaled WCRP CMIP3 climate and hydrology projections: http://gdo-dcp.ucllnl.org/downscaled_cmip3_projections/dcpInterface.html#Welcome.

Assessment of the CMIP3 climate change data included a download of information specific to the region; Microsoft Excel manipulation (including development of averages and means); and the graphing and interpretation of the findings. More information can be found about the data and the process in Chapter 9, Climate Change.

The Shasta Trinity National Forest, which manages large areas of land in the USR, represented the United States Department of Agriculture (USDA) Region 5 in a National Climate Change Assessment of Watershed Vulnerability. The pilot study assessed the interrelationship of regional climate models and the projected exposure to key aquatic resources, recognizing that existing models and predictions project serious changes to worldwide hydrologic processes as a result of global climate change. Projections indicate that significant change may threaten National Forest System watersheds that are an important source of water used to support people, economies, and ecosystems.

A result of this study was the publication: *Assessing the Vulnerability of Watersheds to Climate Change: Results of National Forest Watershed Vulnerability Pilot Assessments.*

Eleven National Forests from throughout the United States, representing each of the nine Forest Service regions, conducted assessments of potential hydrologic change due to ongoing and expected climate warming. A pilot assessment approach was developed and implemented. Each National Forest identified water resources important in that area; assessed climate change exposure and watershed sensitivity; and evaluated the relative vulnerabilities of watersheds to climate change. The assessments provided management recommendations to anticipate and respond to projected climate-hydrologic changes. Completed assessments differed in level of detail, but all assessments identified priority areas and management actions to maintain or improve watershed resilience in response to a changing climate. The pilot efforts also identified key principles important to conducting future vulnerability assessments. This information represents essential additions to the region's understanding of climate change projections and vulnerabilities.

14.2.2 Redband Trout Data and Status

While there are numerous special status species in the USR, the McCloud Redband Trout is the only one for which a conservation agreement has been developed. In the words of the United States Forest Service (USFS) Redband Trout Conservation Agreement (RTCA), "[t]his Conservation Agreement has been prepared to provide for genetic integrity, secure populations and long-term viability of the upper McCloud River Redband trout (McCloud Redband) while respecting existing land uses, resource uses, and private property rights and while providing for angling and other recreational opportunities. The purpose of this document is to provide specific direction that will conserve this species and reduce or remove the threats that could cause it to be listed as threatened or endangered." (USDA- FS 1998)

The RTCA includes scientific data collection — completed largely by the USFS and California Department of Fish and Wildlife (then Fish and Game) — and analysis of that data. Because of the professional nature of the data collection and analysis, as well as the certification of this information by the parties signatory to the RTCA, the document is judged a good source of information.

This conservation agreement informed much of the related text in the Region Description (Chapter 3), and, as the basis for current and future management, will guide any related actions that might be identified by USR stakeholders. Identified threats to the Redband Trout, as described in the RTCA, are similar to those identified for many species and habitats in the USR, including catastrophic fire and persistent drought. The signatories to the Conservation Agreement described above — especially the USFS — will be important partners for any proposed projects affecting the species and associated resources.

14.2.3 Regional Springs and Groundwater Sources

Springs represent the primary source of water for the three communities in the USR (McCloud, City of Mt. Shasta, and Dunsmuir), and groundwater is the water source for most other water uses in the region (via residential and industrial wells). That being the case, it is important for all stakeholders to have a good understanding — preferably a shared understanding — of regional groundwater resources. The connectivity of groundwater resources to each other and to surface water resources via springs and seeps represent significant questions for the region, as this information can help communities to plan for a more secure and flexible water supply portfolio into the future.

The connectivity of groundwater resources throughout the region and to the springs and surface water resources they underlie is a topic undertaken by California Trout in the 2000s. The *Mt. Shasta Springs 2009 Summary Report* is an initial baseline study on general water quality and geochemical parameters concerning volcanic springs in the Mt. Shasta area. The study objectives identified for this task included:

1. At what elevation on the mountain [Mt. Shasta] does the spring water originate?
2. How long does it take for water to emerge as a spring?
3. What are the recharge areas for regional groundwater?
4. How vulnerable are the springs to climate variation?

This study utilized technologies of isotope dating to determine the age of spring water, hydrogen and oxygen isotope analysis to determine the elevation of recharge (where the water enters Mt. Shasta), geochemical analysis to determine the path of the water through the mountain, and a general assessment of these and other variables to determine vulnerability of the source (to climate change, water quality, and water use).

Spring and groundwater connectivity is a central question for the Medicine Lake area. One of the studies used by the Region Description (Chapter 3) to provide additional information on this topic is from the Lawrence Livermore National Laboratory (Davisson and Rose 1997). In a summary statement on that topic, the Laboratory states that the data found in this study "independently confirm the Medicine Lake highlands as a significant recharge source for the Fall River Springs" (Lawrence Livermore National Laboratory 2006). While the data and analyses provided in the referenced study are peer-reviewed and likely a good resource, they don't provide specific information regarding the groundwater resource within the Medicine Lake Highlands. This is a point on which several stakeholder entities would like to obtain additional information.

14.3 Data Gaps

In the process of identifying data and documents, writing Plan sections, and developing project proposals, stakeholders noted a few significant gaps in regional knowledge. Those gaps include: 1) understanding USR groundwater resources and how they are connected to each other and to surface water, and how they may be affected by increased use and/or climate change; 2) how future regulations will affect regional jurisdictions' finances, private businesses bottom lines, and management of and access to public lands; and 3) how the sovereignty of aboriginal nations indigenous to the USR affects and/or is affected by this regional planning process.

14.3.1 Groundwater

While stakeholders seek more detailed information about all groundwater resources in the region, Department of Water Resources' (DWR) California Statewide Groundwater Elevation Monitoring

(CASGEM) program was initiated by the state legislature's SBX7-6 in 2009 to track seasonal and long-term trends in groundwater basin elevations. Groundwater elevation monitoring was scheduled to begin in 2012 and is to be done by local entities that are approved as Designated Monitoring Entities by DWR. The two designated basins in the USR (the McCloud Area and Toad Well Area groundwater basins) are not currently being monitored. Concern has also been expressed about the need for more groundwater information concerning areas that are not officially designated groundwater basins, including the vicinity of the City of Mt. Shasta and the Medicine Lake Highlands. Stakeholders have proposed monitoring projects for regional water management group (RWMG) consideration that are meant to expand understanding of groundwater supply, quality, and connectivity. These entities hope to partner with Siskiyou County and other agencies to expand knowledge of groundwater resources and contribute to monitoring compliance needs while maintaining a region-wide focus. CASGEM groundwater data being collected throughout the State are available through DWR's Water Data Library: http://www.water.ca.gov/waterdatalibrary/.

CASGEM's approved Designated Monitoring Entities within the USR is Siskiyou County for basins within their county boundaries. There are no designated basins within the Shasta County portion of the USR. Monitoring entities may also be made up of interested parties working together as a collaborative group. More information is available at: http://www.water.ca.gov/groundwater/casgem/designated_entities.cfm.

14.3.2 Future Regulation

Two future regulatory activities often cited by USR stakeholders are those related to water quality (affecting, in most cases, effluent discharge and required infrastructure upgrades) and potential regulatory issues related to the proposed reintroduction of salmonid species into regional rivers and streams.

As concern over statewide water quality becomes increasingly sensitive and as related technology improves, water quality regulations tend to become stricter and more complex. Small rural — and often disadvantaged — communities are often not able to keep up; most often due to the cost required for infrastructure upgrades. Not knowing what regulations are coming can be difficult for these entities, as year-to-year costs may change because of regulations and, more often, the permits and fees associated with non-compliance. Getting a better understanding of the costs associated with future regulatory activities related to in-river water quality and the infrastructure needs that will be required could help these communities to plan on meeting related staffing and fiscal requirements.

Because most new water quality legislation usually comes with several years for preparation, making use of the RWMG's collaborative, informative structure could help these communities to plan. In Chapter 15, Financing IRWM Implementation and RWMG Operations, legislation tracking is identified as a desired future activity that would help regional entities to collaborate better and be better prepared for future activities. Tracking legislation would also allow these communities a better and timelier way to provide information and input into the lawmaking process, perhaps affecting it in a way that would make compliance more achievable and less expensive for them in the long run.

14.3.3 Native American Nations' Sovereignty

As identified in Chapters 3 and 11 (Region Description and Impacts and Benefits), the issue of sovereignty as related to the IRWM program has been cited as a significant concern by some tribal representatives. Representatives of other tribes involved in the USR process have voiced the position that sovereignty concerns are not a constraint to their collaboration with the IRWM program. While the relationship of sovereignty concerning IRWM is debated and unresolved at the state level, the process of how sovereignty and national status affects the regional planning process has been a sensitive and difficult issue in the USR. In the pursuit of understanding, in late 2012, the River Exchange submitted a letter to DWR asking the following questions which are based on statements and questions received by the USR stakeholders in 2012 and 2013:

1. How are IRWM Regions to interpret Director Laird's [2012] policy statement vis-à-vis specific and detailed questions from tribal members and other stakeholders on sovereignty and project development?
2. As sovereign nations who claim jurisdiction over the IRWM lands, can or should the determination that the IRWM process is "illegal" result in stopping the process until this issue can be resolved between the state of California and the federal government and the tribes involved?
3. If tribal governments participate in the IRWM process, do they have the prerogative to unilaterally design the process, dictate document content, and otherwise manage the IRWM process?

The region received a response letter from DWR encouraging the continued planning process. However, none of the specific questions have been answered, to date. Stakeholders and the RWMG will continue to pursue answers to these and related questions as they arise. Meanwhile, representatives of tribes in the region will continue to be invited and encouraged to participate in the USR IRWM program.

14.4 Key Reference Documents

Some of the key reference documents identified and used throughout the development of this document are identified below, along with a reference for easy access. For many of these data sets and studies, more detailed reference information may be found in the bibliography. As stated above, more information regarding the climate change data and analysis may be found in Chapter 9, Climate Change.

Table 14.1: A selection of central studies and data sets used in developing the USR IRWMP.

Data or Study	Analysis Method	Results/Derived Information	Use in IRWM Plan	Reference or Source
City and County general plan information	Community assessment	Specific actions for development, open space, recreation, etcetera	To identify future water needs and habitat/open space planning	City and County websites
Disadvantaged Community Status	Statistical Analysis	Those communities with MHI measured at 80% or less than CA's average	Used to identify communities needing additional assistance	DWR's online DAC tool, with data via the US Census Bureau; available at: http://www.water.ca.gov/irwm/grants/resourceslinks.cfm
Mt. Shasta Springs Study (CalTrout 2010)	Scientific data collection and analysis – not peer reviewed	Relative vulnerability of various springs supplied by Mt. Shasta, including water age dating and recharge information	Used to describe regional spring resources and project potential climate vulnerabilities	http://caltrout.org/pdf/Mount%20Shasta%20Springs%20Study%202009_summary%20report.pdf
Shasta Lake Water Resources Investigation, California, Draft Feasibility Report	Scientific and policy data combined to describe the feasibility of raising Shasta Dam	Feasibility identified to raise the dam to provide additional downstream water – doesn't fully address upstream impacts	Used to describe the federal project and process of raising Shasta Dam; also used to assess any upstream impacts	Bureau of Reclamation. 2011. Shasta Lake Water Resources Investigation, California, Draft Feasibility Report.

Table 14.1: A selection of central studies and data sets used in developing the USR IRWMP.

Data or Study	Analysis Method	Results/Derived Information	Use in IRWM Plan	Reference or Source
				Available at: http://www.usbr.gov/mp/slwri/documents.html
Floodplain Maps	Maps provided via DWR – method not indicated	Identify flood areas and potential damage	Used to identify flood areas	Information available via DWR: http://www.water.ca.gov/floodmgmt/lrafmo/fmb/fes/awareness_floodplain_maps/
303(d) listed waters	Scientific determination via sampling and historic assessment	Waters listed as not meeting their beneficial use designations	Identify waters listed as not meeting their beneficial use designations	Information available via the SWRCB: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml
The Eighteen Unratified Treaties of 1851-1852 between the California Indians and the United States Government	Historic research	An assessment of those tribes affected by the unratified treaties and how that inaction affects current status	Information regarding in-region tribes	Heizer, Robert F., Ed. 1972. The Eighteen Unratified Treaties of 1851-1852 between the California Indians and the United States Government. University of California Archaeological Research Facility, Berkeley.
Watershed Analyses	Scientific data collection, habitat and ecological assessment	Watershed condition and status information; management strategies and priorities	Describe regional resources and conditions	Shasta-Trinity National Forests: http://www.fs.usda.gov/detail/stnf/learning/?cid=STELPRDB5323473
McCloud River Outflow for 2011	Stream gages	Flow information	Water year type identification and projections of future conditions with climate change	U.S. Geological survey. 2012. Water Resources Data for the United States, Water Year 2011: U.S. Geological Survey Water-Data Report WDR-US-2011. Site 11368000, accessed May 2013: http://wdr.water.usgs.gov/wy2011/pdfs/11368000.2011.pdf

15. Financing IRWM Implementation and RWMG Operations

The intent of this chapter is to outline Upper Sacramento, McCloud, and Lower Pit Region (USR) stakeholders' priorities, interests, and preferences for implementing the USR Integrated Regional Water Management Plan (IRWMP) over the 20-year planning horizon. This chapter contains information regarding meeting conversations and decisions that will allow the Regional Water Management Group (RWMG) to identify planning priorities and implementation strategies, including the full array of the potential costs and revenues to sustain the RWMG and implement the Plan and projects over time.

A Proposition 84 IRWM (Round 2) Planning Grant funded this first Integrated Regional Water Management (IRWM) planning effort for the USR. Match was demonstrated through the watershed planning and climate change work that stakeholders conducted in the region between 2008 and 2012. Any ongoing efforts identified by the RWMG for implementation will require additional funding and/or in-kind efforts by regional entities and individual stakeholders. The degree to which these funds are required is variable based on the RWMG's desired activities, level of activity, and related regional needs. This is described in greater detail in Section 15.1, below.

The need for project funding detailed in this (and many — if not all — other IRWMPs from around California) far exceeds IRWM Program funding capacity. Project funding will necessarily come from a variety of sources for which IRWM Program planning efforts, and possibly funding, may be a catalyst. Project funding is described in greater detail in Section 15.2, below.

Operations and maintenance is an important consideration for any type of project. While customer/user fees are often the source for these ongoing efforts, there may be other methods worth considering, especially in areas hard-hit by the recession and/or the ongoing regional employment challenge. This topic is discussed further in Section 15.3.

15.1 Programmatic Funding

There are many options that a RWMG can find to finance implementation projects. These are generally thought of as the way in which a RWMG "implements" an IRWMP. However, as Department of Water Resources (DWR) places increasing expectations and responsibilities on IRWM regions, there are some tasks and functions important for a RWMG to consider apart from actual project implementation. In all circumstances, the degree to which a RWMG embarks upon ongoing activities must be a decision by the group as a whole. These decisions will be made according to the USR governance structure, as outlined in Chapter 16.

15.1.1 Potential Future Programmatic Activities

USR stakeholders anticipate future tasks as potentially including regional capacity building, education, and training; in-region economic development; identification and promotion of issues of regional interest and consensus; and engagement with downstream water users. In addition to these roles, USR stakeholders have stated a desire to continue as a viable and durable group outside of the planning process. Ongoing activities and continued dialogue are key to maintaining that cohesion. Some of these are described briefly in Table 15.1 below.

Table 15.1: Potential regional activities requiring the continuity of the RWMG as an organization and forum for discussion.

Potential Topic	Potential Activities
Regional Capacity Building, Education, and Training	Ongoing education efforts are an essential task for any regional group. Stakeholders identified education as a strategy for the region in addressing regional interests and issues through implementing the objectives. Ongoing educational efforts — both original efforts and coordination between multiple groups — could include the development of regional K-12 curriculum; collaboration with local colleges to enhance natural resource and environmental programs; establishing a regional program to increase the understanding of recreationalists using the resources seasonally; or include a more coordinated public outreach and education effort in terms of newspaper articles, forums and lectures, and tours. This ongoing effort would be helped by an entity to facilitate coordination, which could reasonably be the RWMG.
In-region Economic Development	As shown throughout this document, specifically in the Project Review Process and Implementation and Objectives chapters (Chapter 10 and 7, respectively), there is a strong interest by regional stakeholders in supporting a stable and sustainable economy in the region. Various proposals have been brought forward throughout the planning process, some in the form of implementation projects, to aid in this development. In addition, multiple stakeholders approach water management issues from the point of view of protecting the local economy while implementing management strategies and/or meeting state or federal regulatory guidelines. Some ideas brought forward have included: • A balanced approach to salmonid reintroduction that incorporates competing uses for the resources, including Native American interests looking to restore a historic species of great indigenous value; increasing the recreational value of in-region fisheries; and the perceived and projected future regulations on the timber industry and other private business interests, themselves an important regional economic engine; • Increased recreational opportunities while maintaining and protecting those sites of great cultural and spiritual significance to indigenous people; and • The development of a funding pool through fees collection that could contribute to regional cost-share when required by a grant opportunity. Fees could come from a variety of sources including recreational visitors; a “round up” option on utility bills; fee-for-service agreements with local industry or other source. This could conceivably help the region to develop capacity while maintaining self-sufficiency and independence, and could even operate as a regional revolving fund, with borrowed money paid back on a schedule, to be used again by another RWMG member.
Identification and Promotion of Issues of Regional Interest and Consensus	The status of the RWMG as a diverse and united voice for the region creates a capacity for speaking with a stronger voice on local, state, and even federal issues affecting the watershed. Using the USR objectives to identify shared values and priorities can enable the RWMG to develop white papers and speaking points on a variety of topics, including development and restoration activities, endangered species issues, water rights and area-of-origin protections, climate change, and more. While it’s sure that not every RWMG member will feel exactly the same an all points, addressing even one point where consensus can be reached can affect policy on multiple levels and the way resources are managed in — and for — the region into the future.
Engagement with Downstream Water Users	The USR is a source water area for the state, meaning that water resources originating in this region are used by many other parts of California. These resources are provided at historically dependable rates, quality, and times because of the way the watershed is managed. As climate change alters the hydrologic pattern throughout the western US, the integrity of the watershed and associated management activities will become more important. Investments by areas dependent upon these water resources could represent a significant positive step towards comprehensive and consistent management of the watershed to continually provide water resources at the necessary amounts, quality,

Table 15.1: Potential regional activities requiring the continuity of the RWMG as an organization and forum for discussion.

Potential Topic	Potential Activities
	and timing for other parts of California. If the region can be represented in a united manner on how this type of program might be structured, and even work with other IRWM regions to pursue a program (participants have cited the Sierra Water Work Group as a potential partner), participants could play a part in how this policy is shaped and how the resulting resources are allocated.

Stakeholders have identified other ongoing activities that would be helpful — or even essential — for the RWMG to complete in order to have regional support and continue as an organization advancing regional collaboration. These tasks include:

- Tracking federal and state mandates and providing notice of these to RWMG members through an e-mail list serve or rich site summary (RSS) feed (a digital online alert of new postings);
- Tracking funding opportunities to help members respond to mandates and to continue to implement the plan and build on success (again, this could make use of the RWMG e-mail list serve or an RSS feed);
- Continuing to serve as a database of watershed information and a clearinghouse for data resources (via the data management system on the website);
- Serving as a forum for in-person, ongoing discussion on challenging and/or controversial topics; and
- Serving as a voice in responding to mandates and/or policies affecting the region, as points of agreement are identified.

15.1.2 Identifying Staffing Needs and Scenarios for Institutional Capacity

The ability of the RWMP to successfully meet and address the needs of the region will be dependent on the human and financial resources available. The options range from no paid RWMG staff, in which any institutional capacity must be provided in-kind by RWMG members, to a fully staffed RWMG office. A fully staffed RWMG could include an executive director, administrative help, and any variety or number of programmatic staff implementing projects and policy development throughout the region. Some options are displayed in Table 15.2 below.

Table 15.2: RWMG staffing scenarios and consequences for responsibility

Scenario	Institutional Capacity	Member responsibilities
No paid staff	None unless generated by members	RWMG administration; policy direction and/or effort; project development; grant application preparation; performance monitoring; IRWMP updates; project and contract management for implemented projects; all meeting planning, materials, and agendas; website upkeep; all project development and grant pursuits
Half-time administrator	Track e-mails and policy documents; complete discrete project development efforts at member request; take responsibility for meeting logistics and	Policy direction and/or effort; identify and develop projects for funding opportunities; grant application preparation; performance monitoring;

Table 15.2: RWMG staffing scenarios and consequences for responsibility

Scenario	Institutional Capacity	Member responsibilities
	agendas; keep up the website; manage communication to RWMG members and public; research and identify funding opportunities.	IRWMP updates; project and contract management for implemented projects; administration supervision
Full time executive director	Expand the regional and statewide outreach work; work with member entities to identify policy and legislation suggestions and facilitate RWMG discussions; work with partners on a regional and statewide basis; work to integrate projects with stakeholders and provide development guidance; lead grant applications; research funding opportunities; work directly with individual members; keep up website; project and contract management; organizational strategizing and financial planning	Staff supervision; specific project development actions; identification of opportunities for policy development; create partnerships inside and outside of the organization
Full time executive director, administrator, and program director	Further integration of project and policy work into programmatic objectives; enhance project development process with a greater percent of services taken up by the RWMG staff; improve regional coordination on policy issues of a federal significance; promotion of projects to national funder through a programmatic approach; capacity to take on interns and participate in more in-depth opportunities (such as economic development and partnerships)	Attend meetings; provide policy and planning input; review work products

15.1.3 Supporting Regional Implementation

Funding a RWMG staffing scenario can take on a variety of approaches, but all forms represent a responsibility on the part of RWMG members to ensure the perpetuity of the organization. Stakeholders have identified the necessity — and even suggested a requirement — that every RWMG member have a responsibility to participate in at least one working group and/or sponsor at least one RWMG activity (such as periodic meetings, photocopying, etc.). It is expected that this will be a priority for the implementation of this USR IRWMP. At times, however, financial resources are essential for various activities. To support this potential, possible funding structures are identified below. It is possible that these options could be combined as appropriate and feasible.

Private or Foundation Funding

While this is an attractive option for organizational funding, it hasn't proven to be popular with other IRWM regions due to the difficulty in obtaining these types of grants for the on-going operations of a collaborative resource management group. This could be perceived or actual difficulty, but the fact remains that one or more RWMG members must take on the responsibility of pursing this type of funding.

Often, foundations offer grant funding to accomplish measurable, time-limited tangible outcomes, so there may be more success found if the RWMG funding can be tied to an actual programmatic area, goal, and output, such as: water policy (program), protect the headwaters through investment in source water areas (goal) and the development of a fee-based program to retain user-fees from water users (output).

Member Dues

Several RWMGs in the state have identified the collection of member dues as an essential component to keeping the organization operational in order to implement the IRWMP. While dues cannot be required for participation and/or membership in the RWMG, if an entity decided that they represented a feasible opportunity, assessment of each member's willingness to contribute would have to be part of the decision of whether it was a feasible option. Member dues may include a variety of approaches; two possible options are described below.

Based on range of organizational budget

Rates may be assessed at a flat rate, but based on organizational budget. Before true rates were established, the RWMG would need to assess its needs from the perspective of annual budget and identify potential dues-paying members. A possible approach to this is shown below:

Organizational Budget	Rate
Over $5M	$3,000.00
$3M to $5M	$2,000.00
$1M to $3M	$1,500.00
$500,000 to $1M	$1,000.00
$100,000 to $500,000	$800.00
$50,000 to $100,000	$600.00
$10,000 to $50,000	$400.00
$0 to $10,000	$100.00

Based on percent of organizational budget

Dues rates may also be assessed at a percent of overall budget. The rate would need to be identified based on the assumed annual organizational budget needs of the RWMG, but a rate of 0.1% is shown below:

Organizational Budget	Rate	Estimated Dues
$5,000,000.00	0.1%	$5,000.00
$4,000,000.00		$4,000.00
$2,000,000.00		$2,000.00
$750,000.00		$750.00
$300,000.00		$300.00
$750,000.00		$750.00
$30,000.00		$30.00
$5,000.00		$5.00

In-kind Stakeholder Efforts

Part of the discussion of member dues must include an allocation for those entities unable to come up with financial resources, but with access to other essential contributions. This could include in-kind efforts by staff, such as meeting organization and facilitation, map-making, or grant application compilation, or it could include material contributions, such as the use of organizational vehicles, making meeting copies, providing meeting space, etc. While this would require increased regional collaboration and communication, it represents an excellent opportunity for otherwise small and/or disadvantaged entities to participate.

Fee-for-service

In many areas IRWM groups offer services such as the capacity for work groups targeted at specific issues; staff to accomplish technical and/or policy work for project implementation (such as California Environmental Quality Act (CEQA) assessments or facilitation of public meetings); or capacity building such as community education and grant writing. If the RWMG were to identify some of these opportunities that could be useful within the region, a fee structure could be developed that would allow for a staff person to accomplish these activities as well as keep the RWMG functional. One unique feature of the USR is the presence of many forest management entities — public and private. If these entities could identify a service that the RWMG could provide, such as education regarding catastrophic fire prevention, or targeted grant writing for a fuels control program, this may be a good way to provide some funding for specific RWMG services.

Watershed Services Charge/Bulk Water Fee

Watershed services charges would consist of fees levied on out-of-region water users of upstream sources. These funds would aid in the implementation of source protection programs and the activities of the RWMG. While establishing this type of program would be complex, working with other source water areas and organizations (such as the Sierra Water Work Group or Roundtable of Regions) could increase clout.

It is also possible that a special district could be formed to levy fees on users within the watershed, either through property tax assessments, water bills, or other equitable process. While this would be easier to implement from a logistical standpoint (though may not be politically practical), the high number of communities identified as disadvantaged may preclude this from being a fair or effective solution.

Part of Project Overhead

Organizational overhead could be built into each project grant application to cover the ongoing operations of the RWMG. This activity would necessitate an active stakeholder group in continuously pursuing funding, and would also require that the RWMG have some type of check-and-balance system to ensure that the overhead amount is included in each project/grant application.

Another way to look at this would be assessing a value on the commodities produced within the region with regional resources, and identifying that as a benefit to those businesses operating within the region and due to the health of regional resources. For example, revenues assessed on hydropower production or through the carbon credit system could be an efficient and long-term method of funding ongoing operations.

15.2 Project Funding

While projects will be funded as funding sources become available, some funding has already been committed to several. Table 15.3, below, exhibits committed sources of funding as well as potential sources, and the certainty of those sources, to fill the need.

Table 15.3: Implementation project funding options for Priority 1 (ready-to-proceed) projects

Project	Total Project Cost	Funding Source (% of total cost)	Funding Certainty and Longevity	Operations and Maintenance Funding Source	Operations and Maintenance Funding Certainty
IRWM planning efforts	Variable, based RWMG activities identified; probably $10-20,000 annually for regular IRWMP updates and meeting organization	RWMG members' provision of in-kind efforts (100%)	Generally certain, as members see the need	No O&M for this project	No O&M for this project
Dunsmuir Water System Project #1, City of Dunsmuir	$1,550,000	Funded: cost share between USDA Rural Development and Dunsmuir ratepayers	Certain; already funded	Ratepayers	Certain
Dunsmuir Water System Project #2, City of Dunsmuir	$4,800,000	Currently unfunded; 100% grant need	Uncertain; to be determined with appropriate grant sources	Ratepayers	Certain
Mount Shasta Wastewater Treatment Plant Upgrade, City of Mount Shasta	$10,000,000	Currently unfunded; 50% grant need with 50% provided by the City of Mount Shasta	Uncertain; to be determined with appropriate grant sources	Ratepayers	Certain
Lower Elk Springs Rebuild, McCloud Community Services District	$600,000	Currently unfunded; 100% grant need	Uncertain; to be determined with appropriate grant sources	Ratepayers	Certain
Elk Springs Transmission Line Replacement, McCloud Community Services	$11,400,000	Currently unfunded; 100% grant need	Uncertain; to be determined with appropriate grant sources	Ratepayers	Certain

Table 15.3: Implementation project funding options for Priority 1 (ready-to-proceed) projects					
Project	**Total Project Cost**	**Funding Source (% of total cost)**	**Funding Certainty and Longevity**	**Operations and Maintenance Funding Source**	**Operations and Maintenance Funding Certainty**
District					
Upper Sacramento, McCloud, and Lower Pit Groundwater Monitoring Project, McCloud Watershed Council and Trout Unlimited	$161,086	Currently unfunded; 96% grant need with 4% provided by the project sponsors	Uncertain; to be determined with appropriate grant sources	No O&M for this project	No O&M for this project
Hydrological and Climate Change Evaluation of the Medicine Lake Volcano and its Connectivity to the Fall River Springs and Potential Connectivity to the McCloud River, McCloud Watershed Council	$150,000	Currently unfunded; 79% grant need with 21% provided by the project sponsors	Uncertain; to be determined with appropriate grant sources	No O&M for this project	No O&M for this project
Education, Outreach, and Regional Partnerships, Western Shasta RCD	$46,000	Currently unfunded; 100% grant need	Uncertain; to be determined with appropriate grant sources	No O&M for this project	No O&M for this project
Climate Stewardship Coordinator, Western Shasta RCD	$89,000	Currently unfunded; 100% grant need	Uncertain; to be determined with appropriate grant sources	No O&M for this project	No O&M for this project
Rainbow Ridge Collaborative Forest Stewardship	$50,000	Currently unfunded; 80% grant need with 20% provided by College of the Sikiyous, the Natural Resource Conservation Service, and Audubon	Uncertain; to be determined with appropriate grant sources	May be provided by local residents or land manager	Uncertain
Upper Sacramento and McCloud Watershed Working Forest Conservation Easements	$22,500,000	Currently unfunded; 22% grant need with 78% provided by the landowner and other parties	Uncertain; to be determined with appropriate grant sources	Will be provided by land owner/manager	Certain

Securing initial Proposition 84 implementation grant funds would be a substantial economic boost, but the region will need to identify, pursue and be successful in receiving a wide variety of funding sources to accomplish the identified water management improvements. To that end, several of the most likely funding options are discussed in this section, and Table 15.4 shows a review of the funding options put forward by DWR and their relative degree of regional relevance. Generally, due to the small population and largely ubiquitous disadvantaged community (DAC) status, it is not feasible to request that public agencies contribute financial resources beyond their in-kind efforts of participation and some administrative overhead. The suggested mechanisms are discussed in more detail below.

Table 15.4: DWR-suggested funding mechanisms and their relevance and applicability in the USR.

Funding Mechanism	Relevance to USR	Affected Stakeholders
Ratepayers	Several of the funding options described above could make use of ratepayer funds. Any in-kind efforts from public agencies are, essentially, contributions from ratepayers. Financial contributions beyond this are likely infeasible in this region in the near future due to the tight fiscal status of most public agencies and the need to spend these funds on essential goods and services.	All who have public water service and/or pay taxes to local public agencies.
Operating funds	Operating revenue that is not from ratepayers – that is, operating revenue from private business entities and non-governmental organizations – is a potential funding source for the USR RWMG. The fee-for-service discussion, above, identifies this potential in greater detail. This would likely have to include a very focused scope or, potentially, be part of some type of project mitigation effort.	Any non-governmental and/or private business/organization in the region.
Water enterprise funds[26]	The relevance of this funding mechanism is similar to that of ratepayers.	All who have public water service and/or pay taxes to local public agencies.
Special taxes, assessments, and fees	This strategy is described in Section 15.2.3, above. While it's unlikely that a special tax or fee could pass within the region, out-of-region assessments for watershed services is a concept that source water area communities have long discussed.	Those communities dependent upon the USR for water.
State or federal grants and loans	This strategy is identified in section 15.2, above. As stated there, grants and loans allow small communities with tight socioeconomic considerations to remain self-sufficient in terms of resource provision and management.	All who have public water service and/or pay taxes to local public agencies.
Private loans	Private loans are not a consideration for the RWMG or for local agencies in funding project development, as the interest rates are not competitive when compared to public loans. The communities in the USR are generally eligible for public loans and would likely go there before thinking about private financing.	Through increased debt obligation, all who have public water service and/or pay taxes to local public agencies.
Local bonds	Historically, local bonds have been passed to pay for other public goods; it's possible that one might be identified and passed to pay for IRWM implementation, but more likely that they might be used to pay for a single infrastructure project. These are not possible for non-governmental organizations, so would not be an option for funding these projects.	All who have public water service and/or pay taxes to local public agencies.

[26] An enterprise fund establishes a separate accounting and financial reporting mechanism for municipal services for which a fee is charged in exchange for goods or services. Under enterprise accounting, the revenues in expenditures of services are separated into separate funds with its own financial statements, rather than commingled with the revenues and expenses of all other government activities.

15.2.1 Public Grants

Infrastructure Projects

Funding of large capital improvement projects for small communities is becoming increasingly difficult. This places a disproportionately high financial burden on small communities, especially those considered disadvantaged. The challenge to these communities is to maintain financially self-sufficient utilities in the face of rising costs and increased regulations. Often, local governments are caught between increasing regulations, higher costs for utility service, and citizen opposition to increased user fees. Sometimes the challenge isn't increasing regulations but is simply the age of the infrastructure. This is complicated further by California requirements of Proposition 218, which restricts how public agencies are able to restructure and raise rates. All of this is to say that grants are becoming increasingly important to small and rural areas with infrastructure replacement and repair needs. Below are listed some grant opportunities that may be applicable to organizations in the region with these infrastructure needs. The California Funding Coordinating Committee (CFCC) has more detail on up-to-date opportunities, including website references, for the programs listed. This information is available at: http://www.cfcc.ca.gov/funding_fairs.htm.

USDA Rural Development: www.rurdev.usda.gov/ca

Mission Areas:

1. Community Programs (water, wastewater, energy/electric, and telecom)
2. Housing Programs
3. Business-Cooperative Programs (supporting employment or growth of industry)

Eligibility:

- Nonprofit entities with significant community support
- Federally recognized tribes
- Public jurisdictions
- Mutual water companies
- Projects must be located in unincorporated areas and/or census designated places with under 10,000 (water programs) or under 20,000 (other community programs)

Funding:

- Grants up to $1M; requires 25% match
  - For planning/engineering/architectural projects; environmental permitting; legal fees; land and/or right-of-way acquisition; connection fees
- Loans up to $5M at 1.875-3.125%
  - To fund interest on borrowed money; initial (one year) operating expenses; purchase of existing facilities; refinancing (though this isn't done much)

Applications: Accepted continuously throughout the year, with a funding cycle mimicking the federal fiscal year of 10/1–9/30

California Department of Housing and Community Development: Community Development Block Grant: www.hcd.ca.gov/fa/cdbg/index.html

Mission Areas:

1. Community and economic development in low-income areas

Eligibility:

- Only cities and counties are eligible, but they are allowed to act as a pass-through to another organization

  - There are special funds reserved for non federally-recognized tribes; the minimum amount available is usually about $500,000 annually
- Projects include housing (new, rehab, and acquisition), public improvements, community facilities, public services, economic development activities, and planning and technical assistance
- All projects must meet one of three national objectives:
  - Principally benefit low-income households
  - Mitigate slums or blight
  - Meet an urgent need (this isn't used much in California)

Funding:
- Varies each year, but in 2013 there was $29M for jurisdictions
- Projects may be awarded up to $3M, but can be more if they're multi-year

Applications: Accepted continuously, but on a first-come, first-served basis, so it's better to get them in close to January of each year, as that is when funding is awarded.

State Water Resources Control Board — Water Recycling Funding Program:
www.waterboards.ca.gov/water_issues/programs/grants_loans/water_recycling/index.shtml
Mission Areas:
1. To promote the use of treated municipal wastewater to augment or offset State/local water supplies

Eligibility:
- Publically-owned facilities or those owned by private entities regulated by the California Public Utilities Commission (PUC)

Funding:
- Grants for planning: 50% of eligible costs, up to $75,000
- Low-interest loans and limited grants for construction: variable, as required

Applications: Accepted continuously throughout the year; funds are committed in a readiness-to-proceed order and upon review and approval of the application

Bureau of Reclamation — Bay-Delta Restoration Water Use Efficiency Grants:
www.usbr.gov/mp/watershare
Mission Areas:
1. Implement actions to conserve water that benefit the entire state
2. Benefits to the Delta

Eligibility:
- Any entity within the California Bay-Delta (CALFED) Solution Area with water or power delivery authority

Funding:
- Average grant award is just under $1M

Applications: Programs are posted on www.grants.gov for 45–90 days on a periodic basis and awards are made on a competitive basis

Bureau of Reclamation — WaterSMART Grants: www.usbr.gov/mp/watershare

Mission Areas:

1. Water and energy efficiency
2. System optimization
3. Pilot and demonstration projects for advanced water treatment

Eligibility:

- Any entity with water or power delivery authority

Funding:

- Varies

Applications: Project proponents should work with their local Bureau of Reclamation office to identify the project; funding requires congressional allocation

Bureau of Reclamation – Title XVI Water Reclamation and Reuse Program: www.usbr.gov/mp/watershare

Mission Areas:

1. Identify and investigate opportunities to reclaim and reuse wastewater and natural impaired ground and surface water
2. Conduct research for reclamation and reuse
3. Fund planning studies and construction activities

Eligibility:

- Local government authorities

Funding:

- Average grant award ranges between $200,000 and $1.5M

Applications: Programs are posted on www.grants.gov for 45–90 days on a periodic basis and awards are made on a competitive basis

California Department of Water Resources: Safe Drinking Water — Contaminant Removal Technologies: www.water.ca.gov/nav/nav.cfm?loc=t&id=103

Mission Areas:

1. Identification of new technologies to clean California's drinking water
2. Addressing systems which have maximum contaminant level (MCL) compliance violations, surface water treatment or microbial requirements, or mandatory disinfection required by California Department of Public Health (CDPH) or local agency

Eligibility:

- Public water systems who have the jurisdiction to operate and maintain the treatment facility

Funding:

- $50M is currently available
- Requires a 50% cost share
- 25% of funds are designated for disadvantaged communities (no match required in these cases)
- Grant cap is $5M

Applications: This opportunity is open now (as of Spring 2013)

California Department of Water Resources: Flood Emergency Response Program:
www.water.ca.gov/floodmgmt/hafoo/fob/floodER
Mission Areas:
1. Developing an emergency plan
2. Identifying a coordinated regional response to flooding

Eligibility:
- Agencies with primary responsibility for flood emergency response and coordination

Funding:
- Grant cap of $5M (through Proposition 84)

Applications: Guidelines are currently under review; check the website above for the application period

Natural Resource, Water Quality, and Research and Planning Projects
Public grants funding natural resources and water quality efforts have expanded in the last decade. Some of the opportunities below include innovative (non-conventional construction) approaches to water quality and/or stormwater/flooding challenges. While difficult to fund research, monitoring, and planning projects, sometimes partnerships with universities and other research institutions can create unexpected opportunities.

State Water Resources Control Board — 319(h) NPS Grant Program:
www.waterboards.ca.gov/water_issues/programs/grants_loans/319h/index.shtml
Mission Areas:
1. Projects to control non-point source (NPS) pollution consistent with Total Maximum Daily Loads (TMDLs), or those under development

Eligibility:
- Public agencies
- Nonprofits
- Native American tribes
- Planning and implementation projects are both acceptable; work with the local Regional Water Quality Control Board (RWQCB) for preferences

Funding:
- $4.5M available; $125,000 max for planning; $750,000 max per implementation
- 25% match required unless the community qualifies as disadvantaged

Applications: Annual solicitations — see website above for next dates

State Water Resources Control Board — Storm Water Grant Program:
www.waterboards.ca.gov/water_issues/programs/grants_loans/prop84/index.shtml
Mission Areas:
1. Implement low impact development (LID) and other onsite and regional practices that seek to maintain predevelopment hydrology
2. Comply with stormwater TMDL requirements

Eligibility:
- Local public agencies

Funding:
- Between $250 and $3M available through a competitive grant process
- 20% match is required (lower match for disadvantaged communities)

Applications: Annual solicitations — see website above for next dates

California Department of Water Resources: Flood Corridor Program:
www.water.ca.gov/floodmgmt/fpo/sgb/fpcp
Mission Areas:
1. Reduce flood risk through non-structural projects
2. Must include habitat restoration /conservation

Eligibility:
- Public agencies
- Non-profits (tribes may either form or partner with a non-profit entity to receive funds)

Funding:
- $25M available
- Grant cap of $5M

Applications: A new solicitation is expected in early 2014

15.2.2 Public Loans

Public loans are generally low-interest, and are usually restricted to other public entities and jurisdictions. They require a maximum debt ratio and can also require specific rate-based income in order to complete the loan. These opportunities are generally limited to infrastructure improvements. Some of these are listed below.

California Infrastructure and Economic Development Bank (I-Bank):
www.ibank.ca.gov
Mission Areas:
1. Finance public infrastructure
2. Finance private development
3. Promote a healthy climate for jobs

Eligibility:
- Public jurisdictions
- Joint Powers Authority (JPA)
- Projects can include any infrastructure of public benefit, environmental mitigation measures; no funding for housing or buildings such as city hall

Funding:
- $10M annual maximum per jurisdiction; current loan rates are 1.83% (20-year repayment)

Applications: Accepted continuously throughout the year

State Water Resources Control Board – Clean Water State Revolving Fund:
www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/index.shtml
Mission Areas:
1. Wastewater and water recycling (wastewater treatment, local sewers, sewer interceptors, water reclamation facilities)
2. Expanded use projects (NPS projects identified in California's NPS plan, estuary comprehensive management and conservation, stormwater reduction and treatment facilities)

Eligibility:

- Public jurisdictions

Funding:

- 20-year financing term at half of the most recent General Obligation bond sale (typically 2–3%); annual payments begin one year after construction

Applications: Accepted continuously throughout the year, though funds are committed in a readiness-to-proceed order and upon review and approval of the application

15.2.3 Other Public Funding

Special districts and city/county jurisdictions represent the predominant way that non-federal public dollars are spent in the USR. With regard to funding, government activities are classified as either enterprise or non-enterprise, depending on the source of their funding. Enterprise activities are financed entirely or predominantly by user fees set at a level to cover costs. Airports, hospitals, and water and sewer utilities, among others, can be operated as special district enterprise activities. Non-enterprise activities are supported primarily by generalized revenue sources. This form of district activity usually relies heavily on the property tax as a major source of revenue. (Revenue information is from guidetogov.org in June 2013.)

It's possible that local entities may be able to structure rates and/or bills to catch additional funds for watershed work. This can also be implemented in downstream regions that are beneficiaries to the clean, cool water provided by the USR.

As a case study, the city water managers in Denver, CO, after a severe fire season in the early 2000s, decided that investment in headwaters was an important step to protect and preserve the city's water supply. They've established a partnership with the U.S. Forest Service (through the Forests to Faucets program) to implement protection measures. To that end, Denver Water plans to match the U.S. Forest Service's $16.5 million investment, totaling $33 million, toward forest treatment and watershed protection projects over a five-year period in priority watersheds critical to Denver Water's water supply. From the Denver Water website (June 2013):

> "Colorado's forests are critical to the water supply for tens of millions of Americans, billions of dollars of agricultural production, and vast economic activity, from California to the Mississippi River. Forest treatment and watershed protection activities can help minimize sedimentation impacts on reservoirs and other water infrastructure by reducing soil erosion and the risk of wildfires."

The city has restructured their rates and economic projections to include substantial investment in headwaters protection; this is a model that has been used in several other cities across the nation, and could be a good model for California.

15.2.4 Private Funding

As seen throughout the USR planning process, there are multiple opportunities for public-private partnerships (PPPs) in the region. The challenge with this is maintaining the goals associated with these two distinct sectors of the economy: the public entity is concerned with the public good and the private entity is concerned with making a profit. Many of these PPPs have been established around the world to protect and preserve public goods when public funds are inadequate or unavailable. This partnering opportunity would be another way for USR stakeholders to collaborate across conventional organizational and interest lines, and could strengthen the interests of both. Potential issues that public and private entities may be able to find a common investment goal include:

- Perpetuating the RWMG in order to implement projects of resource preservation/protection for profitability and/or risk avoidance (catastrophic fire, etcetera); and/or
- Investing in educational opportunities and programs in order to better convey a message of resource use/conservation.

15.3 Operations and Maintenance Funding

Operations and maintenance (O&M) is a consistent concern for all entities. While it is included in rates for water agencies, and in costs for private businesses, it can be of particular concern for non-profit entities and Resource Conservation Districts in maintaining restored ecosystems. Some of the potential methods below could be useful for a variety of these projects, but it's likely that a combination of all of the funding mechanisms listed in this chapter will be required to maintain implemented projects.

Community Infrastructure: water, wastewater, flood protection, etc.

User rates typically finance the operations and maintenance of public resource management systems and agencies. Customers will usually pay a combination of fixed fees and variable rates (tied to metering, based on volumetric use). Fixed fees usually fund new infrastructure, and will remain on customer bills until the infrastructure improvement is paid off. These rates are often tied to debt service and credit rating. The economic condition of the region makes raising rates a challenge for local agencies, meaning that rate raises are not always made at an adequate pace to keep up with the cost of the water, sewer, or other public service.

One way of paying for O&M over time is to reduce this cost through system design. Two examples would be use of solar or wind generators to power pumps, or use of gravity feed where possible — a common design element in the USR. Alternative energy systems can be more costly upfront, but offer substantial savings once initial costs are amortized.

Parks and Recreation

Funding for O&M for parks and recreation projects varies by the type of entity supporting the project. Funding can include local tax base assessments through sales, property, or other local source; collaboration with a private entity to place infrastructure on the site — such as solar or wind power facilities or a cell phone tower; leasing out specific resources, while maintaining public access to specific portions of the property; and/or producing income with that property in other ways, such as collaborating with a small vendor.

Natural Resources

Though O&M will look different for these projects, restoration grants usually will require a specific period of monitoring and/or maintenance to ensure that the restoration work is sustained. These funds can sometimes come from the same grant source, but are often required as cost share. Some projects can accomplish this requirement with volunteer efforts, though some type of organizational oversight — and therefore cost — will probably be required. Easement or management fees can pay for maintenance if the project is being done in coordination with a private landowner.

Completing a fuel break or other catastrophic fire prevention effort will usually require periodic upkeep. This can sometimes be done relatively inexpensively using inmate crews from California State Prisons.

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16. Governance and Next Steps

Identifying a satisfactory governance structure and method of decision-making can be a challenge for Integrated Regional Water Management (IRWM) planning regions spanning jurisdictional lines. The process of building relationships while discussing how organizations are represented and empowered with decision-making rights represents conflicting processes. However, going through this type of discussion early in the process also allows organizational representatives to get to know each other and understand others' organizational interests and needs, setting the foundation for more productive discussions down the road. The Upper Sacramento, McCloud, and Lower Pit Region (USR) stakeholders spent over a year negotiating governance structure and membership, and as a result identified core group values and priorities. From these deliberations, and a preliminary (temporary) governance structure, the regional water management group (RWMG) evolved as constituted by a Memorandum of Understanding (MOU). This foundation and structure will serve the RWMG well into the future.

Throughout this chapter are discussions regarding the next steps for implementing the Integrated Regional Water Management Plan (IRWMP). These correspond with Chapter 15, Financing IRWM Implementation and RWMG Operations, insofar as they reflect some of the thinking behind the need for financial resources relevant to the degree of desired activity by the RWMG.

16.1 Group Responsible for Plan Development

The final RWMG, which evolved from the initial stakeholder group, is the decision-making body for the USR. While various work groups and committees feed research and information into the process, the RWMG makes the final decisions using the decision-making method identified in Section 16.3, below. These entities, listed in Table 16.1, below, participated in a number of ways. Many of them did not intend to be signatories of an MOU and be recognized as formal members of the resulting RWMG, but only wanted to participate in crafting the document and, in some cases, be project sponsors and adopt the final IRWMP. Participants in this process include those identified in Table 16.1, below.

Table 16.1: A list of organizations participating in the development of the IRWMP, including identification of those signing the USR MOU and/or adopting the finalized IRWMP.

Organization Participating in IRWM Development	Statutory Authority for Water Management[27]	Signatory to the MOU[28]	Project Sponsor[29]
Big Bend	No	No	No
Black Fox Timber Management	No	No	No
Bureau of Reclamation	No	No	No
California Trout	No	Yes	Yes
Campbell Timberland Management	No	No	No
Castle Lake Environmental Research and Education Program	No	No	No

[27] NOTE: Statutory authority over water management is defined by the IRWM Guidelines (defined on page 32 of the November 2012 document), and indicates local agencies with statutory authority over water management (i.e. water use, water delivery, natural waters, water supply, water quality, flood waters, etc.). This definition does not include federal agencies, state agencies, or Native American tribes.

[28] MOU signatory list is as of the date of document adoption: November 25, 2013.

[29] Project sponsor list is as of the date of document adoption: November 25, 2013. Individual agency/organizational adoption will consist of an update/addition to Appendix D throughout the end of 2013 and the beginning of 2014; this will occur prior to any grant submittal to the DWR.

Table 16.1: A list of organizations participating in the development of the IRWMP, including identification of those signing the USR MOU and/or adopting the finalized IRWMP.

Organization Participating in IRWM Development	Statutory Authority for Water Management[27]	Signatory to the MOU[28]	Project Sponsor[29]
City of Dunsmuir	Yes	Yes	Yes
City of Mt. Shasta	Yes	Yes	Yes
Central Valley Regional Water Quality Control Board	No	No	No
California Department of Fish and Wildlife	No	No	No
Hancock Natural Resource Group	No	No	No
Hearst Forest	No	No	No
McCloud Community Services District	Yes	Yes	Yes
McCloud Local First Network	No	No	Yes
McCloud Watershed Council	No	Yes	Yes
Modoc Nation	No	Yes	No
Mt. Shasta Bioregional Ecology Center	No	Yes	Yes
Pacific Forest Trust	No	Yes	Yes
PG&E	No	No	No
Pit River Tribe	No	Yes	No
River Exchange	No	Yes	Yes
Roseburg Forest Products	No	No	No
Sacramento River Watershed Program	No	No	No
Shasta Indian Nation	No	No	No
Shasta Nation	No	No	No
Shasta Valley Resource Conservation District	No	No	Yes
Shasta-Trinity National Forest	No	Yes[30]	No
Sierra Pacific Industries	No	No	No
Siskiyou County	Yes	No	No
Siskiyou County Land Trust	No	Yes	Yes
Trout Unlimited	No	Yes	Yes
Western Shasta Resource Conservation District	No	Yes	Yes
Winnemem Wintu Tribe	No	Yes	Yes

16.2 Description of Chosen Governance Structure

Governance History

Early in the planning process, the concept of a governance structure was identified as the most controversial component of the IRWM planning process. The three main issues included:

1. That jurisdictional entities (cities, counties, water districts, etc.) maintain their rights and responsibilities to their constituents via compliance with local and state law;
2. That sovereign governments (Native American tribes and nations, the federal government) maintain their rights and responsibilities as described in federal law; and
3. The advantages and disadvantages of a full consensus-based decision making process.

[30] The Shasta-Trinity National Forest is participating through an MOU-alternative developed for federal agencies.

During a stalemate in the discussions, a proposed governance structure came forward through one of the participating city representatives. This structure included a single body of all regional stakeholders, identifying one voice — or vote — per entity. This body was identified as the General Assembly. Stakeholder entities could have a voice if they attended regularly, and were expected to make consensus decisions on elements of the Plan, project recommendations, grant applications, and other related matters. If consensus could not be reached in the first meeting in which an issue or topic was brought forward, it would be tabled and the affected stakeholders would discuss it and try to come to a conclusion before the next meeting. In the next meeting, if consensus couldn't be reached, then any member could call for a vote. For an issue to pass, it would have to get a 75% super-majority from all voting entities. If consensus could not be reached and a vote did not pass the issue, it would be dead.

If a proposal was passed by the General Assembly, it would automatically go to the Coordinating Council for a second review by three distinct groups: statutory authorities (cities, counties, and special districts), tribal authorities, and non-governmental entities (non-profit entities, business groups, etc.). Each of these groups would be made up of four entities each. If an issue was referred from the General Assembly, the Coordinating Council would poll every member of the Council either in a Council meeting, by teleconference, or by electronic mail or other means of communication. A super-majority of 75% of the voting members of each sub-group (doesn't include abstention votes; in the event that a sub-group had less than four members, a super-majority would be considered two votes of approval) would have to approve ("support" or "live with") a proposal for it to become a position of the RWMG. Proposals not achieving super-majority approval at both the General Assembly and the Coordinating Council levels would not go forward.

During the transition from the original stakeholder group to the MOU-based RWMG, members of the stakeholder group continued to be consulted and given opportunities to comment on drafts of IRWM plan material and the development of project proposals.

Governance Transition and Future

During the planning process, stakeholders decided that the governance process required formalizing through a MOU. The MOU was developed based very closely on the interim governance structure in place until this point, with a few refinements in structure. Signature onto the MOU was required for continued active participation (voting) in the planning process, and signatories to this MOU became the formal RWMG. Organizational entities (not individuals) could become members of the RWMG through signing onto this MOU, stating their support for the process, their commitment to participate in good faith, and intent to adopt the IRWMP at the end of the process (see Appendix C for the MOU). Identifying an organization as a member then allowed that organization one vote through their chosen representative or alternate(s). Members were to attend meetings consistently with the responsibility of communicating information regarding the IRWM planning process regularly to the entity that they represent. The organization also could designate an alternate in the event that the primary member was not able to attend; it was, and continues to be, expected that the alternate be fully briefed on all pending issues and decisions and be vested with the same authority as the primary representative.

The MOU was also designed to accommodate the process of adopting the completed IRWMP. If an entity chooses to sign the MOU, but not adopt the final IRWMP, this entity may continue to participate in the IRWMP implementation process, but may not submit implementation projects for inclusion in the IRWMP or for any IRWM-based funding opportunity. Adoption of the IRWMP is discussed further in Section 16.5.2, below. Likewise, if an organization didn't want to sign on to the MOU, but did adopt the final IRWMP, they were free to be a project sponsor but would not have a vote on the RWMG.

As described above, the governance strategy identified by the stakeholders early in the planning process, and then formalized into the RWMG, was chosen for its open and democratic process. Thus, as required by the Department of Water Resources (DWR) Guidelines, the “public involvement process [is] direct to local agencies and stakeholders, as applicable to the region.” These agencies and stakeholders include those listed in Table 16.1, above; representatives of local public agencies, non-profit organizations, tribes, private industry, and communities qualifying as disadvantaged were — and continue to be — active participants in the development and implementation of the IRWMP. State and federal agencies, while not signatories to the MOU as members, actively participated in the development of the IRWMP and continue to participate in an advisory role and as project partners. RWMG meetings were open to the public and noticed on the USR website. Many of these meetings also were noticed through press releases, given to local media outlets (see Section 16.5.1). Any individual member who expressed interest and gave the project team their contact information was added to the e-mail list to receive meeting announcements and draft documents.

The development of this IRWMP was supported by the many hours that stakeholders and RWMG members spent in meetings — some in plenary-based RWMG meetings, and many more in work groups and workshops, working out the more technical aspects of this document. Participation in the work groups and workshops was through self-identification in the larger General Assembly meetings and/or recruitment of participation by the project team, and based on need and/or interest. The information presented, discussed, and any recommendations made were brought to the RWMG through chapter additions, drafts, and/or memos for discussion and consideration. The outcome of all work groups were identified through meeting notes which were dispersed to participants within two weeks following a meeting.

Work groups employed during this IRWM development process are listed below, along with their responsibility and coordination with the larger RWMG.

- Project Development Work Group: This group met during Plan development. Topics of discussion included how projects would be developed, how integration could be encouraged, project prioritization, the approach for the next DWR IRWMP Implementation Grant (Round 3 in 2014), and how future discussions of project implementation would be guided by what was submitted in this round. Information brought by the project team to this work group included relevant DWR Guidelines sections, copies of other IRWM examples, and templates developed for the submittal of project application materials. Participants brought project materials applicable for their proposed projects and that may be useful to — or used by — other project sponsors. They also developed the prioritization process being identified and used in Chapter 10 (Project Review Process and Implementation).
- Objectives Work Group: This work group was self-identified in December 2012 and met once in January 2013 to refine the suite of objectives developed for RWMG consideration. They considered the measurability of each objective and the comprehensiveness of meeting stated issues and challenges in other developed sections. Following this meeting, their work was sent out to the RWMG for review and acceptance.
- Finance and Funding Work Group: This work group met periodically in 2013 to discuss funding issues on a larger level. This included project-specific funding, to some extent, but was more focused on funding ongoing RWMG operations and IRWMP implementation. At least one meeting also identified and discussed the process for compiling and submitting an implementation grant, which was complimentary to some of the discussions had by the Project Development Work Group. This group’s work fed directly into the Finance chapter of this document (Chapter 15), which went to the RWMG for review prior to their adoption of the document as a whole.

- MOU/Governance Work Group: This group was made up of RWMG members who provided comments — written or verbal — directly on the MOU document and/or process. These individuals met once to negotiate language and process, and were contacted directly upon the refinement of that language to develop buy-in and confirm the signatory process. Their work was directly on the MOU and that process, and has fed the development of this Governance and the Next Steps chapters.

While each of these committees worked on a separate and specific component of the final IRWMP, they shared a significant portion of membership (i.e. many RWMG members were on more than one committee). In addition, the region is small enough so that regular communication even outside the IRWM process can be had between all RWMG members; this aided in the coordination and communication process.

16.3 Effective Decision Making

Each signatory to the MOU has a single vote in the process. As discussed above, at the first meeting where an issue is discussed and decision needed, consensus is the only option for making that decision. If consensus cannot be reached, then the discussing is tabled and those with the disagreement work to address the outstanding issues before the next meeting. At the second meeting at which the topic is discussed, consensus is the first choice for making a decision, but if consensus still cannot be reached, at that point a vote may be held that would then refer the decision to the Formal Issue Resolution (FIR) process, per the MOU.

The FIR includes three subgroups: Statutory Authorities (cities, counties, community services districts (CSDs), etc.), Tribal Authorities, and Resource Management interests (resource conservation districts (RCDs), non-governmental organizations (NGOs), private businesses, etc.). A motion may only be adopted with the approval of at least two-thirds of the Active Members of each of the three subgroups (three members requires two votes; four members requires three votes; five members requires four votes).

If, after the first meeting where an issue is presented and consensus is not reached, stakeholders see the potential for consensus with further communication and/or coordination of additional information, data, or background materials, there may be outreach performed by individual stakeholders or stakeholder groups to those individuals not joining in consensus. This may be completed in order to better ascertain an individual organizations' hesitancy, and thus, potentially, changing the issue up for consensus.

The USR process is based on a significant amount of person-to-person, or organization-to-organization, communication. The small population and low number of stakeholder organizations (when compared with other regions in the state), makes this type of communication doable, and even more effective than a purely meeting-based negotiation process. The relationships developed as part of this process can make the RWMG seem like a "closed club" to new entities wanting to join in the process. The RWMG membership is aware of this, however, and has worked to obtain input from these stakeholder groups as they show interest.

16.4 Balanced Opportunity for Participation

As shown in Table 16.1, the suite of entities participating in the development of the USR IRWMP has been diverse, including varied interests throughout the region. During the initial outreach phase of the development of the USR IRWMP, organizations and agencies in the region were alerted of the opportunity to participate in and, subsequently, to sign on to the RWMG MOU. This outreach was achieved through personal contact by the grantee (the River Exchange) and extensive email communication. Outreach also included public announcements. The outreach phase extended longer than the first year of the planning process, allowing an extensive time for contact, communication, and ongoing opportunities for participation in the planning process.

This initial, more personal form of outreach set the stage for the outreach process used throughout the planning process. While the IRWM Region website was a helpful way to get information to the fingertips of all stakeholders and interested parties, it was the personal communication that got people to meetings, bridged gaps in understanding and disagreements, and helped the RWMG to identify a formal decision-making structure to take them beyond the planning phase.

The planning process was funded by a DWR Proposition 84 planning grant, and did not require the investment of funds from any individual organization beyond the cost share represented in Chapter 9 (Climate Change). Participation by disadvantaged communities and tribes was also supported by a private grant from the Rose Foundation, awarded to the River Exchange, helping to pay for these entities' time and travel costs. This stipend process encouraged a more diverse group of stakeholders to continue to participate in the planning process. In addition, specific outreach to entities not able to make meetings occurred regularly throughout the process, with the opportunity to submit oral comments and, in some cases, go through the draft document components with the project team.

As noted above, the governance and decision-making structure identified by stakeholders was based on an interim governance structure, and allows for jurisdictions to participate on equal footing with other stakeholders. Each stakeholder has one vote in decision-making processes, and all votes are counted with similar weight. This avoids any particular entity or group of entities having a preponderance of influence or status in the decision-making process.

Equal opportunity and representation of the stakeholder group evolved into the structure identified in the RWMG MOU. The only officers noted in the MOU are Secretary and Fiscal Agent. The MOU defines the designation of these posts as "from time to time", indicating an openness to change but unwillingness to do it without reason. It's likely that the fiscal agent post will only be used when the RWMG has finances to disperse; that is, the fiscal agent post is likely only to become effective upon grant award and/or if membership dues are ever assessed (see Chapter 15, Financing IRWM Implementation and RWMG Operations). Stakeholders making up the RWMG are open to considering any RWMG member filling these roles, as can be seen by the initial designation of the River Exchange — a non-profit organization without statutory power — as the fiscal agent and secretary in this original version of the MOU. Any subsequent entity receiving a grant from DWR or other source for facilitating the ongoing efforts of the RWMG will likely become responsible for providing the services of secretary. The secretary is a de-facto member of the Coordinating Council and will serve in the sub-group associated with this person's organization.

There are currently no terms of service within the MOU-based governance structure; member entities may leave the organization whenever they wish. However, continued participation requires that organizations have at least one primary and one alternate representative actively participating and attending meetings to ensure the continuity and comprehension essential for active and meaningful participation.

16.5 Effective Communication

General Stakeholder Communication

RWMG meetings are noticed on the USR website and announced via e-mail to the list of participants compiled since 2011 and added to as new participants attend and/or contact the River Exchange. If stakeholders state a preference for hard copy documents and announcements, these are mailed to them at the same time as the e-mail is sent.

As mentioned above, the website is a helpful tool for making all resources available to all stakeholders, as well as to those entities who had chosen not to participate but were still interested in following the process. The website includes a calendar which is updated as meetings are scheduled and materials made available. It also has a database for reference documents that allows stakeholders to load their own data and documents as well as view those loaded by others. This adds to process transparency and is an excellent organizational tool for bibliographic materials.

In addition to these efforts, the River Exchange created a stakeholder participant list midway through the planning process, including the representative and alternate for each organization and organizational contact information. This document was created to better facilitate inter-stakeholder coordination and communication on the topic of Plan content as well as to encourage and enhance collaboration with regards to project development. It was handed out to all participants midway through the planning process.

Making project team contact information available to all participants facilitated two-way communication between participants and the project team. In addition, project team members called participants directly. These calls addressed issues such as opportunities for comment, questions regarding submitted comments, general check-in calls to gage process status, and to field questions regarding future efforts (such as document adoption and project financing).

Communication with and between Project Proponents
The initial project solicitation resulted in the submittal of 19 different projects by 12 entities. Project submittal continued to be a topic of RWMG conversation throughout several months, resulting in a final list of 31 projects by 13 entities. After the call for initial project proposals, several stakeholders initiated on their own outreach to other entities to discuss collaborating on specific projects. Further coordination and collaboration among project sponsors was encouraged through the project development workshops to emphasize integration. The RWMG reinforced the need for collaboration by noting that integrated projects would be more likely to be universally supported for inclusion in the IRWMP. This encouragement resulted in better communication between project sponsors, which then resulted in a stronger and more integrated suite of implementation projects.

Communication with neighboring RWMGs
Communication with neighboring RWMGs occurred periodically, as needed. For example, knowing that the North Coast IRWMP has been successful at integrating Native American interests into their governance structure, project team members were in contact with this entity to get more information about their process. In addition, the River Exchange participated regularly in interregional communication opportunities, such as the Sacramento Region Funding Area calls and meetings, and the Roundtable of Regions calls and events. The USR is tied closely to the Upper Pit Region though the Medicine Lake Highlands-Fall River hydrologic connection, and stakeholders expect to do more through this interregional connection in the future (see Chapter 10, Project Review Process and Implementation).

Communication with Government Agencies
Local, state, and federal agencies are all included in the e-mail list for meeting announcements and materials. While most federal and state agencies have chosen not to have a vote in the decision-making process, their document review, suggested edits and addition, and other input is considered on the same level as that of local stakeholders and RWMG members. In the case that projects were proposed on land managed by one of these agencies, stakeholders made sure that one of the partners included on these projects was the land management agency and that all project strategies were in line with that agency's land management directives and goals. Going forward, the continued participation of these state and federal agencies will be integral to the RWMG's success. Local agencies will

undoubtedly continue to participate as project sponsors, and will likely contribute greatly to ongoing meeting and document update efforts.

Communication with the General Public
Meetings of the RWMG and workgroups have been open to participation by any party expressing interest. These meetings have been and will be announced on the website with information relevant to the topic to be discussed. In addition, participating entities discuss the IRWM process regularly at publically noticed board meetings and workshops, and include information regarding the planning process in organizational newsletters. The website is available to the public and is the most readily available and consistently updated place to go for up-to-date information about the IRWM planning process. Please see the following section for public notice announcements.

16.5.1 Public Notice Announcements

The River Exchange, as the grant recipient from DWR, held initial responsibility for publically-noticing the IRWM development process. The first notice went out in March 2011 as a news release to a number of regional news outlets. It announced the grant award and contract as well as a description of the planning process and intent to prepare an IRWMP. The news release included contact information for the River Exchange should readers be interested in participation. This announcement was followed up by progress reports to the same regional news outlets in April and October of 2012.

As the IRWMP was completed, a notice went out in November of 2013 indicating the RWMG's intent to adopt the completed IRWMP. Comments were solicited via the website, with directions indicating how to review documents and submit comments included in the news release.

The RWMG anticipates continuing this proactive pattern, and will need to assign responsibility as the management moves from the River Exchange to the RWMG at large.

16.5.2 Plan Adoption

The type of IRWMP created by the USR RWMG is a new document referencing in-place, existing local plans. It does not supersede or contravene any authority of existing plans and policies or the authorities of statutory jurisdictions, including jurisdictional agencies participating in the planning process or adopting the USR IRWMP.

The adoption of the IRWMP occurred through a process of two central, linked actions on the part of RWMG members. The first action was that of RWMG approval through the group's adoption of the IRWMP. This occurred on November 25th, 2013, and was a consensus of the agencies and organizations present. The second phase of action was that of individual RWMG members and other parties bringing the RWMG-adopted document to their respective organizations for organizational adoption. Organizational adoption was structured through a mutually agreed upon resolution (see Appendix D). The signatures of an organization's governing body, and the submittal of a copy of that resolution to the RWMG through the River Exchange, represented organizational adoption. While not finalized with adoption on November 25th, 2013, this appendix will be updated as adoptions occur.

Document adoption is open to any interested organization, whether they participated in developing the IRWMP or not. Due to DWR Guidelines, adoption was and is required of all organizations that sponsor projects. Each of these organizations is expected to adopt the final IRWMP. Table 16.1, above, shows those organizations that adopted the IRWMP, with a note if the organization has sponsored a project. All adoption resolutions may be found in Appendix C of this document.

16.5.3 Interim and Formal Changes to the Plan

It is anticipated that minor changes in strategy or situation could result in occasional changes to the IRWMP by the RWMG. These may be factual changes, such as a new endangered species or changes in approaches to resource management by state and federal agencies, and thus be incorporated into the appropriate section and result in a revised section or addendum. It is not anticipated that these types of changes will require members to re-adopt the IRWMP.

There may also be procedural changes requested by RWMG members or required by an outside entity, such as the DWR or other granting agency. In this case, it is likely that a more formal process will be put into place, based largely on the decision-making structure described earlier in this chapter. Changes in and additions to the project list for implementing the IRWMP will likely be done through the development of addenda and appendices.

The performance measures chapter describes in more detail how plan implementation success is to be measured. It is through this process that stakeholders anticipate assessing the need for plan revisions or updates, and whether they need to be simple revisions or a more formal process.

16.5.4 Updating or Amending the Plan

Stakeholders view the IRWMP as a living document, essential to assess for relevance and effectiveness on a regular basis. The performance measures chapter describes this process in more detail, but the RWMG does assume that some changes will be required as conditions within the region change and as accomplishments are made. In particular, the process for assessing performance may determine that one or more of the objectives become less important due to success in meeting the measurements placed on it. This may indicate a need to change the measurements, a need to edit the objectives, or both. It is likely that a formal review of the IRWMP and resulting changes will occur, on average, every five years.

16.6 Long-term Implementation

This document was written with a planning horizon of 20 years. The RWMG MOU governance structure is designed to be useful and applicable for as long as it is needed. In the process of identifying a governance strategy, several other RWMGs' strategies were considered; most of the groups examined had been around for at least five years. It was felt that if a governance strategy could be adopted that was similar to that which had brought another group through the planning process and into implementation and ongoing governance, that it was likely that this strategy could be similarly effective for the USR. Adding strength to this assessment was the fact that many of those governance structures were similarly organized, including the following points: 1) all interested organizations were included in the decision-making structure; and 2) the structure emphasized consensus, but had an "out" for final decision making if consensus could not be reached. More information on the topic of future plans is available in Chapter 15, Financing IRWM Implementation and RWMG Operations.

16.6.1 Organizational Structure and Needs

As stated in Chapter 15, Financing IRWM Implementation and RWMG Operations, DWR has indicated that it is looking at IRWM as the future of water management in California. Supporting this, there are more places in the California Water Code and current legislation that cite additional responsibilities for the RWMG and the IRWM process. While not a mandate, there are some tasks and functions important for a RWMG to consider apart from actual project implementation. As stated in Chapter 15, the degree to which a RWMG embarks upon ongoing activities must be a decision by the group as a whole.

Discussed in Chapter 15, Finance, and Chapter 12, Plan Performance and Monitoring, the USR RWMG anticipates regular review of IRWM implementation status and success, as well as updates to this IRWMP on a periodic basis (generally every five years). The governance structure and IRWM adoption resolution, allows for ongoing decision-making; there are no anticipated changes needed for the governance structure to accommodate updates to the IRWMP. However, other RWMGs have formalized their governance structure to allow for greater funding options and legal organization and responsibility. The current RWMG structure is not a legal organization, with signatures to an MOU identifying members and no formal entity (e.g. non-profit incorporation, Joint Powers Authority (JPA), etc.) established. However, stakeholders are looking to the future at potential options for organization. Some of the organizational discussions have included consideration of the following options:

- Joint Powers Authority/Agreement: This would formalize the process and would require adherence to all governmental organizational laws (such as the Brown Act). This organizational tool could allow for governmental and federally- and state-recognized aboriginal nations to participate as members of the JPA, but could sideline, somewhat, the role of the non-profit entities, private corporations, and those aboriginal nations not recognized by the federal or State government.
- Merging with another IRWM planning region: Because of the relatively small size of the USR, in area and in population, stakeholders have discussed potential benefits and costs associated with joining another region. While a potential partner may be had in any neighboring region, differences in resource use (conventional agricultural vs. timber), stakeholder organization and momentum, hydrologic region (the North Coast versus the Sacramento River Hydrologic Regions), and basin type (headwater vs. lower valley) may cloud the objectives of each existing RWMG. Existing advocacy and organizational entities could also serve as an organizing force. An existing group of IRWM regions, the Sierra Water Work Group, currently works with IRWM regions throughout the Sierra to advocate for common issues, including source water area protection, area of origin water rights, and rural/mountainous region issues. The Sierra Water Work Group could represent an opportunity to magnify the voice of USR stakeholders on issues of common interests within the State legislature.

16.6.2 Ongoing Operations and Maintenance Support

The funds needed for ongoing operations will depend on the activities identified by the RWMG for implementation. However, an in-kind or financial contribution by members will likely be necessary in order to allow for continual updates to the IRWMP: financial contributions would allow the RWMG to hire temporary staff to do this work, or pay a member organization to do it; in-kind contributions could allow member organizations to contribute effort in lieu of financial resources in order to update the IRWMP.

16.7 Coordination

The governance structure allows for individual member entities to make any efforts they feel are necessary to advance the interests of the RWMG, as long as they're clear that they're acting on their own behalf and not on behalf of the RWMG.

Coordination within the USR for Information and Project Development

As stated above, in Section 16.5, coordination within the USR is good. Information and meeting dates are shared via the USR IRWM website and announced via e-mail to the list of participants. If stakeholders state a preference for hard copy documents and announcements, these are mailed to them at the same time as the e-mail is sent. While the website is a helpful tool for making all resources available to all stakeholders, person-to-person communication has proven to be the most successful form of coordination within the USR. The region is of a good size to accommodate this method of communication, and new stakeholders are easily absorbed into the RWMG. To support these efforts, a participant list allows stakeholders to have contact information for all of those entities and representatives involved in the IRWM process.

Future coordination efforts will include the identification of the Project Development Work Group as an ongoing effort to facilitate communication and coordination regarding IRWM implementation efforts, priority projects, and the identification of synergistic partnerships and planning efforts. Stakeholders in this process have voiced on several occasions the increased efficiency, synergy, and expected process improvements associated with doing project development and implementation through this coordinated group. Participants expect, after some initial challenges, that project identification, development, and implementation will be a smoother process and will involved fewer challenges from a process, legal, and/or collaborative perspective. A good example of how this coordination affected project development can be seen in the project submitted for the City of Mt. Shasta. A traditional infrastructure upgrade was made more robust by stakeholders' suggestions of efficiencies, green infrastructure, and public outreach additions. These tasks will add to the organization's ability to convey the importance of the project to their ratepayers, and will also increase the value of the project overall.

Coordination with Neighboring IRWM Efforts

Several stakeholders participate both in the USR process as well as another IRWM process. This adds to the coordination between regions due to stakeholders' knowledge regarding other regions' processes, interests, and issues. In addition, the River Exchange also participates actively in interregional efforts (coordination between immediate boundary-area regions, participation in the Sacramento Hydrologic Region Funding Area group, and participation in the Roundtable of Regions) and brings that information back to the RWMG as information and, as necessary, decision points.

A challenge in interregional coordination specific to the USR and the River Exchange was the change in leadership with the River Exchange on several occasions throughout the application and implementation process. While these changes didn't interfere with participation, it is possible that the development of relationships and organizational coordination was somewhat hampered. That being said, good interregional efforts were demonstrated throughout the planning process. There was participation in DWR's May 2011 IRWM conference, as well as regular attendance in the Roundtable of Regions calls and meetings. Project staff also coordinated closely with the North Coast RWMG on topics of governance and tribal issues, and with the Inyo-Mono region on the climate change assessment.

Stakeholders have discussed the opportunity for at least one interregional project, looking at the connectivity of the Medicine Lake Highlands to the springs that feed Fall River in the Upper Pit IRWM Region. It's likely that there could be some water management collaboration between the USR and the North Sacramento Valley IRWM Region, if the need were there. Further discussions as the IRWMPs are implemented will further show the potential for this interregional work.

Coordination with State and Federal Agencies

State and federal agencies, while not voting members of the RWMG, have regular representation at the RWMG meetings. State agencies participating in the process include the DWR, the Central Valley Water Quality Control Board, and Department of Fish and Wildlife. Federal agencies attending RWMG meetings and participating in the planning process include the Forest Service and Bureau of Reclamation. These agencies are included in regular RWMG communications and are continually invited to submit projects, comment on chapters, and participate in the general operations of the RWMG. Several of these entities are partners on implementation projects.

Some of these agencies serve regional roles of a regulatory and/or management nature, and thus are important reviewers for the IRWMP document. The fact that the Forest Service manages nearly half of the USR makes that agency of particular value in the process. Likewise, because the region provides a vast amount of water for uses throughout the state, DWR and the Bureau of Reclamation are important participants. These roles are respected and stakeholders expect to continue these relationships as planning moves into implementation; in fact, these agencies will be essential partners if the RWMG is to accomplish all that is identified in the objectives section.

State agencies have been particularly important in the development and implementation of this IRWMP. One topic that has come up repeatedly in the region, emphasizing both its importance and controversial nature, is groundwater status and monitoring. This was felt with particular emphasis during the project development phase of the IRWM planning effort, as there were numerous projects identified that addressed the topic. State agencies (DWR and the Central Valley Water Quality Control Board) were particularly helpful in these discussions and e-mails through the provision of Water Code understanding and references, as well as information regarding the ways that other regions have implemented challenging components of IRWM. The DWR was instrumental in identifying a governance structure for the region, as well as with implementation support, and will likely continue to play a role in the region's implementation efforts.

16.8 Collaboration to Establish Objectives

While the outcomes of this process can be found in Chapter 7, Objectives, and (generally) in the Planning Framework chapter (Section 2.2.8), the process to establish objectives included all interested parties in the process through an extensive process of individual meetings and interviews, group identification of issues and interests, a workgroup formed to nuance and revise the objectives for discussion by the entire RWMG (see Section 16.2, above), and a process to review the objectives for completion and gaps. Those who may not have desired such active participation in all of the meetings and workgroups had ample opportunity to submit comments and edits throughout the development process, and were part of chapter approval and ultimate IRWMP review and, if applicable, adoption.

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Appendix B: Glossary of Terms

A

ABORIGINAL: While often thought of as relating directly to those native to the Australian continent, the terms is used in this document to mean "first" or "earliest known". It may be considered interchangeable with "native" and "indigenous".

ACRE-FOOT: The quantity of water required to cover one acre to a depth of one foot; equal to 43,560 cubic feet, or approximately 325,851 gallons.

ALLUVIAL: Sediment deposited by flowing water, such as in a riverbed.

ANADROMOUS: Pertaining to fish that spend a part of their life cycle in the sea and return to freshwater streams to spawn.

APPLIED WATER DEMAND: The quantity of water that would be delivered for urban or agricultural applications if no conservation measures were in place.

AQUIFER: An underground layer of rock, sediment or soil, or a geological formation/ unit that is filled or saturated with water in sufficient quantity to supply pumping wells.

B

BEDROCK AQUIFER: A consolidated rock deposit or geological formation of sufficient hardness and lack of interconnected pore spaces, but which may contain a sufficient amount of joints or fractures capable of yielding minimal water to a well.

BENEFICIAL USES: Aquatic ecosystems and underground aquifers provide many different benefits to the people of the state, and those benefits as identified by the State Water Resources Control Board define the resources, services, and qualities of these aquatic systems that are the ultimate goals of protecting and achieving high water quality. Beneficial use designations for any given water body do not rule out the possibility that other beneficial uses exist or have the potential to exist.

BEST MANAGEMENT PRACTICE (BMP): A best practice is a method, process, activity, incentive, or reward which conventional wisdom regards as more effective at delivering a particular outcome than any other technique, method, or process when applied to a particular condition or circumstance.

C

CONFINED AQUIFER: A water-bearing subsurface stratum that is bounded above and below by formations of impermeable, or relatively impermeable, soil or rock.

CONJUNCTIVE USE: The operation of a groundwater basin in coordination with a surface water storage and conveyance system. The purpose is to recharge the basin during years of above average water supply to provide storage that can be withdrawn during drier years when surface water supplies are below normal.

COSMOLOGICAL DISTRICT: A designation by the NRHP for a region that supports exceptionally clear and dark skies.

CUBIC FEET PER SECOND (cfs): A unit of measurement describing the flow of water. A cubic foot is the amount of water needed to fill a cube that is one foot on all sides, about 7.5 gallons.

D

DWR: California Department of Water Resources.

E

ECOLOGICAL INTEGRETY: The quality of a natural unmanaged or managed ecosystem in which the natural ecological processes sustain the function, composition and structure of the system. Such systems, for example, may have complete food webs, a full complement of native species that can maintain their populations, and naturally functioning ecological processes (energy flow, nutrient and water cycles, etc).

ECOTOURISM: a form of tourism involving visiting relatively undisturbed natural areas, intended as a low-impact and often small scale alternative to standard commercial tourism. The purpose may be to educate the traveler, to provide funds for ecological conservation, to directly benefit the economic development and political empowerment of local communities, or to foster respect for different cultures.

EFFICIENT WATER MANAGEMENT PRACTICE (EWMP): An agricultural water conservation measure that water suppliers could implement. EWMPs are organized into three categories: 1) Irrigation Management Services; 2) Physical and Structural Improvements; and 3) Institutional Adjustments.

EFFLUENT: Wastewater or other liquid, partially or completely treated or in its natural state, flowing into another water body.

ENVIRONMENTAL JUSTICE: The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Environmental Justice seeks to redress inequitable distribution of environmental burdens (i.e. pollution, industrial facilities) and access to environmental goods (i.e. clean water and air, parks, recreation, nutritious foods, etc.).

EVAPOTRANSPIRATION (ET): The sum of evaporation — the movement of water to the air from sources such as soil, canopy interception, and water bodies — and transpiration — the movement of water within a plant and subsequent loss of water as vapor through its leaves. Quantitatively, it is expressed in terms of depth of water per unit area during a specified period of time.

F

FIRM YIELD: The maximum annual supply of a given water development that is expected to be available on demand, with the understanding that lower yields will occur in accordance with a predetermined schedule or probability.

FOREBAY: A reservoir or pond situated at the intake of a pumping plant or power plant to stabilize water levels. Also, a groundwater basin immediately upstream or upgradient from a larger basin or group of hydrologically connected basins.

G

GREEN INFRASTRUCTURE: Strategically planned and managed networks of natural lands, working landscapes and other open spaces that conserve ecosystem values and functions and provide associated benefits to human populations. The foundation of green infrastructure networks are their natural and engineered elements that work together as a whole to sustain ecological values and functions.

GROUNDWATER: Water that occurs beneath the land surface and completely fills all pore spaces of the alluvium or rock formation in which it is located.

GROUNDWATER BASIN: A groundwater reservoir, together with all the overlying land surface and underlying aquifers that contribute water to the reservoir.

GROUNDWATER OVERDRAFT: The condition of a groundwater basin in which the amount of water withdrawn by pumping exceeds the amount of water that replenishes the basin over a period of years.

GROUNDWATER RECHARGE: Increases in groundwater quantities or levels by natural conditions or by human activity.

GROUNDWATER TABLE: The upper surface of the zone of saturation (all pores of subsoil filled with water), except where the surface is formed by an impermeable body.

H

HYDROMODIFICATION: Any activity that increases the velocity and volume (flow rate), and often the timing, of runoff (from the State Water Resources Control Board website, accessed 11/2013: http://www.waterboards.ca.gov/water_issues/programs/nps/encyclopedia/5.0_hydromod.shtml).

I

I & I: "I & I" is an abbreviation for "inflow and infiltration". Inflow is rainwater that enters the sanitary sewer through holes in manhole covers, catch basins or improper plumbing connections. Infiltration is groundwater that seeps into the sewer through cracks or joints in sewer pipes.

INDIAN: The term "indian" has been used to identify people directly descending from the aboriginal people of North America – specifically the United States. Currently, it is interpreted to exclusively apply to those aboriginal people whose governmental bodies (see "nation") have been recognized by the US government and represented by the Bureau of Indian Affairs. This is not an inclusive term, and is generally acceptable only in reference to proper nouns (such as the Shasta Indian Nation) or in use by people belonging to the affected ethnic group(s).

INDIGENOUS PEOPLE: This is a more specific reference than Native Americans, these groups being indigenous to what is now the United States before the first contact by Europeans. This term is inclusive of all groups, or tribes — federally recognized or not. It is also the reference used in the United Nations Declaration on the Rights of Indigenous Peoples (DRIP — available here: http://www.un.org/esa/socdev/unpfii/documents/DRIPS_en.pdf), which is inclusive of all groups in all parts of the world who are indigenous to the places in which they continue to reside.

INSTREAM USE: Use of water that does not require diversion from its natural watercourse. For example, the use of water for navigation, recreation, fish and wildlife, esthetics, and scenic enjoyment.

IRRIGATION EFFICIENCY: The efficiency of water application. Computed by dividing evapotranspiration of applied water by applied water and converting the result to a percentage. Efficiency can be computed at three levels: farm, district, or basin.

IRRIGATION RETURN FLOW: Applied water that is not transpired, evaporated, or deep percolated into a groundwater basin, but that returns to a surface water supply.

M

M&I: Municipal and Industrial (water use); generally urban uses for human activities.

MILLIGRAMS PER LITER (MG/L): The mass (milligrams) of any substance dissolved in a standard volume (liter) of water. One liter of pure water has a mass of 1000 grams. For dilute solutions where water is the solvent medium, the numerical value of mg/l is very close to the mass ratio expressed in parts per million (ppm).

N

NATION: The term “nation”, as used in the USR IRWMP, respects the authority of a group of indigenous people as a sovereign entity — similar to that of a country. It is a preferable reference in place of “tribe”.

NATURALLY OCCURRING CONTAMINANTS (IN GROUNDWATER): A deleterious substance present in groundwater which is of natural origin, i.e. not caused by human activity.

NET WATER CONSERVATION: The difference between the amount of applied water conserved and the amount by which this conservation reduces usable return flows.

NET WATER DEMAND: The applied water demand less water saved through conservation efforts (= net applied water = actual water used).

NONPOINT SOURCE: Nonpoint source (NPS) pollution refers to both water and air pollution from diffuse sources. Nonpoint source water pollution affects a water body from sources such as polluted runoff from agricultural areas draining into a river, or wind-borne debris blowing out to sea. Also see Point Source.

P

PARTS PER MILLION (PPM): A ratio of two substances, usually by mass, expressing the number of units of the designated substance present in one million parts of the mixture. For water solutions, parts per million is almost identical to the milligrams per liter.

PER-CAPITA WATER USE: The amount of water used by or introduced into the system of an urban water supplier divided by the total residential population; normally expressed in gallons per-capita-per-day (gpcd).

PERCOLATION: The downward movement of water through the soil or alluvium to the groundwater table.

PERENNIAL YIELD: The rate at which water can be withdrawn perennially under specified operating conditions without producing an undesired result. An undesired result is an adverse situation such as: (1) a reduction of the yield of a water source; (2) development of uneconomic pumping lifts; (3) degradation of water quality; (4) interference with prior water rights; or (5) subsidence. Perennial yield is an estimate of the long-term average annual amount of water that can be withdrawn without inducing a long-term progressive drop in water level. The term “safe yield” is sometimes used in place of perennial yield, although the concepts behind the terms are not identical: the older concept of “safe yield” generally implies a fixed quantity equivalent to a basin’s average annual natural recharge, while the “perennial yield” of a basin or system can vary over time with different operational factors and management goals.

PERMEABILITY: The capability of soil or other geologic formation to transmit water.

POINT SOURCE: Any discernable, confined and discrete conveyance site from which waste or polluted water is discharged into a water body, the source of which can be identified. See also Nonpoint Source.

POLLUTION (OF WATER): The alteration of the physical, chemical, or biological properties of water by the introduction of any substance into water that adversely affects any beneficial use of water.

POTABLE WATER: Water suitable for human consumption without undesirable health consequences. Drinkable: meets Department of Health Services drinking water requirements.

R

RECHARGE BASIN: A surface facility, often a large pond, used to increase the infiltration of water into a groundwater basin.

RECYCLED WATER: Reclaimed water, sometimes called recycled water, is former wastewater (sewage) that has been treated to remove solids and certain impurities, and then used in sustainable landscaping irrigation or to recharge groundwater aquifers.

REVERSE OSMOSIS: Method of removing salts from water by forcing water through a membrane.

RETURN FLOW: The portion of withdrawn water that is not consumed by evapotranspiration and returns instead to its source or to another body of water.

REUSE: The additional use of once-used water.

RIPARIAN: Of, or on the banks of, a stream or other body of water.

RIPARIAN VEGETATION: Vegetation growing on the banks of a stream or other body of water.

RUNOFF: The surface flow of water from an area; the total volume of surface flow during a specified time.

RWQCB: Regional Water Quality Control Board.

S

SAFE YIELD (GROUNDWATER): The maximum quantity of water that can be withdrawn from a groundwater basin over a long period of time without developing a condition of overdraft. Sometimes referred to as sustained yield.

SALINITY: Generally, the concentration of mineral salts dissolved in water. Salinity may be measured by weight (total dissolved solids), electrical conductivity, or osmotic pressure. See also TDS.

SECONDARY TREATMENT: In sewage treatment, the biological process of reducing suspended, colloidal, and dissolved organic matter in effluent from primary treatment systems. Secondary treatment is usually carried out through the use of trickling filters or by an activated sludge process.

SUSTAINABLE/SUSTAINABILITY: Managing or using a resource in a way that meets the needs of the present, and does not compromise future needs. Sustainability implies proactive decision-making and innovation that considers a balance between social equity, environmental protection, and economic growth.

SWP: State Water Project.

SWRCB: California State Water Resources Control Board.

T

TERTIARY TREATMENT: In sewage, the additional treatment of effluent beyond that of secondary treatment to obtain a very high quality of effluent.

TOTAL DISSOLVED SOLIDS (TDS): a quantitative measure of the residual minerals dissolved in water that remain after evaporation of a solution. Usually expressed in milligrams per liter (mg/l) or in parts per million (ppm). See also Salinity.

TRADITIONAL ENVIRONMENTAL KNOWLEDGE (TEK) – A cumulative body of knowledge, practice and belief about the relationship of living beings (including humans) with one another and with their environment, evolving by adaptive processes and handed down through generations by cultural transmission. Refers specifically to types of knowledge about the environment derived from the experience and traditions of a particular group of people.

TRIBE: Similar to “indian”, the term “tribe” is becoming obsolete except in proper noun references. A preferred term is that of “nation”.

TURBIDITY: A measure of cloudiness and suspended sediments in water. Water high in turbidity appears murky and contains sediments in suspension. Turbid water may also result in higher concentrations of contaminants and pathogens, that bond to the particles in the water.

W

WATER QUALITY: A term used to describe the chemical, physical, and biologic characteristics of water with respect to its suitability for a particular use.

WATER RECLAMATION: The treatment of water of impaired quality, including brackish water and seawater, to produce a water of suitable quality for the intended use.

WATER RIGHT: A water right is a legal entitlement authorizing water to be diverted from a specified source and put to beneficial, non-wasteful use. Water rights are property rights, but their holders do not own the water itself. They possess the right to use it. The exercise of some water rights requires a permit or license from the State Water Resources Control Board (State Water Board), whose objective is to ensure that the State's waters are put to the best possible use, and that the public interest is served. (Definition from the State Water Board website: http://www.waterboards.ca.gov/waterrights/board_info/water_rights_process.shtml)

WATERSHED: An area or ridge of land that separates waters flowing to different rivers, basins, or seas; the area or region drained by a river, stream, or reservoir; drainage basin.

WATER TABLE: The surface of underground, gravity-controlled water.

WORKING FOREST: A forest that sustains the timber resources, water, wildlife, and a well-balanced climate, while providing public and/or private income from forestry, farming, and/or other activities.

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Appendix C: MOU Text and Signature Pages

The MOU text is included on the following pages, with the signature pages for those entities signing on to the MOU included immediately following the MOU.

UPPER SACRAMENTO-MCCLOUD-LOWER PIT REGIONAL WATER MANAGEMENT GROUP

MEMORANDUM OF UNDERSTANDING

September 1, 2013

**UPPER SACRAMENTO-MCCLOUD-LOWER PIT
REGIONAL WATER MANAGEMENT GROUP**

MEMORANDUM OF UNDERSTANDING

THIS MEMORANDUM OF UNDERSTANDING ("MOU") is entered into with an assigned effective date of September 1, 2013. Parties to this MOU shall be recognized when a "Confirmation and Signature for Approval" form, attached to this MOU as Exhibit B, has been completed and, when applicable, new members have been approved pursuant to Section 2.10 herein.

The following list indentifies (in alphabetical order) agencies and entities which, due to their standing and interests in the region and participation in the IRWM process, are initially considered as appropriate potential parties for this MOU. This list does not intend to presume whether each entity will choose to adopt this MOU, nor is this list exclusive. Entities not included in this list may also be considered as appropriate parties for this MOU. When determined to be applicable by the RWMG, potential new members to this MOU may be considered pursuant to Section 2.10 herein.

CalTrout
Campbell Timberland
City of Dunsmuir
City of Mt. Shasta
Community of Big Bend
County of Shasta
County of Siskiyou
Hancock Natural Resources Group
Hearst Forests
McCloud Community Services District
McCloud Local First Network
McCloud Watershed Council
Modoc Nation
Mount Shasta Bioregional Ecology Center
Pacific Forest Trust
Pit River Tribe
River Exchange
Roseburg Forest Products
Shasta Indian Nation
Shasta Nation
Shasta Valley RCD
Sierra Pacific Industries
Siskiyou Land Trust
Trout Unlimited
Western Shasta RCD
Winnemem Wintu Tribe

RECITALS

WHEREAS, the Integrated Regional Water Management Planning Act (Water Code Sections 10530 to 10547) authorizes three or more local agencies, at least two of which have statutory authority over water supply or water management, to enter into a memorandum of understanding ("MOU") or other legal agreement to establish a Regional Water Management Group ("RWMG"); and

WHEREAS, the parties to this MOU desire to develop and adopt an Integrated Regional Water Management ("IRWM") Plan and to increase coordination and collaboration among stakeholders in the Upper Sacramento-McCloud-Lower Pit Region ("Region"); and

WHEREAS, the River Exchange ("REX") entered into a Grant Agreement on October 7, 2011 with the California Department of Water Resources ("DWR") to develop a new IRWM Plan for the Region.

WHEREAS, the parties to this MOU seek to ensure that an appropriate share of the $73 million in IRWM funding available in the Sacramento River funding area is allocated to the Region; and

WHEREAS, the parties to this MOU seek to implement a long-term IRWM Program within the Region which will be closely coordinated with other planning and land and water resource management interests and agencies; and

WHEREAS, the parties to this MOU seek to provide stability and consistency in the planning, management, and coordination of resources within the Region and to implement projects to benefit the Region; and

WHEREAS, the parties to this MOU seek to ensure that IRWM funding and any other future funding is expended in the best way possible to enhance the many beneficial uses of water and other resources in the Region for the benefit of the Region itself and for downstream water users.

NOW, THEREFORE, in consideration of the above premises and of the mutual promises and agreements herein contained, the parties to this MOU agree as set forth below to work together in the RWMG for the Upper Sacramento-McCloud-Lower Pit Region to carry out the purposes of this MOU.

ARTICLE I
DEFINITIONS

Section 1.01. Definitions. Unless the context otherwise requires, the words and terms defined in this Article I shall, for the purpose hereof, have the meanings herein specified.

"Consensus" means approval of the Members to move forward with a particular action. "Consensus" does not necessarily mean that all Members affirmatively support an action but rather that no Member has opposed the action. A Member may verbally note disagreement with an action but still allow consensus on an action without the Member's support if the action does not affect the Member or compromise the Member's interests.

"Coordinating Council" means the Coordinating Council of the Upper Sacramento-McCloud-Lower Pit Regional Water Management Group having the responsibilities and composition described herein.

"Fiscal Year" means the period from July 1st to and including the following June 30th.

"Integrated Regional Water Management Plan" or "IRWM Plan" or "IRWMP" has the meaning set forth in Water Code Section 10534, which is a comprehensive plan for a defined geographic area, the specific development, content, and adoption of which shall satisfy requirements developed pursuant to Part 2.2 of Division 6 of the Water Code. At a minimum, an Integrated Regional Water Management Plan describes the major water-related objectives and conflicts within a region, considers a broad variety of water management strategies, identifies the appropriate mix of water demand and supply management alternatives, water quality protections, and environmental stewardship actions to provide long-term, reliable, and high-quality water supply and protect the environment, and identifies disadvantaged communities in the region and takes the water-related needs of those communities into consideration.

"IRWM Planning Act" means the Integrated Regional Water Management Planning Act, Part 2.2 of Division 6 of the California Water Code (commencing with section 10530).

"Member of the Regional Water Management Group" or "Member" means a local agency, tribe, or non-governmental organization that has become a party to this MOU. Federal and State agencies are not Members of the Regional Water Management Group, but such agencies may be parties to this MOU and may designate liaisons to the RWMG as provided herein.

"MOU" means this Memorandum of Understanding.

"Regional Water Management Group" or "RWMG" means the Regional Water Management Group for the Upper Sacramento-McCloud-Lower Pit Region. Regional Water Management Group has the meaning set forth in Water Code Section 10539, which is a group in which three or more local agencies, at least 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 a plan that meets the requirements in Water Code Sections 10540 and 10541, participate by means of a joint powers agreement, memorandum of understanding, or other written agreement, as appropriate, that is approved by the governing bodies of those local agencies.

"Secretary" means the secretary appointed by the Regional Water Management Group.

"Upper Sacramento-McCloud-Lower Pit Region" and "Region" mean those portions of the Sacramento, McCloud, and Pit River watersheds depicted in the map attached hereto as Exhibit A.

ARTICLE II
PURPOSE, ORGANIZATION, OPERATION, AND MEMBERSHIP

Section 2.01. Purpose. This MOU is entered into in accordance with the provisions of the IRWM Planning Act for the purposes of permitting a Regional Water Management Group to carry out the Region's IRWM Program and further develop, implement, and periodically update the Region's IRWM Plan. In carrying out the IRWM Program, the RWMG shall work to:

- Support the objectives of the California Department of Water Resources' IRWM Program, which seeks to ensure sustainable water uses, reliable water supplies, better water quality, environmental stewardship, efficient development, protection of agriculture, and a strong economy.
- Promote communication and collaboration in the Region to identify and implement resource management strategies and projects with broad-based stakeholder support.
- Facilitate local investment in projects that can minimize costs and maximize regional benefits through economies of scale or through projects with compound resource benefits.

Section 2.02. Term. This MOU shall become effective on the assigned date of September 1, 2013. This MOU shall continue in effect until terminated by mutual consent of all current Members. The inclusion of additional Members pursuant to Section 2.15 or withdrawal of some, but not all, of the Members pursuant to Section 2.16 shall not be deemed a termination of this MOU, so long as at least three local agencies, two of which have statutory authority over water supply or management remain signatories.

Section 2.03. Regional Water Management Group. Pursuant to the IRWM Planning Act, the signatories to this MOU have agreed to work together to serve as the Regional Water Management Group for the Upper Sacramento-McCloud-Lower Pit Region and to carry out the IRWM Program in the Region.

Section 2.04. Member Representatives; RWMG Decision-Making; Coordinating Council; Technical Committees.

(a) Member Representatives: Each Member shall be represented by an individual designated from time to time by the Member's governing body or executive officer. Member Representatives will attend meetings consistently and will regularly communicate information about the process to the entity they represent. Each Member's governing body or executive officer may designate one alternate representative to represent the Member in the absence of the primary representative. It is expected that alternate representatives have been briefed on all pending decisions and are vested with the same authority as the primary representative.

- Active Member: In order to be considered an Active Member of the RWMG, a Member Representative or designated alternate of the Member shall have attended at least 2/3 of the RWMG or Coordinating Council meetings in the previous 12 months.

8. RWMG Decision-Making: Every Member of the RWMG will have one vote and the RWMG shall make decisions by Consensus or, when necessary, through the resolution process described in this section. The RWMG may approve elements of the IRWM Plan, project proposals, grant applications, and any other decisions that may or must be made regarding approval or implementation of the IRWM Plan. The RWMG may delegate authority to make certain types of decisions to the Coordinating Council or Secretary in addition to the authorities provided herein. If the RWMG is unable to reach Consensus by a second meeting at which a matter is considered, any Member may make a motion to initiate the Formal Issue Resolution ("FIR") Process and, upon an affirmative vote of at least 75% of the Members in attendance, the matter shall be referred to the FIR Process.

   The FIR Process consists of a voting mechanism where the Members are classified into three subgroups with representation as described below:

   - Statutory Authorities: participating statutory authorities have one seat each. Potential Members in this category, if party to the MOU, include: Siskiyou County (including the Siskiyou Power Authority and the Siskiyou County Flood Control and Water Conservation District), Shasta County, the Cities of Dunsmuir and Mt. Shasta, and McCloud Community Services District.

- Tribal Authorities: participating Tribal Authorities have one seat each. Potential Members in this category, if party to the MOU, include: the Modoc Nation, Pit River Tribe, Shasta Indian Nation, Shasta Nation, and Winnemem Wintu Tribe.
- Resource Management Interests: participating Resource Management Interests, including non-governmental organizations, resource conservation districts, and industrial timberland owners, shall appoint or elect one voting representative from each of the following broad areas of interest: fisheries management, timber/ag. management, resource/land management, and environmental advocacy.

A motion may only be adopted with the approval of at least two-thirds of the Active Members of each of the three subgroups (3 members requires 2 votes; 4 members requires 3 votes; 5 members requires 4 votes).

The RWMG shall not approve a grant application for any project located within the jurisdiction of any one of the statutory authorities described in Section 2.04(b)(i) that contravenes any authority of the affected statutory authority, and any element or policy of the IRWM Plan shall only be effective within the jurisdiction of a statutory authority described in Section 2.04(b)(i) if it does not contravene any authority of the affected statutory authority.

9. Coordinating Council: The Coordinating Council shall consist of one representative from each of the three subgroups identified in Section 2.04(b), the Fiscal Agent, any Member who is a party to an IRWM grant agreement with the Department of Water Resources, and the Secretary. The Coordinating Council shall be responsible for overseeing routine administrative matters, developing agendas for meetings of the RWMG, and performing any other responsibilities delegated by the RWMG.

10. Technical Committees: Technical committees may be established as standing committees or ad hoc committees by the RWMG to consider issues of importance upon referral from the RWMG. Technical committees shall report all findings or recommendations to the RWMG.

Section 2.05. Meetings.

- Meetings:
    - **Regional Water Management Group.** The RWMG shall meet from time to time as necessary to conduct business and no less frequently than every six months.

13. **Coordinating Council.** The Coordinating Council shall meet from time to time as necessary to conduct business or at any such other regular frequency as the Bylaws may provide.

(b) Notice and Conduct of Meetings: All meetings of the RWMG shall be open to the public. An agenda for each meeting shall be prepared with a brief description of each item on which action may be taken by the RWMG. No later than 72 hours before a meeting, the agenda for the meeting shall be posted on the Region's website and distributed by email to all persons who have requested notice of the meetings of the RWMG .

Section 2.06. Meeting notes. The Secretary shall cause to be kept a record of the meetings of the RWMG and shall, as soon as possible after each meeting, cause a draft copy to be forwarded to each Member Representative and any other interested parties who have requested to be included on the distribution list.

Section 2.07. Bylaws and Policies. The RWMG may, from time to time, adopt Bylaws or policies and procedures for the conduct of business

Section 2.08. Annual Budget. If any funds are in the custody and control of the RWMG, the RWMG shall approve an annual budget for each Fiscal Year in consultation with the Fiscal Agent.

Section 2.09. Annual Operational and Fiscal Report. The Secretary shall cause an annual operational report and annual fiscal report to be prepared and provided to each Member.

Section 2.10. Addition of New Members. After establishment of the RWMG, any local agency, non-governmental organization, or other entity that is not a Member and desires to become a Member shall have attended at least two meetings of the RWMG and shall submit a written request to the Secretary. Upon approval by the RWMG at a duly convened meeting, a new Member shall be allowed to execute an amendment to this MOU adding the new Member as a party. This MOU shall be deemed amended to reflect the addition of a new Member upon execution of the amendment by the new Member and by the Secretary.

Section 2.11. Withdrawal of Member. Any Member may withdraw from this MOU at any time by providing written notice of such withdrawal to the Secretary. Upon the effective date of withdrawal, this MOU shall be deemed automatically amended to reflect the deletion of the withdrawing Member.

ARTICLE III
OFFICERS AND ADMINISTRATION

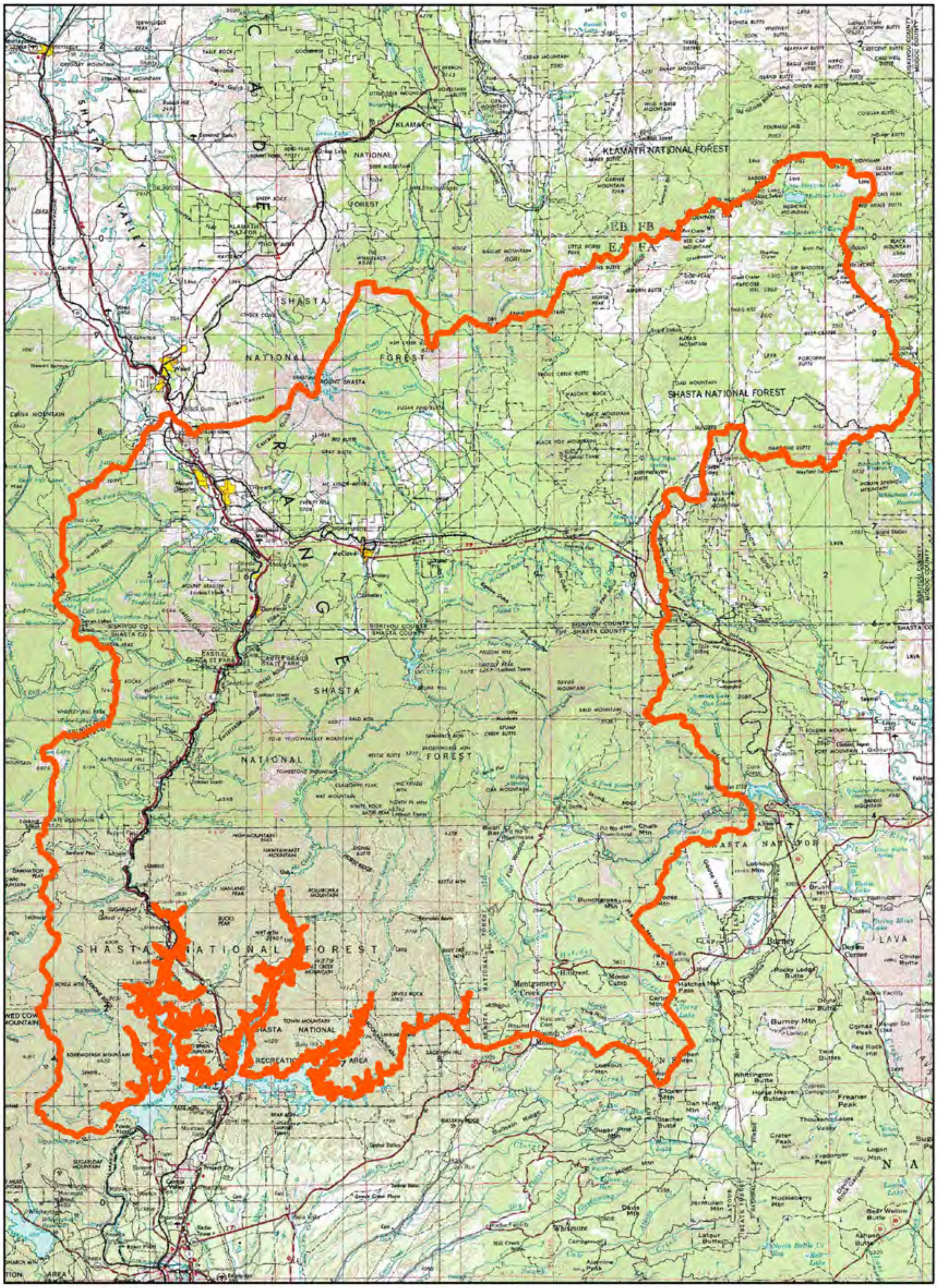
Section 3.01. Secretary. The River Exchange, or such other Member as the RWMG may designate from time to time, shall serve as the Secretary to perform such duties as may be necessary to operate and administer the RWMG and to maintain a record of its activities. The Secretary shall be responsible for the call and noticing of all meetings of the RWMG and Coordinating Council. The RWMG may further provide for the duties and responsibilities of the Secretary through administrative and fiscal policies.

Section 3.02. Fiscal Agent. The River Exchange, or such other Member as the RWMG may designate from time to time, shall serve as the Fiscal Agent to receive, disburse, and account for funds related to this MOU. Members may make contributions to the Fiscal Agent to support the IRWM Program in such amounts as the Members may agree, in their individual discretion, to contribute from time to time. Funding received by the Fiscal Agent to carry out projects shall be disbursed to other Members or to cooperating entities only after the Fiscal Agent enters a funding agreement or collection agreement ("Project Contracts") with the other Member or entity, as may be appropriate or required depending on the source of the funding and any requirements of the recipient party or entity. The Fiscal Agent shall be responsible for any necessary financial reporting under this MOU, including reports needed to comply with the terms of any grant agreement.

Section 3.03. Relationship of the Parties. In entering into this MOU, it is the intention of the Parties that this MOU shall not be construed to be an enforceable contract or agreement, but rather a statement of principles, and shall not be the basis for litigation between the parties or by any third party. This MOU is not intended to, and does not create, any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity, against any of the Parties or their agencies or officers or against any person.

Section 3.04 Relationship to Existing Plans, Ordinances, and Regulations. Although the IRWMP refers to many legally binding statutory and regulatory provisions—such as general plans, zoning ordinances, water quality plans, and various permits, licenses, and approvals— its purpose in doing so is to ensure that the IRWMP is consistent and compatible with those existing legal obligations. Rather than adding to or modifying the present legal and regulatory environment, the IRWMP is intended to streamline and improve the stakeholders' ability to operate and succeed within that environment.

<u>Exhibit A</u>: Upper Sacramento/McCloud/Lower Pit Region



Upper Sacramento, McCloud, Lower Pit IRWM Region

Exhibit B

MEMORANDUM OF UNDERSTANDING
CONFIRMATION AND SIGNATURE FOR APPROVAL

UPPER SACRAMENTO/MCCLOUD/LOWER PIT REGION
INTEGRATED REGIONAL WATER MANAGEMENT PLAN
REGIONAL WATER MANAGEMENT GROUP

This statement by the authorized official named below hereby confirms that the governing body of the identified agency or entity, on the date indicated, approved and agreed to be party to the Memorandum of Understanding (MOU) concerning the above referenced Integrated Regional Water Management program and the related Regional Water Management Group (RWMG). Signature via this confirmation form shall be incorporated by reference into said MOU as being signatory to the MOU provided that, when applicable, the RWMG has approved the necessary amendment of the MOU for addition of the new member pursuant to Section 2.10 of the MOU.

____
Agency or Entity Approving the MOU

____
Name of person initially appointed to represent
this entity on the RWMG

____
Name and Title of Authorized Official hereby
confirming approval of the MOU

____
Signature of Authorized Official

____
Date of Approval

MOU signature pages follow on next pages:

Exhibit B

**MEMORANDUM OF UNDERSTANDING
CONFIRMATION AND SIGNATURE FOR APPROVAL**

**UPPER SACRAMENTO/MCCLOUD/LOWER PIT REGION
INTEGRATED REGIONAL WATER MANAGEMENT PLAN
REGIONAL WATER MANAGEMENT GROUP**

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California Trout

Agency or Entity Approving the MOU

Meadow Fitton

Name of person initially appointed to represent this entity on the RWMG

Curtis Knight, Conservation Director

Name and Title of Authorized Official hereby confirming approval of the MOU

Signature of Authorized Official

10/3/2013

Date of Approval

Exhibit B

**MEMORANDUM OF UNDERSTANDING
CONFIRMATION AND SIGNATURE FOR APPROVAL**

**UPPER SACRAMENTO/MCCLOUD/LOWER PIT REGION
INTEGRATED REGIONAL WATER MANAGEMENT PLAN
REGIONAL WATER MANAGEMENT GROUP**

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City of Dunsmuir
Agency or Entity Approving the MOU

Brenda Bains
Name of person initially appointed to represent this entity on the RWMG

Brenda Bains / City Manager
Name and Title of Authorized Official hereby confirming approval of the MOU

Brenda Bains
Signature of Authorized Official

8/30/13
Date of Approval

Exhibit B

MEMORANDUM OF UNDERSTANDING
CONFIRMATION AND SIGNATURE FOR APPROVAL

UPPER SACRAMENTO/MCCLOUD/LOWER PIT REGION
INTEGRATED REGIONAL WATER MANAGEMENT PLAN
REGIONAL WATER MANAGEMENT GROUP

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City of Mt. Shasta
Agency or Entity Approving the MOU

Geoff Harkness
Name of person initially appointed to represent the entity on the RWMG

Theodore E. Marconi
Name and Title of Authorized Official hereby confirming approval of the MOU

Theodore E. Marconi
Signature of Authorized Official

August 12, 2013
Date of Approval

Exhibit B

MEMORANDUM OF UNDERSTANDING
CONFIRMATION AND SIGNATURE FOR APPROVAL

UPPER SACRAMENTO/MCCLOUD/LOWER PIT REGION
INTEGRATED REGIONAL WATER MANAGEMENT PLAN
REGIONAL WATER MANAGEMENT GROUP

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McCloud Community Services District
Agency or Entity Approving the MOU

Wayne Grigsby
Name of person initially appointed to represent the entity on the RWMG

Alan R. Schoenstein - Vice President of the Board
Name and Title of Authorized Official hereby confirming approval of the MOU

Signature of Authorized Official

9/25/13
Date of Approval

Exhibit B

**MEMORANDUM OF UNDERSTANDING
CONFIRMATION AND SIGNATURE FOR APPROVAL**

**UPPER SACRAMENTO/MCCLOUD/LOWER PIT REGION
INTEGRATED REGIONAL WATER MANAGEMENT PLAN
REGIONAL WATER MANAGEMENT GROUP**

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McCloud Watershed Council
____
Agency or Entity Approving the MOU

Angelina Cook
____
Name of person initially appointed to represent this entity on the RWMG

Debra Anderson, Board of Directors President
____
Name and Title of Authorized Official hereby confirming approval of the MOU

Debra Anderson
____
Signature of Authorized Official

9/26/13
____
Date of Approval

Exhibit B

**MEMORANDUM OF UNDERSTANDING
CONFIRMATION AND SIGNATURE FOR APPROVAL**

**UPPER SACRAMENTO/MCCLOUD/LOWER PIT REGION
INTEGRATED REGIONAL WATER MANAGEMENT PLAN
REGIONAL WATER MANAGEMENT GROUP**

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Medicine Lake Citizens for Quality Environment, Inc.
Agency or Entity Approving the MOU

Janie Painter
Name of person initially appointed to represent this entity on the RWMG
alternate: Diane Shockey

Janie Painter Executive Director
Name and Title of Authorized Official hereby confirming approval of the MOU

Janie Painter
Signature of Authorized Official

11-1-13
Date of Approval

Exhibit B

MEMORANDUM OF UNDERSTANDING
CONFIRMATION AND SIGNATURE FOR APPROVAL

UPPER SACRAMENTO/MCCLOUD/LOWER PIT REGION
INTEGRATED REGIONAL WATER MANAGEMENT PLAN
REGIONAL WATER MANAGEMENT GROUP

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The Modoc Nation
Agency or Entity Approving the MOU

Chief Jefferson Greywolf-Kelley / Jeff Kelley
Name of person initially appointed to represent this entity on the RWMG

Chief Jefferson Greywolf-Kelley / Jeff Kelley
Name and Title of Authorized Official hereby confirming approval of the MOU

Chief Jefferson Greywolf Kelley / Jeff Kelley
Signature of Authorized Official

10/5/2013
Date of Approval

Exhibit B

**MEMORANDUM OF UNDERSTANDING
CONFIRMATION AND SIGNATURE FOR APPROVAL**

**UPPER SACRAMENTO/MCCLOUD/LOWER PIT REGION
INTEGRATED REGIONAL WATER MANAGEMENT PLAN
REGIONAL WATER MANAGEMENT GROUP**

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Mount Shasta Bioregional Ecology Center
Agency or Entity Approving the MOU

Michelle Berditchevsky - Senior Conservation Consultant
Name of person initially appointed to represent
this entity on the RWMG

Richard Lucas President of the Board
Name and Title of Authorized Official hereby
confirming approval of the MOU

Signature of Authorized Official

10/8/13
Date of Approval

Exhibit B

**MEMORANDUM OF UNDERSTANDING
CONFIRMATION AND SIGNATURE FOR APPROVAL**

**UPPER SACRAMENTO/MCCLOUD/LOWER PIT REGION
INTEGRATED REGIONAL WATER MANAGEMENT PLAN
REGIONAL WATER MANAGEMENT GROUP**

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The Pacific Forest Trust, Inc.
Agency or Entity Approving the MOU

Megan Wargo
Name of person initially appointed to represent this entity on the RWMG

Laurie Wayburn, President
Name and Title of Authorized Official hereby confirming approval of the MOU

Signature of Authorized Official

9/30/13
Date of Approval

Exhibit B

MEMORANDUM OF UNDERSTANDING
CONFIRMATION AND SIGNATURE FOR APPROVAL

UPPER SACRAMENTO/MCCLOUD/LOWER PIT REGION
INTEGRATED REGIONAL WATER MANAGEMENT PLAN
REGIONAL WATER MANAGEMENT GROUP

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The River Exchange
Agency or Entity Approving the MOU

Phil Detrich
Name of person initially appointed to represent this entity on the RWMG

Phil Detrich, President, The River Exchange
Name and Title of Authorized Official hereby confirming approval of the MOU

Signature of Authorized Official

October 14, 2013
Date of Approval

Exhibit B

MEMORANDUM OF UNDERSTANDING
CONFIRMATION AND SIGNATURE FOR APPROVAL

UPPER SACRAMENTO/MCCLOUD/LOWER PIT REGION
INTEGRATED REGIONAL WATER MANAGEMENT PLAN
REGIONAL WATER MANAGEMENT GROUP

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Siskiyou Land Trust

Agency or Entity Approving the MOU

Kathleen Hitt, Conservation Director

Name of person initially appointed to represent this entity on the RWMG

Sam Baxter, President

Name and Title of Authorized Official hereby confirming approval of the MOU

Signature of Authorized Official

10/8/2013

Date of Approval

Exhibit B

**MEMORANDUM OF UNDERSTANDING
CONFIRMATION AND SIGNATURE FOR APPROVAL**

**UPPER SACRAMENTO/MCCLOUD/LOWER PIT REGION
INTEGRATED REGIONAL WATER MANAGEMENT PLAN
REGIONAL WATER MANAGEMENT GROUP**

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Winnemem Wintu Tribe
____
Agency or Entity Approving the MOU

Mark Miyoshi, Primary and Luisa Navejas, Alternate
Mt. Shasta District Representatives and Water Advisors, Winnemem Wintu Tribe
____
Name of person initially appointed to represent
this entity on the RWMG

Caleen Sisk, Chief and Spiritual Leader, Winnemem Wintu Tribe
____
Name and Title of Authorized Official hereby
confirming approval of the MOU

Caleen Sisk
____
Signature of Authorized Official

October 27, 2013
____
Date of Approval

Exhibit B

**MEMORANDUM OF UNDERSTANDING
CONFIRMATION AND SIGNATURE FOR APPROVAL**

**UPPER SACRAMENTO/MCCLOUD/LOWER PIT REGION
INTEGRATED REGIONAL WATER MANAGEMENT PLAN
REGIONAL WATER MANAGEMENT GROUP**

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Western Shasta Resource Conservation

Agency or Entity Approving the MOU

Leslie Bryan, Watershed/Climate Stewardship Coordinator

Name of person initially appointed to represent this entity on the RWMG

David DeMar, District Manager

Name and Title of Authorized Official hereby confirming approval of the MOU

Signature of Authorized Official

October 23, 2013

Date of Approval

Exhibit B

MEMORANDUM OF UNDERSTANDING
CONFIRMATION AND SIGNATURE FOR APPROVAL

UPPER SACRAMENTO/MCCLOUD/LOWER PIT REGION
INTEGRATED REGIONAL WATER MANAGEMENT PLAN
REGIONAL WATER MANAGEMENT GROUP

This statement by the authorized official named below hereby confirms that the governing body of the identified agency or entity, on the date indicated, approved and agreed to be party to the Memorandum of Understanding (MOU) concerning the above referenced Integrated Regional Water Management program and the related Regional Water Management Group (RWMG). The MOU is approved and agreed upon to the extent that it is consistent with the "Pit River Tribal Statement of Principles for Resources Protection", Resolution Number 12-45-12, dated December 28, 2012 as well as the "Pit River Tribal Water Resolution Protecting our Sacred Water Rights", Resolution Number 13-04-01, dated April 16, 2013. The Pit River Tribe's cultural and spiritual values to protect water and water resources within ancestral lands are understood and incorporated as the current policy and law of the Pit River Tribe. The Pit River Tribe's participation in the MOU concerning the RWMG will be consistent with the above mentioned and attached resolutions to this Exhibit B. Signature via this confirmation form shall be incorporated by reference into said MOU as being signatory to the MOU provided that, when applicable, the RWMG has approved the necessary amendment of the MOU for addition of the new member pursuant to Section 2.10 of the MOU.

Dolores A. Raglin

Dolores Raglin, Chairman Pit River Tribe

Vernon Ward Jr.

Vernon Ward, Pit River Tribe RWMG Representative

____

Name and Title of Authorized Official herebyconfirming approval of the MOU

____

Signature of Authorized Official

____

Date of Approval

DOLORES RAGLIN
TRIBAL CHAIRMAN

CORINA LEGO
TRIBAL VICE-CHAIR

IDA RIGGINS
TRIBAL SECRETARY

PIT RIVER TRIBE

PIT RIVER TRIBE
36970 Park Ave.
Burney, CA. 96013

Telephone 530-335-5421
Fax No: 530-335-3140

ELEVEN AUTONOMOUS BANDS

ITSATAWI | HEWISEDAWI | ASTARIWI | ILLMAWI | ATSUGEWI | KOSEALEKTE | APORIGE | HAMMAWI | AJUMAWI | MADESI

RESOLUTION NO: **13-04-01**
DATE: **April 16, 2013**

SUBJECT: **Pit River Tribal Water Resolution Protecting our Sacred Water Rights;**

WHEREAS: The Pit River Tribe of California (Includes the XL Ranch, Big Bend, Likely, Lookout, Montgomery Creek and Roaring Creek Rancheria) is a federally recognized Indian tribe organized under Section 16 of the Indian Reorganization Act of June 18, 1934 (48 Stat. 984), codified at 25 U.S.C. 476, et seq., as amended, by the Act of June 15, 1935 (49 Stat. 378); AND

WHEREAS: The Pit River Tribe of California ("Tribe") is a federally recognized Tribe composed of eleven autonomous bands located in Northeastern California, since time immemorial, they are as follows: 1) Atwamsini, 2) Atsugewi, 3) Astarawi, 4) Aporige, 5) Ajumawi, 6) Hewisedawi, 7) Illmawi, 8) Itsatawi, 9) Kosealekte, 10) Hammawi, and 11) Madesi; AND

WHEREAS: The tribe is represented and governed by the Pit River Tribal council, a body who is duly elected under the Constitution of the Pit River Tribe, : adopted on Sunday August 16, 1987 and formally approved by the Assistant Secretary of Interior of Indian Affairs on Thursday December 3, 1987, as amended, AND

WHEREAS: The Pit River Tribal Council is empowered by Article VII of the Constitution to enact all ordinances and resolutions which shall be necessary and proper for carrying into effect the Council's powers and responsibility, including, but not limited to contract with Federal, State, Counties, and Tribal Governments, private enterprises, individuals and organizations, AND

WHEREAS: The essential nature of water has generated societal protections to serve the greater and common good, as expressed throughout history in sources including and not limited to: Public Trust Doctrine; access to safe drinking water and sanitation, as a basic human right, is addressed internationally through several United Nation (UN) Resolutions including UN Human Rights Council Resolution 15/9, Human Rights and Access to Safe Drinking Water and Sanitation (2010, recognized by the United States); UN Declaration on the Rights of Indigenous Peoples (2010, Endorsed by the United States); in California, Assembly Bill (AB) 685 established state policy "that every human being has the right to clean, safe, affordable and accessible water adequate for human consumption, cooking and sanitary purposes" and that this policy is to be considered by all relevant State agencies, AND

ATWAMSINI

Resolution No: 13-04-01
Date: April 16, 2013
Subject: Water Resolution

WHEREAS: Government –to-Government consultation with Federal, State and County governments is established and assured by laws, regulations, policies, and executive orders s such as; Public Law 93-638, Indian Self Determination and Education Assistance Act of 1975, (State) Executive Order B-10-11 (2011), California Natural Resources Agency Tribal Consultation Policy (2012); U.S. Constitution, "Indian Commerce Clause"; Article I, Section 8, Clause 3, Executive Order 13007, Executive Order 13175, California on Indian Sacred Sites, Executive Order 12898 on Environmental Justice, the American Indian Freedom of Religion Act, the National Environmental Policy Act, the National Historic Preservation Act the Native American Graves Protection and Repatriation Act, the Endangered Species Act, the Clean Water Act, California Environmental Quality Act, Senate Bill 18, and the National Register Bulletin 38 on Traditional Cultural Properties. The Council invokes the United States Government's Trust Responsibility to the Indian Peoples of this land. and the repeated promise of good will by the United States Government, AND

WHEREAS: the Council unanimously adopted a resolution on March 29th, 2012 affirming the United Nations Declaration on the Rights of Indigenous Peoples adopted by the UN General Assembly in 2007 and also endorsed by the United States on December 10, 2010. AND

WHEREAS: the United Nations Declaration on the Rights of Indigenous Peoples is the minimum standard for the dignity, survival and well-being of Indigenous Peoples and recognizes the rights of Indigenous Peoples pertaining to cultural practices, (Article 11), access to and protection of sacred sites (Article 12), spiritual relationship with traditional lands and waters (Article 25), environmental protection (Article 29) and Free prior and

Resolution No: 13-04-01
Date: April 16, 2013
Subject: Water Resolution

Informed Consent regarding development projects (Article 29) among a number of other relevant provisions. AND

WHEREAS: the Pit River Tribe and communities predate the formation of the State of California; many California Native American Tribes have and continue to co-exist with the environment and sustainability steward the lands, ***waters*** and resources on Tribal Lands and aboriginal areas, applying traditional ecological knowledge. AND

WHEREAS: Pit River Tribe has enforceable inherent right to treatment of state and cultural beneficial use to our Pit River watershed. Pit River Tribe assumes jurisdiction and authority for oversight and management of our waterways and resources within the ancestral boundary of it's 100 mile square. AND

NOW THEREFORE BE IT RESOLVED: That the Pit River Tribal Council invoke these statutes, Declarations, Resolutions, decrees and Conventions and reaffirms its strong opposition to any and all threats to our sacred water ways of life and development projects that will impact the Pit River Tribe within our Ancestral Boundaries. AND

BE IT FURTHER RESOLVED: that Water is essential to all life and has shaped, and continues to shape, human existence. Water supplies and water quality are inextricably linked to the conditions of associated watersheds and ecosystems, and are further affected by land uses. Water supplies and water qualities are inextricably linked to Pit River Tribal's spiritual, cultural, subsistence and traditional life ways and practices. AND

BE IT FURTHER RESOLVED: that the sacred responsibility to maintain the health and integrity of future generations is also a central element of Pit River Peoples' spirituality, traditional ceremonial practices, religious expressions and ceremonial practices.

Resolution No: 13-04-01
Date: April 16, 2013
Subject: Water Resolution

C-E-R-T-I-F-I-C-A-T-I-O-N

I, the under-signed Tribal Chairperson, Dolores Raglin of the Pit River Tribe, do hereby certify the Pit River Tribal Council is composed of eleven autonomous bands of which 9 were present, constituting a quorum at a regular scheduled, noticed, convened and held meeting this 16 day of april. 2013, and the resolution was adopted by a vote of 8 yes 1 no 0 abstaining, and that said resolution has not been rescinded in any way.

Dolores Ragl
Tribal Chairperson, Dolores Raglin

04.16.13
Date

Ida Riggins
Tribal Secretary, Ida Riggins

April 16, 2013
Date

Tribal Council Member Signatures:

Precious Wilson — 4-16-13 Date

4.16.13 Date

4/16/13 Date

4/16/13 Date

4/16/13 Date

Randy Quinn — 4.16.13 Date

Aaron Ward — 4-16-13 Date

4-16.13 Date

Date

Date

Date

DOLORES RAGLIN
TRIBAL CHAIRMAN

CORINA LEGO
TRIBAL VICE-CHAIR

IDA RIGGINS
TRIBAL SECRETARY

PIT RIVER TRIBE
36970 Park Ave.
Burney, CA. 96013

Telephone 530-335-5421
Fax No: 530-335-3140

ELEVEN AUTONOMOUS BANDS

ITSATAWI HEWISEDAWI

RESOLUTION NO: 12-45-12

DATE: December 28, 2012

SUBJECT: **Pit River Tribal Statement of Principles for Resources Protection**

WHEREAS: The Pit River Tribe is a federally recognized Tribe composed of eleven autonomous bands located in Northeastern California since time immemorial, AND;

ASTARIWI ILLMAWI

WHEREAS: The Pit River Tribe is governed by the Pit River Tribal Council, the body duly Constituted and elected under the Constitution of the Pit River Tribe adopted August 15, 1987 and approved by the Assistant Secretary of the Interior for Indian Affairs on December 3, 1987, AND;

WHEREAS: The Pit River Tribal Council is empowered by Article VII of the Constitution to enact all ordinances and resolutions which shall be necessary and proper for carrying into effect the Council's powers and responsibilities, contract with federal, state, and Tribal government, private enterprises, individuals and organizations, AND;

WHEREAS: The Pit River Tribe has the authority to charter and regulate independent organizations, subordinate organizations, committee and boards of officials of the Tribe and delegate powers, AND;

ATSUGEWI KOSEALEKTE

WHEREAS: The Pit River Tribe has inherent sovereign governmental powers to protect and promote the health, safety, and/or general welfare of the people of the Pit River Tribe, AND;

WHEREAS: Government-to-government consultation with Federal, State, and County governments is established and assured by laws, regulations, policies, and executive orders such as; the National Environmental Policy Act, the National Historic Preservation Act, the Native American Graves Protection and Repatriation Act, Executive Order 13007, Executive Order 13175, California Environmental Quality Act, Senate Bill 18, etc. prior to the implementation of activities within Pit River Ancestral lands.

APORIGE HAMMAWI

WHEREAS: Natural and Cultural resources as well as the Pit River people are indistinguishable within the harmony of the Pit River world.

NOW, THEREFORE BE IT RESOLVED: that the Pit River Tribe through this statement of principles supports the protection of natural and cultural resources within its defined ancestral lands.

Pit River Tribe Statement of Principles for Resources Protection:

AJUMAWI MADESI

1. Pit River Ancestral lands shall be managed with respect and care, minimizing damage to the Tribe's sacred resources.

ATWAMSINI

Resolution No: 12-45-12
Date: December 28, 2012
Subject: Pit River Tribal Statement of Principles for Resources Protection

SUBJECT: Pit River Tribal Statement of Principles for Resources Protection

2. Meaningful involvement of the Tribal Council, Band Elders, and Band Cultural representatives is essential in the development of management prescriptions and measures necessary to both implement developments and restore the Pit River environment.
3. Projects within the Pit River Ancestral Lands should be monitored by approved Pit River Band cultural monitors. Agencies and developers should plan for funding the costs of monitoring.
4. Agencies and developers working within Pit River Ancestral lands must commit to effective restoration of the environment and respectful use of its gifts, with an eye to sustaining resources for future generations.

C-E-R-T-I-F-I-C-A-T-I-O-N

I, the under-signed Tribal Chairperson, Dolores Raglin of the Pit River Tribe, do hereby certify the Pit River Tribal Council is composed of eleven autonomous bands of which 8 were present, constituting a quorum at a regular scheduled, noticed, convened and held meeting this 28 day of December 2012, and the resolution was adopted by a vote of 8 yes 0 no 0 abstaining, and that said resolution has not been rescinded in any way.

Dolores A Raglin — 1.25.13
Tribal Chairperson, Dolores Raglin — Date

Ida Riggins — 1.25.13
Tribal Secretary, Ida Riggins — Date

Tribal Council Member Signatures:

Anna Barnes — 12/28/12
Date
Vernon Ward — 12-28-12
Date
Randy Quinn — 12.28.12
Date
12.28.12
Date
12-28-12
Date
12-28-12
Date
12.28.2012.

Resolution No: 12-45-12
Date: December 28, 2012
Subject: Pit River Tribal Statement of Principles for Resources Protection

	Date 1-25-13
	Date
	Date
	Date
	Date

Exhibit B

**MEMORANDUM OF UNDERSTANDING
CONFIRMATION AND SIGNATURE FOR APPROVAL**

**UPPER SACRAMENTO/MCCLOUD/LOWER PIT REGION
INTEGRATED REGIONAL WATER MANAGEMENT PLAN
REGIONAL WATER MANAGEMENT GROUP**

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Trout Unlimited
Agency or Entity Approving the MOU

Robert Blankenship
Name of person initially appointed to represent this entity on the RWMG

George Sutherland - Project Coord.
Name and Title of Authorized Official hereby confirming approval of the MOU

G Sutherland
Signature of Authorized Official

11/22/13
Date of Approval

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Appendix D: IRWMP Adoption Resolutions

NOTE: The resolution and signatures of the USR Regional Water Management Group (RWMG) adoption are on the following pages, and are immediately followed by individual organizations' adoption resolutions, as they are signed and available. For the most up-to-date list of adoptees, please contact the RWMG directly.

Upper Sacramento, McCloud, and Lower Pit Rivers IRWMP Region (USR) Regional Water Management Group (RWMG)

RESOLUTION NO. 2013-01

A Resolution of the USR RWMG to Adopt the USR Integrated Regional Water Management Plan (IRWMP)

WHEREAS, the USR is an IRWMP region comprised of hydrologic areas that include the Upper Sacramento, McCloud, and Lower Pit River watersheds, terminating at the high water mark of Shasta Lake Reservoir, and which also includes the Medicine Lake Highlands; and

WHEREAS, it is understood that the integrated regional water management plan (IRWMP) program offers opportunities to help communities and organizations in the USR address long-term needs related to water supply, water quality, flood management, ecosystem protection and enhancement, sustainable employment and economy, and recreation, and RWMG members see the adoption of this IRWMP as a vehicle for these opportunities; and

WHEREAS, the River Exchange, on behalf of the USR, received approval from the California Department of Water Resources (DWR) for designation of the IRWMP region and later, with the support of diverse in-region interests, applied for and received a grant funded by the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 (Proposition 84) to prepare an IRWMP; and

WHEREAS, various stakeholders in this IRWMP region met multiple times in the period of 2011-2013 to provide input for development of the IRWMP and formation of the RWMG; and

WHEREAS, pursuant to the California Water Code, the USR RWMG was established through a memorandum of understanding to coordinate and complete the IRWMP for the USR planning area; and

WHEREAS, it is understood that adoption of the USR IRWMP in no way commits the RWMG as a whole or individual signatories to supporting or implementing provisions of the California Water Plan or other DWR policies; and

WHEREAS, approval of this IRWMP does not relieve the RWMG or any signatory of responsibilities, and establishes no new authorities, under existing statutes or regulations; and

WHEREAS, the USR IRWM plan is a living document, with defined processes for updating plan components and projects; and

WHEREAS, a public meeting pursuant to the California Water Code was held by the RWMG on November 25, 2013, in Mt. Shasta, California, to consider adoption of the USR IRWMP.

NOW THEREFORE BE IT RESOLVED THAT the RWMG so finds and determines that the facts contained in the recitals above are true and correct.

FURTHER, BE IT RESOLVED THAT the USR RWMG hereby adopts the USR IRWM plan and authorizes it for submittal to the DWR.

PASSED AND ADOPTED THIS 25th DAY OF NOVEMBER, 2013, BY THE MEMBERS OF THE USR RWMG.

SIGNED AND ATTESTED:

Brenda Bains — 11/26/13

Coordinating Council Representative: Statutory Authorities — DATE
Brenda Bains, City Manager, City of Dunsmuir

Mark Miyoshi — 11-25-13

Coordinating Council Representative: Tribal Authorities — DATE
Mark Miyoshi, Representative, Winnemem Wintu Tribe

Kathleen Hitt — 11/25/13

Coordinating Council Representative: Resource Management Interests — DATE
Kathleen Hitt, Executive Director, Siskiyou Land Trust

Medicine Lake Citizens for Quality Environment

resolution #1213

A resolution for Individual Member Adoption of the Upper Sacramento, McCloud, and Lower Pit Region (USR) Integrated Regional Water Management Plan (IRWMP)

WHEREAS, the USR is an IRWMP region comprised of hydrologic areas that include the Upper Sacramento, McCloud, and Lower Pit River watersheds, terminating at the high water mark of Shasta Lake Reservoir, and which also includes the Medicine Lake Highlands; and

WHEREAS, it is understood that the integrated regional water management plan (IRWMP) program offers opportunities to help communities and organizations in the USR address long-term needs related to water supply, water quality, flood management, ecosystem protection and enhancement, sustainable employment and economy, and recreation, and RWMG members see the adoption of this IRWMP as a vehicle for these opportunities; and

WHEREAS, the River Exchange, on behalf of the USR, received approval from the California Department of Water Resources (DWR) for designation of the IRWMP region and later, with the support of diverse in-region interests, applied for and received a grant funded by the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 (Proposition 84) to prepare an IRWMP; and

WHEREAS, pursuant to the California Water Code, the USR Regional Water Management Group (RWMG) was established through a memorandum of understanding to coordinate and complete the IRWMP for the USR planning area; and

WHEREAS, the USR RWMG's diverse membership, including public agencies, water providers, agriculture, business, residential water users, community, recreation, and environmental organizations and tribal interests have jointly developed this IRWMP and met multiple times in the period of 2011-2013 to provide input for development of the IRWMP and formation of the RWMG; and

WHEREAS, it is understood that adoption of the USR IRWMP in no way commits the RWMG as a whole or individual signatories to supporting or implementing provisions of the California Water Plan or other DWR policies; and

WHEREAS, approval of this IRWMP does not relieve the RWMG or any signatory of responsibilities, and establishes no new authorities, under existing statutes or regulations; and

WHEREAS, the USR IRWM plan is a living document, with defined processes for updating plan components and projects, and serves as a voluntary planning document that identifies broadly supported objectives for enhancing beneficial uses of water in the USR; and

WHEREAS, an integrated regional approach to water management will streamline individual efforts and increase efficiencies: the USR IRWMP will also increase partnership, collaboration and organizational capacity, and collaborative management will provide a forum for stakeholder input and support for projects that address the common goals and objectives for the USR; and

USR Resolution for Individual Entity Adoption

WHEREAS, a public meeting pursuant to the California Water Code was held by the RWMG on November 25, 2013, in Mt. Shasta, California, to consider adoption of the USR IRWMP by the RWMG as a whole, and the document was adopted by a unanimous vote; and

WHEREAS, Medicine Lake Citizens for Quality Environment representatives have engaged in good faith negotiations with other stakeholders in the region and have briefed its Board and/or leaders, and realize that the IRWMP will not be a legally binding document, but rather a regional compact with commitments to work together as a region to implement the plan; and

Whereas, the IRWMP will be a living document, reviewed and updated over time, and individual entities/signatories can remain involved or terminate their involvement at any time.

THEREFORE BE IT RESOLVED, that Medicine Lake Citizens for Quality Environment hereby adopts the USR IRWMP as a voluntary document that provides broadly supported, identified goals, objectives, strategies, and projects to meet the integrated water needs of the people and the rivers of the Upper Sacramento, McCloud, and Lower Pit region now and into the future.

Janie Painter 12-30-2013

NAME: Janie Painter DATE SIGNED
TITLE: Director
ORGANIZATION: Medicine Lake Citizens for Quality Environment

The Modoc Nation P.O. Box 506 Independence, OR. 97351

The Modoc Nation

Resolution 2013-019

A resolution for Individual Member Adoption of the Upper Sacramento, McCloud, and Lower Pit Region (USR) Integrated Regional Water Management Plan (IRWMP)

WHEREAS, the USR is an IRWMP region comprised of hydrologic areas that include the Upper Sacramento, McCloud, and Lower Pit River watersheds, terminating at the high water mark of Shasta Lake Reservoir, and which also includes the Medicine Lake Highlands; and

WHEREAS, it is understood that the integrated regional water management plan (IRWMP) program offers opportunities to help communities and organizations in the USR address long-term needs related to water supply, water quality, flood management, ecosystem protection and enhancement, sustainable employment and economy, and recreation, and RWMG members see the adoption of this IRWMP as a vehicle for these opportunities; and

WHEREAS, the River Exchange, on behalf of the USR, received approval from the California Department of Water Resources (DWR) for designation of the IRWMP region and later, with the support of diverse in-region interests, applied for and received a grant funded by the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 (Proposition 84) to prepare an IRWMP; and

WHEREAS, pursuant to the California Water Code, the USR Regional Water Management Group (RWMG) was established through a memorandum of understanding to coordinate and complete the IRWMP for the USR planning area; and

WHEREAS, the USR RWMG's diverse membership, including public agencies, water providers, agriculture, business, residential water users, community, recreation, and environmental organizations and tribal interests have jointly developed this IRWMP and met multiple times in the period of 2011-2013 to provide input for development of the IRWMP and formation of the RWMG; and

WHEREAS, it is understood that adoption of the USR IRWMP in no way commits the RWMG as a whole or individual signatories to supporting or implementing provisions of the California Water Plan or other DWR policies; and

WHEREAS, approval of this IRWMP does not relieve the RWMG or any signatory of responsibilities, and establishes no new authorities, under existing statutes or regulations; and

WHEREAS, the USR IRWM plan is a living document, with defined processes for updating plan components and projects, and serves as a voluntary planning document that identifies broadly supported objectives for enhancing beneficial uses of water in the USR; and

The Modoc Nation P.O. Box 506 Independence, OR. 97351

The Modoc Nation

Resolution 2013-019

WHEREAS, an integrated regional approach to water management will streamline individual efforts and increase efficiencies: the USR IRWMP will also increase partnership, collaboration and organizational capacity, and collaborative management will provide a forum for stakeholder input and support for projects that address the common goals and objectives for the USR; and

WHEREAS, a public meeting pursuant to the California Water Code was held by the RWMG on November 25, 2013, in Mt. Shasta, California, to consider adoption of the USR IRWMP by the RWMG as a whole, and the document was adopted by a unanimous vote; and

WHEREAS, _The Modoc Nation____ representatives have engaged in good faith negotiations with other stakeholders in the region and have briefed its Board and/or leaders, and realize that the IRWMP will not be a legally binding document, but rather a regional compact with commitments to work together as a region to implement the plan; and

Whereas, the IRWMP will be a living document, reviewed and updated over time, and individual entities/signatories can remain involved or terminate their involvement at any time.

BE IT THE RESOLUTION OF THE MODOC NATION that it hereby adopts the USR IRWMP as a voluntary document that provides broadly supported, identified goals, objectives, strategies, and projects to meet the integrated water needs of the people and the rivers of the Upper Sacramento, McCloud, and Lower Pit region now and into the future.

ISSUED this 31st day of December 2013

Cody Plath, Speaker of the Council	Dorothy Carnes, Chairperson Council of Elders

APPROVED this 31st day of December, 2013

Chief Jefferson Greywolf Kelley

Chief Jefferson Greywolf-Kelley
Chief of The Modoc Nation

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Appendix E: USR Project Application Templates

The USR project application process included several stages of materials and development. These are discussed in Chapter 10 (Project Review Process and Implementation). Below are copied both the main project application (containing all of DWR's review criteria), and the templates designed for the work plan, schedule, budget, and greenhouse gas assessment.

Project Application:

INITIAL PROJECT APPLICATION
PLEASE READ THIS PAGE!

As discussed at the February 2013 RWMG meeting, the IRWMP team is seeking input from RWMG members regarding potential projects. Recognizing that project proponents may not yet have all of the information to complete this section, at a minimum please complete the first page.

If you don't have information beyond this, your project may be submitted as "conceptual" to the RWMG for inclusion in the IRWMP. Conceptual projects are welcome as a kind of "food for thought" or "incubator" project; these projects are not likely to be put at the front of the line for funding, but may be integrated into other projects as appropriate. If you'd like for your project to be considered for the next round of IRWM implementation funding (projected spring/summer of 2014), you'll need to complete the balance of this application to the best of your ability.

IMPORTANT: Please fill all of your information into this form, and save it with the following file name format: PROJECT-NAME_ SPONSOR_app. For example, a file name might be: MEADOW-RESTORATION_ XYZ-WATERSHED-GROUP_ app. The file name formats for the attachments are included in the table in Section C, on the last page of this document. Please use a consistent project name for all of the files associated with that project.

PROCESS and CRITICAL DATES:
The anticipated timeline for submittal and review of the initial project submittals is as follows:
Integration workshop to be scheduled for early May (e-mail coming soon) – all project sponsors are encouraged to attend
Project applications (this document; attachments are due later – see #6, below) uploaded via the website or emailed to the project team (mail@riverexchange.org) no later than May 23rd – this is a hard deadline
While conceptual projects may be submitted at any time, we encourage you to submit them by May 23rd to guarantee that they be considered for inclusion in the IRWMP
Applications reviewed by the project team; follow-up questions for clarification, etcetera, may occur (please make sure your contact information is correct!)
Financing workshop to be scheduled for June 6th – project sponsors with ready-to-proceed projects are encouraged to attend, as well as any other interested parties
Cost/benefit workshop scheduled for June; cost/benefit ratios and backup calculations are due no later than two weeks following the workshop

Attachment templates (budget, work plan, schedule, greenhouse gas calculations) are due no later than July 15th to the project team (mail@riverexchange.org) – this is a hard deadline

CRITICAL CONSIDERATIONS:
Submitting a project to this review and development process does not mean that it will definitely be included in the IRWMP. Inclusion in the IRWMP, and relevant ranking and prioritization discussions, must be made by the RWMG. This will happen later in the process.
Inclusion in the IRWMP does not mean a certainty of project funding. However, a project seeking proposition 84 funds from the State of California must be included in the IRWMP to be considered.
All projects at any level of readiness are welcome to be submitted for inclusion in the IRWMP. While conceptual projects may not be ready for immediate implementation (and therefore will be difficult to fund), having a better understanding of the needs and desires in the region will contribute to a better suite of projects and a stronger overall IRWMP.
It is imperative that project sponsors consider the elements of the IRWMP when developing their projects. Projects that better implement the IRWMP (address identified issues, resource management strategies, and objectives) have a better chance of being funded down the road.

SECTION A – GENERAL PROJECT INFORMATION

All project sponsors interested in being included in the IRWMP must fill out the table below. If your project is conceptual only (i.e.: NOT ready to compete for grant funds immediately and missing a key component, such as a detailed work plan or budget), you ONLY need to fill out this page. If you'd like your project to be considered for the next round of IRWM funding (projected spring/summer of 2014), you'll need to fill out the entire application to the best of your ability. Members of the project team will follow up with any clarifying questions they may have.

Project Name ______________________________
Project Sponsor ______________________________
Address ______________ City ______________ State ______ Zip ______
Phone ______________ Fax ______________
e-mail ______________ Entity Type (Municipal, NGO…)
Name/Title of Project Contact ______________________________
Contact's Address ______________ City ______________ State ______ Zip ______
Contact's Phone Contact Fax E-mail Address

Project Type. Check all that apply (check at least 1)	
☐ Municipal Infrastructure	☐ Habitat Restoration
☐ Forest Management	☐ Flood Control
☐	☐
☐	☐
☐ Other…	

Project Executive Summary (no more than 250 words)

SECTION B – DWR REQUIRED PROJECT REVIEW FACTORS

In the sections below, please respond to the identified project review factors (no more than 250 words per section). Each of these is taken directly from the DWR Guidelines. You may use the reference document provided to get more information on each factor, below.

After you submit this application, the project team will review it and follow up with clarifying questions.

The projects will be brought to the RWMG for review and discussion in June. Note that submittal of an application does not mean immediate inclusion in the IRWMP; this must be decided by the RWMG members. You must adopt the final IRWMP to have a project included in it.

IRWMP objectives: How does the project support achievement of IRWM Plan Objectives? List each objective met and describe how the objective is applicable.

Resource Management Strategies (RMS): How is the project related to the RMS? List the strategies used and how each is used in your project.

Technical feasibility: Technical feasibility is related to the knowledge of the project location; knowledge of the water system at the project location; or with the material, methods, or processes proposed to be employed in the project. Provide information supporting your knowledge and experience in implementing a project of this type.

Specific benefits to critical disadvantaged community (DAC) water issues: Critical water issues include those directly related to adequate water supply and quality – this includes issues of health and safety and of adequate human supply in times of drought. Projects addressing these needs for a DAC may include studies and design.

Specific benefits to critical Native American water issues[31]: Critical water issues include those directly related to adequate water supply and quality – this includes issues of health and safety and of adequate human supply in times of drought. Projects addressing these needs for a tribe may include studies and design.

Environmental Justice (EJ) considerations: Your project review process must include a consideration of EJ issues. These include both inequitable distribution of project impacts (i.e.: noise, pollution, etcetera), and equitable access to environmental goods and project benefits (i.e.: parks, clean water and air, etcetera). Please describe this consideration process below.

Project costs and financing: Please fill in Attachment 1 and take the numbers directly from that spreadsheet for this section. Note that Attachment 1 includes 4 worksheets: 1) a summary budget that will be filled based on

[31] Note that this is DWR's definition of "critical water issues." The project team is aware that there is more to traditional indigenous' people's relationship with water than simply quantity and quality. While DWR will not use this information to rank your project (if submitted for funding), we encourage you to include text here that describes a more generous definition of the term.

your work in sheet 2; 2) a detail budget including hourly rates and hours estimates for each task and individual involved, as well as direct costs; 3) a worksheet for calculating direct costs (this won't be necessary for all projects, but if used, please enter that information directly into the direct cost column (column P) of the hourly worksheet; and 4) a worksheet for indicating the source(s) of project funds.
Total estimated project cost (include cost share AND funding request):
Total un-funded to date (project need/funding request):
Please describe secured funding sources as shown in the second worksheet in Attachment 1A
How operations and maintenance will be covered:

Economic feasibility:
Economic analysis – cost/benefit ratio (this may be filled in after the workshop in June 2013):

Project status:
☐ Conceptual
☐ Ready to proceed pending permitting
☐ Ready to proceed pending financing
☐ Ready to proceed: the project could be implemented tomorrow if you received the funds today

Provide justification for status:
Provide work plan and schedule in Attachment 2 and 3.

Strategic considerations for IRWMP implementation: Please provide a description below, and consider the following questions:
Has this project been integrated with another or include additional aspects because of IRWM conversations?
Has this project scope and/or geography been widened because of IRWM conversations?
If "no" to either or both of the above questions, please explain why it makes sense for this project to go forward as-is, without integration on an issue- or geographic-level.

Describe your strategy for project integration and relevance to the IRWMP:

Contribution of the project in adapting to effects of climate change: Climate change is projected to bring with it more variability in precipitation, generally warmer temperatures (resulting in less snowpack into the summer), and a greater occurrence of catastrophic events (fires, floods, windstorms, etcetera). Please describe below how your project provides the region some adaptive capacity.

Contribution of the project in reducing greenhouse gas (GHG) emissions: DWR requires that the IRWMP span a 20-year planning horizon. California has put forward many mitigation plans (see www.caladapt.org).
Please describe how your project (the preferred alternative, if applicable) can help the state in meeting its reduced GHG emissions targets:
What is your project's estimated annual emissions (please use Attachment 4 to calculate these):

SECTION C – ATTACHMENTS

These have been provided as separate documents from this application; please fill out as appropriate and save as indicated below. It's very important that you consistently use the same file name so that the project team is able to track the materials submitted on behalf of your project(s).

	Attachment	File Name Format
1	Project Budget (4 worksheets in the single workbook)	PROJECT-NAME_SPONSOR_budget
2	Project Work Plan	PROJECT-NAME_SPONSOR_wkpln
3	Project Schedule	PROJECT-NAME_SPONSOR_sched
4	Greenhouse Gas Emissions Worksheet	PROJECT-NAME_SPONSOR_ghg

Work Plan Template

PROJECT NAME:
Project sponsor (organization):
Contact person:
Phone number:
E-mail address:

Total project budget: $
Grant Share: $
Cost Share: $

WORK PLAN TASKS
NOTE: the task titles are supplied as a sample consideration. Feel free to change them or add to them. Please LEAVE the CATEGORIES: they are there to organize the work plan similarly to how the budget is organized; please fill in your budget corresponding with these tasks and categories.
Also, ensure that each of the tasks and subtasks identified here is also identified in your project schedule (attachment 3).

Category (a): Direct Project Administration
The total budget for this task is $
Grant Share: $
Cost Share: $

Task 1: Direct Project Administration
Description

Subtask 1.1: Administration and Management
Description

Deliverables:

Subtask 1.2: Labor Compliance
Description: (This is often a policy that entities already have in place)

Deliverables:

Subtask 1.3: Reporting

Description: (Including monthly or quarterly progress reports, invoices, final reports, and post completion reports)

Deliverables:

Subtask 1.4: Coordination with partner agencies and organizations

Description: (procedures by which the applicant will coordinate with its partner agencies and organizations that may receive funding from the grant including any contracts, memorandums of understanding (MOUs), and other formal agreements)

Deliverables:

Category (b): Land Purchase/Easement

The total budget for this task is $
Grant Share: $
Cost Share: $

Task 2: Property / ROW / Easement Acquisition

Description

Subtask 2.1: SAMPLE [Property - Negotiation and Legal]

Description

Deliverables:

Subtask 2.2: SAMPLE [Property – Boundary Survey]

Description

Deliverable:

Category (c): Planning/Design/Engineering/Environmental Documentation

The total budget for this task is $
Grant Share: $
Cost Share: $

Task 3: Preliminary Project Development

Description

Subtask 3.1: SAMPLE [Preliminary Investigations (Geotechnical, Biological, GW monitoring, etc.)]
Description

Deliverables:

Task 4: Project Design and Permitting
Description

Subtask 4.1: SAMPLE [Project Design]
Description

Deliverables:

Category (d): Construction/Implementation
The total budget for this task is $
Grant Share: $
Cost Share: $

Description of construction, health and safety, and laboratory standards/classification methods that will be used in implementation.

Task 5: Pre-Construction Contracting
Description

Deliverable:

Task 6: Project Construction
Description

Deliverable:

Task 7: Performance Testing and Demobilization

Description

Deliverables:

Category (e): Environmental Compliance/Mitigation/Enhancement
The total budget for this task is $
Grant Share: $
Cost Share: $

Task 8:
Description

Deliverables:

Category (f): Construction Administration
The total budget for this task is $
Grant Share: $
Cost Share: $

Task 9:
Description

Deliverables:

Category (g): Other Costs
The total budget for this task is $
Grant Share: $
Cost Share: $

Task 10: Develop and Maintain USR Project-Specific Webpage
Description

Deliverables:

Task 11: Performance Measures and Monitoring Plan
Description

Deliverables:

Task 12: Data Management
Description

Deliverables:

Budget Category (h): Construction/Implementation Contingency (start month/year – end month/year)
The total budget for this task is $
Grant Share: $
Cost Share: $

Task 13:
Description

Deliverables:

Schedule Template

	Month:	1	2	3	4	5	6	7	8	9	Etc…
Task	**Title**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**…**
1	**Administration (example)**										
1.1	Grant reporting										
1.2	Grant invoicing										
2											☐
2.1											
2.2											
2.3											
3											
3.1											
3.2											
3.3											
4											
4.1											
4.2											
4.3											
5											
5.1											
5.2											
6											
6.1											
6.2											

Budget Template

NOTE: this template was provided to project proponents in Excel format; the summary budget was required, with the detail budget being an optional submittal.

Summary Budget

Project Budget

Project Name

Project Sponsor

		(a)	(b)	(c)	(d)	(e)
Budget Category		**Non-State Share* (Funding Match)**	**Requested Grant Funding**	**Other State Funds Being Used**	**Total**	**% Funding Match**
(a)	Direct Project Administration Costs				$ -	#DIV/0!
(b)	Land Purchase/Easement				$ -	#DIV/0!
(c)	Planning/Design/Engineering/Environmental Documentation				$ -	#DIV/0!
(d)	Construction/Implementation				$ -	#DIV/0!
(e)	Environmental Compliance/Mitigation/Enhancement				$ -	#DIV/0!
(f)	Construction Administration				$ -	#DIV/0!

(g)	Other Costs				$ -	#DIV/0!
(h)	Construction/Implementation Contingency				$ -	#DIV/0!
(i)	**Grand Total (sum of rows (a) through (h) for each column)**	**$ -**	**$ -**	**$ -**	**$ -**	**#DIV/0!**
***List sources of funding:Use as much space as required**						

Detail Budget

Project Name

Project Sponsor

	position	position	position	position	Total Labor Hours	Total Labor Costs	Other Direct Costs[1]	Total Project Funds Requested
Billing Rate	*$100.00*	*$45.00*	*$60.00*	*$80.00*				
Budget Category (a) - Direct Project Administration Costs								
1					**0.0**	**#REF!**	**$ -**	**#REF!**
1.1					*0.0*	*#REF!*	*$ -*	
1.2					*0.0*	*#REF!*	*$ -*	
Budget Category (b) - Land Purchase/Easement								
2					**0.0**	**#REF!**	**$ -**	**#REF!**
Budget Category (c) - Planning/Design/Engineering/Environmental								
3					**0.0**	**#REF!**	**$ -**	**#REF!**
3.1					*0.0*	*#REF!*	*$ -*	
3.2					*0.0*	*#REF!*	*$ -*	
3.3					*0.0*	*#REF!*	*$ -*	
Budget Category (d) - Construction/Implementation								
4					**0.0**	**#REF!**	**$ -**	**#REF!**
4.1					*0.0*	*#REF!*	*$ -*	

4.2					*0.0*	*#REF!*	*$*	*-*	
5					**0.0**	**#REF!**	**$**	**-**	**#REF!**
5.1					*0.0*	*#REF!*	*$*	*-*	
5.2					*0.0*	*#REF!*	*$*	*-*	
Budget Category (g) - Other Costs									
6					**0.0**	**#REF!**	**$**	**-**	**#REF!**
6.1					*0.0*	*#REF!*	*$*	*-*	
6.2					*0.0*	*#REF!*	*$*	*-*	
7					**0.0**	**#REF!**	**$**	**-**	**#REF!**
7.1					*0.0*	*#REF!*	*$*	*-*	
7.2					*0.0*	*#REF!*	*$*	*-*	
Budget Category (h) - Construction/Implementation Contingency									
8					**0.0**	**#REF!**	**$**	**-**	**#REF!**
Hours:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**#REF!**	**$**	**-**	**#REF!**
Total Cost:	**$0.00**	**$0.00**	**$0.00**	**$0.00**					

Notes: *We suggest that you make any required explanatory notes with a superscript letter indication in the header or end of the row for which you'd like to make a comment, and then come down here and indicate the letter and then the note (per below).*

1 You may enter direct costs here, or use the following sheet to calculate those costs (if needed)

Greenhouse Gas Assessment Template

NOTE: This template was provided to project proponents in Excel format to facilitate accounting.

PROJECT NAME - Inventory and Calculation of Greenhouse Gas Emissions

Line	Emissions from Construction Equipment							
1	Type of Equipment	Maximum Number per Day	Total Operation Days	Total Operation Hours[1]	Fuel Consumption Per Hour[2]	Total Fuel Consumption (gal. diesel)	CO_2e/gal diesel[3]	Total CO_2 Equivalent Emissions (metric tons)
2				0		-	0.010	-
3				0		-	0.010	-
4				0		-	0.010	-
5				0		-	0.010	-
6				0		-	0.010	-
7				0		-	0.010	-
8				0		-	0.010	-
9				0		-	0.010	-
10				0		-	0.010	-
11				0		-	0.010	-
12				0		-	0.010	-
13				0		-	0.010	-
14				0		-	0.010	-
15				0		-	0.010	-
16				0		-	0.010	-
17				0		-	0.010	-
18				0		-	0.010	-
19				0		-	0.010	-
20				0		-	0.010	-
21				0		-	0.010	-
22				0		-	0.010	-
23				0		-	0.010	-
24				0		-	0.010	-
25	TOTAL					-		-
26	[1] An 8-hour work day is assumed.							
27	[2] California Air Resource Board Offroad 2007 Emissions Inventory fuel consumption factors							
28	[3] World Resources Institute-Mobile combustion CO_2 emissions tool, June 2003 Version 1.2							
29								

Emissions from Transportation of Construction Workforce

Average Number of Workers per Day	Total Number of Workdays	Average Distance Travelled (round trip)	Total Miles Travelled	Average Passenger Vehicle Fuel Efficiency[4]	Total Fuel Consumption (gal. gasoline)	CO_2e/gal Gasoline[3]	Total CO_2 Equivalent Emissions (metric tons)
			0		#DIV/0!	0.009	#DIV/0!

[4] United States Environmental Protection Agency. 2008. Light-Duty Automotive Technology and Fuel Economy Trends: 1975 through 2008. [EPA420-R-08-015]

Emissions from Transportation of Construction Materials

Trip Type	Total Number of Trips	Average Trip Distance	Total Miles Travelled	Average Semi-truck Fuel Efficiency	Total Fuel Consumption (gal. diesel)	CO_2e/gal Diesel[3]	Total CO_2 Equivalent Emissions (metric tons)
Delivery			0		#DIV/0!	0.010	#DIV/0!
Spoils						0.010	0
TOTAL							#DIV/0!

Construction Electricity Emissions

Upper Sacramento, McCloud, and Lower Pit
Regional Water Management Group

UpperSacIRWM.org

The River Exchange
Promoting Healthy Watersheds

5937 Dunsmuir Avenue • Dunsmuir, CA 96025
530.235.2012 • RiverExchange.org

Forsgren Associates Inc.

3110 Gold Canal Drive, Ste. C • Rancho Cordova, CA 95670
916.638.1119 • Forsgren.com