

14. Technical Analysis

14.1 Framework and Scope of Technical Analyses

As required by Integrated Regional Water Management (IRWM) Grant Program Guidelines, this chapter illustrates the breadth of data and information used to prepare the Upper Sacramento, McCloud, and Lower Pit (USR) IRWM Plan; presents a summary of technical analysis related to the Plan; discusses analysis methods used to improve regional understanding of water needs over the planning horizon; and provides the methodology for much of the data analysis. Plan guidelines assert that the planning horizon is 20 years; therefore, information was gathered and analyzed to illustrate water management needs over that period when possible. Due to the projected long-term nature of climate change and the need for communities to develop and reevaluate plans accordingly, however, climate change was assessed through the end of the century.

During development of the initial IRWM Plan in 2012, numerous individuals were involved in preparing the 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 the various Plan sections, analysis methods used in the planning process, and references, such as source information for much of the work completed in 2012. Data sources used for the initial climate change analysis in 2012, as well as those used for the 2018 IRWM Plan update, however, are not included in Table 14.1. This information is provided in detail in Chapter 9, Climate Change. Chapter 9 also includes an end-of-chapter bibliography with links to online sources whenever available. As such, the scope of the USR's climate change assessment is only briefly described below.

14.2 Technical Data, Information, Methods, and Analyses used in Plan Development

The USR project team and stakeholders attempted to use the best available information to understand the region's water management needs over the planning horizon, including through a review of projected climate change impacts and other changes in the region, pursuant to IRWM Grant Program Guidelines.

Being located in a source water area of far northern California, fewer climate change assessments and data sets have been prepared for the USR than have been developed in the more populous areas of the state. Nevertheless, the information used in the development of the region's IRWM process is significant because of its direct relevance to the region. In-region stakeholders conducted most of the studies within the region, and very few studies were identified where inference was required. Examples of important data sources are provided below, along with descriptions of their content and how they were used.

14.2.1 Climate Change Assessment

The growing concern over global and local changes to the climate has necessitated the development and coordination of large amounts of data and technical information. This includes reviews of weather and climate trend observations as well as the continual refinement of computer models for projecting probable future conditions. Though fewer climate studies have been developed for the USR than for more populated and/or coastal areas of the state, there has been valuable information generated by a variety of sources.

To date, the RWAG's understanding of potential climate change impacts has been informed through: the use of World Climate Research Programme's Coupled Model Intercomparison Project Phase 3 (CMIP3) projections for temperature and precipitation; preparation of the region's climate change vulnerability assessment in 2012 (updated in 2018) using Appendix B of the Climate Change Handbook for Regional Water Planning (USEPA and DWR 2011); validation of CMIP3 projections and a review of other climate

metrics in 2018 utilizing Cal-Adapt, an online climate portal developed by the California Energy Commission; review of climate change assessments prepared by the Shasta-Trinity National Forest; and review of a significant body of literature (see Chapter 9).

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 largest 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 Mount 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: 1a) understanding of USR groundwater resources and how they are connected to each other and to surface water, and 1b) how these groundwater resources 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 (RWAG) 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: 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: 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 RWAG's collaborative, informative structure could help these communities to plan. In Chapter 15, Financing IRWM Implementation and RWAG 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 RWAG 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 can be found in Chapter 9, Climate Change.

Table 14.1: A Selection of Central Studies and Data Sets Used in Developing the USR IRWM Plan				
<i>Data or Study</i>	<i>Analysis Method</i>	<i>Results/Derived Information</i>	<i>Use in IRWM Plan</i>	<i>Reference or Source</i>
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: 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	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. Available at: 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: 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: 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.

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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: 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: wdr.water.usgs.gov/wy2011/pdfs/11368000.2011.pdf