

Section 5: Challenges and Opportunities Summary

This section describes the major challenges and opportunities related to integrated water management in the Westside Sacramento Region (Region). These challenges and opportunities were identified through multiple conversations with resource managers and other stakeholders and were informed by the material presented in Sections 2 through 4 of this *Integrated Regional Water Management Plan* (IRWM Plan). The term “challenges and opportunities” is used to mean the water-related items of interest or concern within the Region. The list does not distinguish whether a particular item is a challenge or an opportunity, because given the diversity of interests and values in the Region, one person’s challenge may very well be another’s opportunity. By including both challenges and opportunities, stakeholders were able to reach broad agreement on the topics that warrant consideration and focus within this Plan.

Identification and discussion of challenges and opportunities began early in the Plan development process, ultimately generating the Plan goals and objectives presented in Section 6. Over the course of several conversations, the project team began grouping the challenges and opportunities into 10 focus areas, which are listed below in no particular order:

- **Education and Awareness** – Fostering broader watershed stewardship in the community,
- **Habitat and Invasives** – Restoring and enhancing riparian habitat, protecting endangered and listed species, and reducing the spread of and preventing invasive species,
- **Infrastructure** – Ensuring appropriate investments in water-related infrastructure to provide a reliable water management system over time,
- **Reasonable Use** – Promoting reasonable use of water supplies and watershed resources,
- **Recreation** – Maintaining and expanding water-based recreational opportunities,
- **Risk Management** – Addressing the risks associated with water and natural resources management (e.g., flood, drought, fire, ineradicable invasive species, etc.),

- **Water Quality** – Providing appropriate quality water compatible with its intended use(s),
- **Water Supply** – Providing reliable water supply at the time and location needed for multiple beneficial uses in the Region,
- **Understanding of Watershed Function** – Improving the information and knowledge base regarding watershed function and management, and
- **Land Use** – Integrating land use management and water management.

Each of these focus areas and their associated challenges and/or opportunities are described in more detail below. Sections 2, “Region Description,” 3, “Existing and Future Conditions,” and 4, “Water and Land Use Planning” introduce important background information for each focus area and provide context for each challenge and opportunity.

5.1 Education and Awareness

Historical and ongoing human activities have had profound effects on the watersheds of the Westside Region. Many people may not realize that their actions may be negatively affecting the well-being of their communities and watersheds. Some examples of harmful actions are irresponsible application or discharge of stormwater that transports runoff pollutants (e.g., fertilizers, pesticides, oil and grease); illegal dumping of garbage and refuse near water bodies; and septic system overflows that can contaminate creeks, streams, and lakes, affecting critical fisheries and aquatic habitat. Boating-related activities that can impact watersheds adversely include improper disposal of trash or sanitary waste and the spread of invasive species from one water body to another.

Several participants in the Plan development process emphasized that water and associated resource management organizations should be conducting community outreach to engage with members of the public in practical and collaborative ways. A suggested focus for outreach

includes helping citizens understand the importance of the watersheds and natural resources of the Region, how these vital resources affect them individually, and what they can do to help sustain them. This expectation for community outreach is based on the belief that increased awareness and understanding about sustainable management and the long-term impacts of unsustainable activities can foster better public involvement in, and financial support of, effective resource management and watershed protection. There are also regulatory mandates in place that require public engagement, such as the general Small Municipal Separate Storm Sewer Systems (MS4) permits, which include provisions requiring that permittees develop an education and outreach program tailored and targeted to the water quality issues specific to the community. The outreach program should not only include the public as the target audience, but also include entities such as permittee staff and construction site operators.

Numerous watershed and environmental stewardship organizations are committed to continued enhancement of watershed public education throughout the Region. They include the Yolo Basin Foundation, Putah Creek Council, Sierra Club Lake Group, Tuleyome, Inc., Upper Putah Creek Stewardship, and the Clear Lake Advisory Committee. Ongoing support of these organizations and expansion of public outreach and education programs can considerably improve protection of the Region's critical waterways.



5.2 Habitat and Invasive Species

5.2.1 Supporting the Health and Biodiversity of Native Aquatic and Riparian Species

Maintaining the agrarian and rural character of the Region is a value that has been clearly articulated by stakeholders, and with it comes the desire to maintain the health and biological diversity of native aquatic and riparian species.

The lakes, creeks, wetlands, sloughs, Delta, and other water features throughout the Region provide key habitat for many of California's well-known fish and wildlife species. Anadromous fish migrate into the Region and use its waterways for spawning. Resident and migratory waterfowl rely on the lakes and wetlands for food and nesting habitat. More than 50 federally and state-listed wildlife and plant species are found in the Region, and hundreds of other species with special-status designations are supported by habitats. Populations of fish that are declining throughout the state can still be found in the Region. Of particular note is the Clear Lake hitch, a species endemic to the Clear Lake watershed. While not federally or state-listed, the Clear Lake hitch has been identified by the CDFW as a species of special concern. A petition was submitted in 2012 to the State of California and U.S. Fish and Wildlife Service (USFWS) to have the Clear Lake hitch listed as a threatened or endangered species.

Multiple Regional conservation areas, such as the Yolo Bypass Wildlife Area, Cache Creek Natural Area/Cache Creek Wilderness Area, Clear Lake Wildlife Area, Berryessa Snow Mountain (proposed), and Mendocino National Forest, have been or will be established to protect important habitats and species. The Inner Dam Reach of Putah Creek is proposed by the CDFW as designated heritage trout waters. In addition, Cache Creek is designated as a California Wild and Scenic River. This designation for more than 31 miles of the creek is aimed at maintaining free-flowing conditions and preserving its aquatic and riparian environment.

However, these conservation areas and designations do not cover the entire Region, and

additional work is necessary to improve special status and endangered species habitat including:

- Increase productive floodplain connectivity,
- Improve overall fish passage,
- Expand contiguous extent of riparian canopy,
- Establish and manage additional reserves and preserves, and
- Protect vernal pools and migratory bird wintering areas.

5.2.2 Conserving and Restoring Habitat

Protection of the Region’s important environmental resources extends beyond the formation of dedicated conservation areas. Ongoing large-scale planning that addresses the interplay between water resource management and environmental resources within the Region are underway; they include the Solano Habitat Conservation Plan (HCP), Yolo Natural Heritage Program HCP/Natural Communities Conservation Plan (NCCP), and the Bay Delta Conservation Plan (BDCP). Design and implementation of such substantial programs is one of the many ways that critical habitat can be restored throughout the Region. The following efforts do not encompass the entirety of the Westside Region, but do provide a valuable foundation:

- **The Solano HCP** aims to promote the conservation of biological diversity and the preservation of endangered species and their habitats while allowing for activities that support the continued health of cities, agriculture, and industry in Solano County. This plan originated with the Solano Project Biological Opinion (BO), which suggested development of the HCP as a conservation measure. The BO was issued by the U.S. Fish and Wildlife Service as part of the renewal of the contract between the U.S. Bureau of Reclamation (USBR) and Solano County Water Agency (SCWA) to continue operation of the Solano Project.

The Solano HCP provides Endangered Species Act incidental take authorization for activities associated with future water in the SCWA contract service area. The Solano HCP covers the conversion of species habitat for urban uses, new development, and water infrastructure;

operations and maintenance of flood management and irrigation facilities; and activities undertaken to manage or enhance habitat or relocate covered species.

- **The Yolo Natural Heritage Program HCP/NCCP** (Yolo NHP) is being developed to protect and enhance biodiversity within Yolo County while facilitating permitting for activities that could affect protected species. The Yolo NHP is similar to the Solano HCP in that it covers infrastructure expansion and improvements as well as operations and maintenance for water facilities; also, it is intended to improve ecological conditions so as to allow incidental take authorization for activities supporting the preservation of the area’s cities, agriculture, and industry. The main difference between the Yolo NHP and the Solano HCP is that the Yolo NHP also is pursuing an NCCP to cover take of unlisted state species.
- **The BDCP** is being planned to balance provision of a reliable water supply to those receiving it from the Sacramento-San Joaquin River Delta (Delta) with protection of ecosystem health. The BDCP is intended to improve ecological conditions to allow long-term regulatory authorization of the operations of the State Water Project (SWP) and Central Valley Project (CVP). The potential benefits and effects of the BDCP planning effort are relevant to the Plan, since a portion of the Westside Region falls within the Delta, and the Cache Creek and Putah Creek watersheds contribute flows to the Delta. In addition, imported surface water diversions from the Delta are a source of supply for several of the Westside water agencies.

5.2.3 Preserving Ultramafic Soils and Associated Habitat

Resource managers and other stakeholders within the Region have an ongoing interest in preserving ultramafic soils and their associated habitat types. Ultramafic soils contain high concentrations of iron and magnesium and low concentrations of phosphorus. The Region has one of the largest acreages in the world of unique serpentine botanical assemblages. Although not directly a water-related, ultramafic soils are recognized as important habitat in the Region and large areas of the Upper Cache, Upper Putah, and Bear Creek

watersheds are covered by ultramafic (serpentine) soils. The habitats found over ultramafic soils often contain chaparral vegetation, including scrub oak, chaparral oak, chamise, and several species of manzanita and ceanothus. Many rare species (plant and animal) in the Bear Creek watershed are found on ultramafic soils (Bear Creek Watershed Assessment, 2010).

The largely rural character of Lake County provides an opportunity to protect this important habitat. Lake County has adopted a wide range of policies to ensure protection of sensitive species. Lake County development policies include clustering development, limiting development in areas with sensitive habitat, and requiring buffers between development and significant watercourses, riparian vegetation, and wetlands.

5.2.4 Addressing the Presence and Spread of Aquatic and Terrestrial Invasive Plant Species

Invasive plants present a significant challenge to the management of the Region's water resources. Hence, addressing the spread of invasive species is an important component of maintaining the natural diversity of the Region and helping to protect water.

From the late 19th century to today, development of urban communities, agriculture conducted across large areas, and disturbance of the stream channels through mining and construction of infrastructure has altered riparian habitat throughout the Region. This disturbance has led to increased intrusion of invasive species in both terrestrial and aquatic areas, which can cause widespread impacts through the watershed. A number of invasive plants and animal species either already occur in or threaten to invade the Region. Invasive plant species of concern include *Arundo donax* (giant reed), tamarisk, French and Scotch brooms, yellow star-thistle, water hyacinth, Eurasian milfoil, Hydrilla and ravenna grass.



Yellow Starthistle

The major risks to the watersheds from the spread of invasive aquatic and terrestrial plant species are described below.

- **Changes to water quality** generally result from temperature changes due to changes in river shading as well as chemical changes such as increased nutrient loading, increased pH, and decreased dissolved-oxygen content.
- **Impacts to water supply** include reduced local availability of surface water and groundwater due to excessive evapotranspiration needs of the invasive species and obstructions to water supply infrastructure through the unmanaged growth of invasive plant communities.
- **Flooding** risks may increase as a result of alterations to the stream channel conveyance capacity, and raising water levels during high flows.
- **Increased erosion** occurs as a result of decreased bank stability due to differences in the root structures of invasive plant species, which cause undercutting and bank collapse. It also results from changes in flow patterns due to obstructions within waterways, which can cause constrictions, higher flow velocities in certain areas, and potentially increased erosion.
- **Increased fire hazards** result from the dense growth patterns of some invasive plants, which present a significant fuel source in upland areas and decrease the ability of riparian areas to serve as natural firebreaks. Native riparian areas tend to be open networks of plants and steep lightly vegetated banks that are poor fire fuel.
- **Displacement of native habitats and associated wildlife** mainly occurs through the invasive species' ability to outcompete native plants, leading to the loss of food and habitat for native wildlife; additionally, water quality changes impact the habitat of native aquatic wildlife.
- **Adverse effects on recreational activities** can result from obstructions to waterways and upland areas, which hinder navigation.

5.2.5 Limiting and Preventing Colonization of Water Bodies by Quagga Mussels, Zebra Mussels, and Spread of New Zealand Mud Snails

A population of New Zealand mud snails (NZMS), *Potamopyrgus antipodarum*, was discovered in Putah Creek downstream of Monticello Dam in 2003. The Putah Creek discovery was the first appearance of the organism west of the Sierra Nevadas. NZMS are present in the Putah Creek inter-dam reach, between Monticello and the Putah diversion dams; the snails have spread approximately 6 miles downstream from a fishing access location after sustained high flood flows during the 2003-2004 winter, and it is very likely that the limit of infestation has moved farther downstream because of flood flows in Putah Creek during the winter-spring of 2006. The infested reach includes the intake to the Putah South Canal.



Invasive New Zealand Mud Snail

The primary impact from NZMS is that they outcompete other invertebrates such as mayflies and deplete algae and periphyton, which support the anadromous fish food chain. However, no studies have been completed that directly link NZMS to significant ecosystem disruption or adverse fish impacts. Some fish will consume NZMS but retain no nutrient value, as the snails are able to pass through the digestion canal alive and intact. They are particularly difficult to eradicate because they are self-cloning females and a single individual can start a new population.

Dreissenid mussels, such as quagga and zebra mussels, pose a significant threat to the Region.

These aquatic invertebrates have not been found in the Region but are found in nearby water bodies around California. The closest known infestation of zebra mussels is about 100 miles away, and it resulted in the closure of San Justo Reservoir to public use (San Benito County Water District website, 2013). These mussels have caused devastating impacts on municipal water systems, recreation, and fisheries in other areas of the country, and they have recently been discovered in reservoirs in the western U.S. and major water delivery systems in Southern California. Dreissenid mussels significantly alter lake ecology by displacing native species, destroying native habitats and the species that depend on natural habitats, blocking water delivery, disrupting recreational and commercial fishing, undermining docks and all other structures in the water, and impeding navigation and enjoyment of waterways.

Several water management agencies in the Region have already initiated activities to prevent the introduction of dreissenid mussels and control the spread of NZMS. The Region has taken some steps to address their continued threat to water supply infrastructure. For example, the Lake County invasive mussel prevention program at Clear Lake and USBR invasive mussel program require inspections or self-certifications that watercraft are mussel-free before they can be launched. Likewise, SCWA is collaborating with USBR to develop and implement an early detection and education plan for dreissenid mussels for the Solano Project (including Lake Berryessa). In mid-2012, nearby Sonoma and Mendocino Counties created the North Coast consortium program to prevent mussel infestation with support from the U.S. Army Corps of Engineers.

5.3 Water Supply

5.3.1 Sustaining Groundwater Resources

Groundwater is a key component of the Region's conjunctive water supply portfolio. Various challenges are associated with managing the Region's groundwater aquifers. A primary challenge is that very little data are available on the sustainable yield of the aquifers. Although agencies have tried to improve understanding of groundwater resources through preparation of

groundwater management plans and monitoring programs, much work remains to truly quantify the reliable, sustainable supply available.

Groundwater makes up approximately 33% of the water supply for users in the Valley Floor PA in an average water year, and for many agricultural users and municipalities, groundwater is the only source of supply. Some agricultural areas, such as the Yolo Zamora area, are fully reliant on groundwater. Municipalities such as the Cities of Woodland, Davis, Dixon, and Rio Vista also currently obtain all of their drinking water supplies from wells. The Cities of Davis, Woodland, and Vacaville obtain some of their water from the deeper Tehama formation, which is of high quality, but water managers are uncertain about the sustainable yield of the aquifer.

Furthermore, the groundwater basins in the Upper Cache Creek and Upper Putah Creek PAs do not provide a high level of drought protection. The shallow groundwater basins are generally drawn down over the summer months and recharged during the winter season, meaning that groundwater supplies are not a reliable source of supply during multiple-year drought periods. Some domestic and municipal wells are located in the volcanic formations, which are generally considered to be unreliable sources of supply because it is difficult to quantify the capacity of the formation.

Another challenge is subsidence (consolidation of the aquifer causing decreased ground levels) due to groundwater pumping. Lower land surfaces resulting from subsidence of peat soils behind levees, some of which can be attributed to groundwater pumping, also contribute to flood risk because of the reduced effectiveness of the levees. Subsidence due to groundwater pumping has been detected in the northern Yolo-Zamora area of Yolo County between Zamora and Knights Landing, where subsidence is reported to be on the order of 5 feet, and the vicinity of Davis and Woodland, where subsidence is estimated at 2 to 3 feet. Experts have reported subsidence around Clear Lake in excess of four feet in Scotts Valley and approximately two feet around Big Valley.

Previous overdraft conditions in the subbasins of the Sacramento Valley groundwater basin led to the development of supplemental surface water delivery projects to offset groundwater demand.

The current conjunctive use measures have reduced but not eliminated concerns about subsidence stemming from the previous overdraft and allow for increased reliance on groundwater supplies in the Valley Floor planning area (PA) during drought periods, when surface water supplies are sometimes restricted.

5.3.2 Ensuring the Availability of Reliable Water Supplies for Beneficial Uses during Drought Periods

The Region's water supplies offer innumerable beneficial uses, including ecosystem, municipal and industrial applications, and agricultural support. Generally speaking, the Region has access to sufficient quantities of water for most intended uses under typical conditions.

Some surface water leaves the Region and flows downstream into the Sacramento River and San Francisco Bay Delta; imported surface water is diverted from the Delta by some users in the Valley Floor PA. Despite its availability in most conditions, water is a finite resource and the quantity available under varying hydrologic conditions is not certain year to year. An abundance of water may be available during a wet year, while water users may not have access to sufficient quantities to meet all intended uses during a drought.

As a result, many of the Region's water users have developed water supply portfolios that provide more confidence in supply availability. However, not every water user in the Region has multiple supply options, and in some of the dryer years, some farmers fallow lands or plant different crops in response to water scarcity. Water scarcity during droughts may also negatively affect aquatic and riparian habitat quality and fisheries.

Local surface water sources, including the Cache Creek and Putah Creek systems, are operated by Region agencies. The major lakes and reservoirs including Clear Lake, Indian Valley Reservoir, and Lake Berryessa provide additional stability in firm yield and carryover storage from year to year for the portions of the Region that can access this storage.

The reliability and availability of imported surface water supply is subject to water rights seniority and

Term 91 curtailments, which is a provision that allows the State Water Resources Control Board (SWRCB) to reduce allowable diversions when water needs to be released from SWP or CVP storage to meet instream water quality standards (typically during dry hydrologic years). Additionally, imported surface water supplies can be curtailed because of environmental regulations that limit Delta diversions and changes in precipitation and snow pack from climate change.

5.3.3 Addressing Competing Need for Water Supplies due to Environmental Regulations and Future Climate Change

Agencies with required environmental flows must ensure they have adequate water storage to provide for their customers as well as minimum in-stream release requirements. Required releases from Indian Valley Reservoir, in Lake County and the Putah Creek Diversion Dam, in Solano County fall under this requirement. Putah Creek environmental flow requirements at Monticello Dam are dictated by required instream flows for Lower Putah Creek established in the *Putah Creek Accord* (2000).

Imported surface water supplies are more vulnerable to environmental flow regulations and climate change than are local surface water supplies. Therefore, water supply reliability planning and alternative water resources planning should be considered as precautionary measures to the extent possible.

Sustainable, reliable water supplies are necessary to maintain the Region’s economic viability and ecological health, but climate change could affect the availability of water supplies in the future. Large variations in the weather patterns would affect the municipalities, farmers, and streams receiving water from all of their sources. In many cases, improvements to infrastructure to better distribute surface water supplies around the Region to be used conjunctively with groundwater would improve resilient responses to the potential effects of climate change. However, the impacts of climate change on the Region are difficult to predict; current information from climate change models is not sufficiently precise to demonstrate specific

impacts to water supply reliability within the Region.

5.4 Infrastructure

5.4.1 Maintaining and Modernizing Water System Infrastructure

One of the ongoing challenges facing water suppliers and wastewater management agencies is aging and inadequate infrastructure. Much of the water storage and conveyance infrastructure, including the dams, canals, pipelines, and pump stations throughout the Region, was built in the 1960s or earlier and could be nearing the end of its useful life. Some of the water supply systems may also require technological updates to keep pace with modern regulatory requirements and other drivers. Production groundwater wells also have a limited useful life, and groundwater producers must periodically drill replacement wells. Further, increasingly stringent water treatment requirements have required many existing and new wells to be retrofitted with groundwater treatment systems to remove contaminants and undesirable constituents such as arsenic, iron, and manganese. Many communities in the Region are facing similar needs for investment in wastewater treatment facilities, and several are seeking to upgrade their flood protection infrastructure.

As a result of the combination of aging infrastructure and rising expectations, water managers within the Region must determine how they can make the significant investments required to replace and modernize aging infrastructure.

Many of the Region’s disadvantaged communities (DACs) are faced with similar water infrastructure needs but cannot afford the required investments. In some cases, communities may not be able to meet basic bacteriological water quality requirements or fire flow requirements and need to improve treatment, upgrade undersized water lines, and increase tank storage to comply with current fire codes and California Department of Public Health (CDPH) waterworks standards.

5.5 Reasonable Use

As competition for water supplies throughout California grows more intense, water users are

being asked to make use of limited resources in a reasonable way. Some recent regulatory requirements require additional steps towards reasonable water use; the Water Conservation Act of 2009 (SBx7-7) requires a 20% statewide reduction in per capita water use by 2020 for urban water suppliers. The Region's urban water suppliers, including the Cities of Davis, Dixon, Vacaville, West Sacramento, and Woodland, are implementing plans to achieve their specific water use targets to comply with the direction provided by the state Department of Water Resources. Some of the methods being used by urban water suppliers include water conservation best management practices (BMPs) as defined by the California Urban Water Conservation Council.

Similarly, agricultural water suppliers (suppliers with more than 10,000 irrigated acres) were required by December 31, 2012 to adopt and implement cost-effective efficient water management practices in an effort to practice reasonable use of agricultural irrigation water at the farm level. The Region's many large agricultural water suppliers, such as Yolo County Flood Control and Water Conservation District (YFCWCD), Solano Irrigation District, and others, may be subject to these regulations.

5.6 Risk Management

5.6.1 Providing an Appropriate Level of Flood Protection

Many areas within the Region have been affected by flooding and continue to face significant flood risk. Local governments and flood management agencies are attempting to provide an appropriate level of flood protection for each area. Decisions on what level of protection is appropriate and how to provide it vary with location; for example, the approaches to flood protection by the communities surrounding Clear Lake may be very different than those by the cities of Woodland and West Sacramento, because the people and resources at risk and the flooding mechanisms vary. In addition, providing an appropriate level of flood protection requires close coordination and collaboration among a multitude of local, state, and federal agencies, similar to efforts underway for the Central Valley Flood Protection Program.

The impacts of climate change are expected to include more extreme weather events that could increase the frequency and duration of flooding in the Region. This will be exacerbated in the Valley Floor, because subsidence behind some of the levees could reduce their effectiveness. In addition, increasing development pressures continue to occur along the lakeshore of Clear Lake, as tourism and second homes are promoted, leading to increased flood risk for developing areas that are located within a floodplain.



Flooding in Solano County

5.6.2 Providing an Appropriate Level of Protection from Fire, Drought, and Other Natural Disasters

As noted in Sections 2 and 4, the vast acreage of federal lands predominantly in a natural state poses a significant chance for wildfires in the Region. In addition, fire tends to lead to the presence of terrestrial invasive species, which often are the first to establish themselves after a fire event. The likely results of wildfire are property damage, loss of life, and increased erosion and landslide potential with associated sediment loads to water bodies. Furthermore, drought events, which may be exacerbated by climate change, can increase fire risk by stressing vegetation, thereby increasing its vulnerability to insect infestations.

Funding for vegetation management to reduce fire risk is usually insufficient to completely cover the large acreages in the Region. Recent philosophies regarding vegetation management using the

available funding focus on targeting areas at the urban-wildland interface.

5.7 Understanding of Watershed Function

5.7.1 Responding to Potential Impacts of Climate Change

As discussed earlier, climate change could significantly impact the Region, impacting the ecological, environmental, and economic conditions. USBR has undertaken an extensive analysis of climate change and its potential impacts on water resources in the western states, completing global climate model modeling and hydrologic modeling steps for several western U.S. rivers, including the Sacramento River, and releasing the results. Because the Region is a part of the Sacramento River Basin, the projections for future temperature and precipitation developed by USBR for the Sacramento River watershed are representative of the likely changes to the Westside Region.

The potential impact of climate change should be studied and considered in planning for resource management and economic development. The following areas of concern, addressed in the climate change vulnerability assessment in Section 3, are particularly relevant to the Region:

- Increases in peak storm water runoff flows and flood risk,
- Increased evapotranspiration,
- Decreased agricultural production due to changes in temperature and carbon dioxide levels,
- Reductions in the habitat of riparian and aquatic species, and
- Decreased availability of water supplies.

5.7.2 Coordinating Data Acquisition, Management, and Access

Documentation of current and historical conditions is required to provide an understanding of changes occurring in the Region. Yet data collection and management can be challenging when different agencies and stakeholders are collecting and using

data for different purposes. Close collaboration between entities that maintain data can help leverage limited resources to make data usable for regional planning. To support policy-making and public education, data must be available from various sources and widely accessible but also managed to ensure data quality (accurate, up to date). There is an inherent difficulty in ensuring quality and consistency of data provided by, and interpreted by multiple agencies, organizations, and the public.

5.7.3 Providing Better Data and Information to Support Decision-Making and More Sustainable Public Behaviors

The accessibility and dissemination of credible and coordinated data and information helps governing bodies make informed decisions about policies that can impact the health of watersheds and other resources in the Region. Also, meaningful educational activities and community outreach focused on the environmental impacts of public behaviors relies on the availability, credibility, and clarity of relevant data and information.

5.8 Water Quality

5.8.1 Complying with Applicable Discharge Requirements and Basin Plan Objectives

Water quality objectives are prescribed by the Regional Water Quality Control Board in the *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins* (Basin Plan) to protect the many beneficial uses of the Region's waters, including municipal and domestic supply, agricultural supply, industrial supply, recreation, fishing, freshwater and wildlife habitat, and migration and spawning corridors. The Basin Plan includes narrative and numeric water quality objectives. Waste load allocations have been and will continue to be adopted as part of the development of total maximum daily loads (TMDLs) for waterways within the Region.

Managers and stakeholders express a shared desire to improve the quality of the lakes and waterways that are impaired by various water

quality constituents. The Basin Plan identifies many water bodies within the Region as impaired (i.e., not meeting narrative or quantitative water quality objectives) under Clear Water Act Section 303(d). Some of the 303(d) listed constituents of primary concern are mercury, boron, pesticides, nutrients, and fecal coliform.

Mercury is a significant source of water quality impairment and is a legacy of the Region's mining history. Erosion of naturally mercury-enriched soils, geothermal springs, and atmospheric deposition contribute mercury to the watershed, but the major source of mercury is runoff from historic mines (Regional Water Quality Control Board, 2011). The mercury TMDLs that have been developed for Clear Lake, Cache Creek, Bear Creek, Harley Gulch, and Sulphur Creek prescribe cleanup of inactive mines and erosion control measures to decrease the transport of mercury. Mercury from the Upper Cache Creek flows through Cache Creek to the settling basin that drains into the Yolo Bypass, which in turn eventually drains into the Bay Delta. Cache Creek is a major contributor of mercury to the Bay Delta through this pathway. Putah Creek has also been identified as a major contributor of mercury; however, the construction of Lake Berryessa has greatly reduced this contribution. Due to mercury contamination from these sources, and others, the Sacramento and San Joaquin Delta also has a mercury TMDL.

A water quality challenge specific to the Upper Cache Creek PA is the increased cyanobacteria blooms on Clear Lake. A USEPA report published in 1994 identified nutrient-laden sediment runoff from soils in the Upper Cache Creek watershed as the primary cause of excessive algae production in Clear Lake (USEPA, 1994). High levels of nutrients in watershed soils created a naturally eutrophic lake even before European settlement began; ensuing resource extraction and development practices contributed to accelerated degradation of the lake, leading to the current hyper-eutrophic condition. Increased algae growth is contributing to higher costs for lake water purveyors who filter the water, and the mat-forming cyanobacteria are causing aesthetic issues affecting recreation and other lake uses.

Wastewater discharges are regulated by the Regional Water Quality Control Board through the issuance of waste discharge requirements for land

application or National Pollutant Discharge Elimination System (NPDES) permits for discharges to surface waters. Discharge requirements that were established in part to be consistent with the Basin Plan objectives are posing difficulties for many agencies in the Region. Some of the challenging new requirements in some permits include selenium discharge limits and potential future limits for boron and salinity in the Valley Floor PA. In the Upper Cache Creek PA, new requirements in the NPDES stormwater management permit include incorporation of TMDL compliance measures to achieve reductions of nutrient inputs thought to be causing excessive algal blooms in Clear Lake.

Many wastewater discharge permits at publically owned treatment works have been revised in recent years, increasing the level of treatment required and creating a need to modernize wastewater facilities. For example, the City of Davis is required to upgrade its wastewater treatment system by 2017 to a secondary biological treatment, clarification, and tertiary filtration process, replacing the current pond and overland flow treatment system. In the Upper Cache Creek PA, wastewater treatment plants have been updated, sewage removal systems are gradually being improved, and the majority of treated effluent is reused and/or conveyed to the geothermal steam fields near Cobb Mountain to facilitate power production. Programs to evaluate on-site septic systems that may be contributing to Clear Lake nutrient or other pollutant contamination (such as fecal coliform) are needed for future development of local watershed protection and ecosystem management programs.

5.8.2 Meeting Applicable Drinking Water Standards

Meeting applicable drinking water standards is becoming more difficult for some of the surface water and groundwater suppliers in the Region. Some of the suppliers that rely on water diverted from Clear Lake, for example, must deal with organics, *cryptosporidium*, pesticides, and other constituents to meet California Code of Regulations Title 22 and CDPH drinking water standards. Similarly, drinking water supplies diverted from the Delta often have naturally occurring contaminants such as organic carbon,

which can cause undesired side effects during municipal water treatment.

Groundwater being used for drinking water supplies within the Region meets most drinking water standards, but it must be monitored continuously to ensure that the quality of the supplies is maintained. Some secondary constituents, such as manganese, have recently required treatment at municipal wells in the Region. Emerging contaminants such as hexavalent chromium, and potential tightening of the maximum contaminant levels for constituents such as arsenic, also present future challenges to ensuring that groundwater supplies meet drinking water standards. Treatment systems or alternative supply sources will be required at municipal wells that are impacted by current or future drinking water standards.

5.8.3 Providing Water of Suitable Quality for the Intended Beneficial Use

Surface waters in the Region must be managed to protect a multitude of beneficial uses including municipal, agricultural, and industrial water supply, recreation, fishing, and various habitat uses. The primary strategy for maintaining and improving the quality of water for beneficial use within the Region is to control both point and NPS of pollution to these surface waters. NPS pollution is inherently much more difficult to manage because of the broad geographic distribution of discharge points. Point source pollutants, such as wastewater discharges, are regulated through permitting to meet Basin Plan objectives, as described earlier. NPS pollution, such as urban stormwater and agricultural runoff, also is regulated, using BMPs as the primary water quality management mechanism.

Increasing public education and outreach focused on the impacts of human activities and the benefits of BMPs for agricultural operations could help reduce NPS pollution. Groundwater must be managed to meet municipal and agricultural water quality needs; in most cases this requires understanding and promoting the responsible use of herbicides, pesticides, fertilizers, and septic discharges that can migrate into groundwater aquifers during recharge.

5.8.4 Understanding Salt Loading and the Implications on Water Quality and Land Use

Increasing salinity in both surface water and groundwater is a concern. As salinity rises in water supply sources, managers may have a harder time meeting wastewater discharge requirements. Rising salinity levels also may reduce the productivity of agricultural lands. The sources of salinity within the Region are dissolution of salts from rocks and soils in the watershed and various land use factors, such as the softening of domestic water that flows to wastewater treatment plants, agricultural irrigation using water with high levels of total dissolved solids, application of fertilizers to agricultural lands, and land-applied wastewater discharges. Recycled water applications in the Region are limited and have been developed mainly to meet disposal requirements. Increasing the use of recycled water as a supply source likely will require a better understanding of salt loading in the Region through the preparation of salt and nutrient management plans.

5.9 Recreation

Recreation and tourism provide significant economic benefits to the Region, particularly in the Upper Cache Creek area around Clear Lake and the Upper Putah Creek area around Lake Berryessa. Current recreational opportunities in the Region include swimming, camping, fishing, and boating as well as rafting on Class II to Class V white-water rapids. Tourism opportunities in the Region include gaming, resorts with entertainment, and wine tasting. The attraction of the area is its rural character and growth in tourism and recreational opportunities in the Region should be managed and guided with the intention to preserve its rural attributes. Conversely, improving water quality and maintaining sufficient water levels within recreational lakes and reservoirs will be critical to preserving and expanding recreation and tourism opportunities within the Region.



PHOTO: BOR

Lake Berryessa provides numerous recreational opportunities.

5.10 Land Use

5.10.1 Preserving Agricultural Lands and a Thriving Agricultural Economy

Urbanization poses a minimal threat to the existing agricultural character of the Region because of its vast acreages of prime agricultural soils and the Region-wide goal to maintain agricultural lands, as outlined in the county general plans. The urban growth that is anticipated through the planning horizon should continue to be guided, through appropriate land use planning, to prioritize preservation of agricultural lands.

5.10.2 Reducing the Degradation of Soils, Water Bodies, and Habitat Caused by Land Uses and Other Human Activities

The following land uses and human activities can contribute to the degradation of soils, water bodies, and habitat and can make watershed management more difficult. While some of the listed activities have been described under several earlier topics, they are emphasized here because of their importance to the stakeholders:

- Alteration of the natural landscape for any purpose, creating disturbed soils susceptible to erosion, and requiring installation of minimum control measures prescribed for NPDES stormwater management permit compliance;

- Application or accidental release of potentially contaminating substances or prohibited waste discharges to water supplies, including wastewater system overflows, septic system failures, water treatment byproducts, pest abatement, improper disposal of litter or refuse, and lack of stormwater management;
- Removal of natural vegetation and wildlife habitat, including destruction of wetlands, waterways, and shoreline ecologies;
- Improper livestock husbandry and other poorly implemented agriculture, industry, and commercial BMPs; and
- Potential for conflict between land and water use for: (a) recreation and tourism, (b) agriculture, and (c) opportunities to restore and preserve the environment.

5.10.3 Balancing Recreational Opportunities and Environmentally Responsible Commercial Activities with the Conservation of Natural and Cultural Resources on State and Federal Lands

Federal and state lands are intended to be managed to meet multiple, and sometimes conflicting, goals. Often the impacts of resource development must be balanced with environmental restoration and conservation efforts. On Bureau of Land Management (BLM) lands, the increase in activities such as livestock grazing, energy and mineral extraction, wind energy development, and recreational use may impact the preservation of cultural and natural resources, including wildlife and fish, vegetation, and riparian and wetland ecosystems.

One example of an effort to manage conflicting goals is the 2006 *Ukiah Resource Management Plan*, covering over 270,000 acres in Northern California, including BLM lands in the Region from Lake Berryessa through Lake County. The *Ukiah Resource Management Plan* describes the management areas and approaches used to protect and improve natural resources while allowing mineral extraction, livestock grazing and recreation to occur.

In the Mendocino National Forest, management of timber, rangeland, mineral, and energy resources, construction of transportation facilities, fire management, and increased recreational use may conflict with restoration and conservation efforts, such as improvements to fish and wildlife habitat, protection of threatened and endangered species, management of areas prone to mass soil movement and soil instability, enhancement of water quality and quantity, and watershed restoration. The *Mendocino Forest Management Plan* (1995) seeks to balance these potentially conflicting activities by creating management areas where various conservation and restoration activities can balance resource management and economic benefit.

CDFW seeks to protect natural habitats, such as grassland, riparian woodland, oak woodland, serpentine chaparral, and serpentine grassland, while also determining and guiding an appropriate level of public use, enjoyment, and benefit. CDFW

manages these activities primarily through consultation and issuance of streambed alteration agreements.

5.10.4 Incorporating Federal and State Land Management Participation in Watershed Restoration and Water Quality Improvements

Federal and state agencies such as BLM, United States Forest Service, and CDFW operate as land managers in the Region. The use of federal and state lands often focuses on resource development activities like forestry, energy, and grazing. However, balancing resource development with environmental protection is essential to sustainable watershed management. The participation of federal and state land use agencies is crucial to the success of watershed restoration and water quality improvements.

