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Report Details — Administrative Draft

Glossary entries	*Type any terms/definitions here that you would like to see included in the glossary. Please ensure they are defined in the text of this report… (partially completed)* Klamath Basin Restoration Agreement (KBRA); Klamath Hydroelectric Settlement Agreement (KHSA); Evapotranspiration (ET); Reference ET (ETo); CIMIS; Spatial CIMIS; Applied Water (AW); Evapotranspiration of Applied Water (ETAW); Effective Precipitation (EP); Consumed Fraction (CF); Crop coefficient (Kc); Crop stress factor (Ks); Atmospheric River; Atmospheric Evaporative Demand; Orographic lift; Advection; Solar Radiation; Relative Humidity; Rain Shadow; Clean Water Act; MAD, management allowable depletion; crop coefficient, k_c; NPDES; MS4 Permit; MWe, Megawatt electrical; Pacific (inter) Decadal Oscillation; El Nino/ Southern Oscillation (ENSO);
Captions	This regional report also has one photo at this time. It is labeled as Photo NC-1 for the time being (eventual layout version will not use numbering) and shows “Geese and Mt. Shasta as seen from the Klamath Basin National Wildlife Refuge.” (may find a better image, this one is a bit fuzzy when zoomed in)

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North Coast Hydrologic Region

North Coast Hydrologic Region Summary and Recommendations

Summary

[This subsection will contain a discussion of the following topics.

- Highlights from regional report leading up to resource management strategies and policies.]

Resource Management Strategies and Policies

[Content not ready as of the advisory committee draft deadline. Will be added later.]

[This subsection will contain a discussion of the following topics. (Primary authors may be Regional Office staff, coordinating with design teams and regional forum participants with an emphasis on local integrated regional water management [IRWM] managers.)

- Implementation recommendations (and priorities where possible).

Sources for this information may be IRWM plans, the Senate Bill x7-7 process, urban water management plans, agricultural water management plans, groundwater management plans, water elements of general plans, floodplain management plans, stormwater plans, Regional Water Quality Control Board basin plans and water quality reports, watershed management plans, habitat conservation plans, multi-species conservation plans, etc.

Considerations for this subsection:

- This section will directly support funding recommendations in the Update 2013 finance plan (within Volume 1).
- Priorities will be regionally driven and can vary from specific regionally preferred projects to entire IRWM or other plans.
- Priorities can be expressed by IRWM, county, or another geopolitical subdivision.]

Finance

[This subsection will contain a discussion of the following topics.

- An estimate of total funding proposals within the region.
- Public benefits of local and regional proposals (eligible for State funding).
- Cost-sharing criteria.

Considerations for this subsection:

- This section will directly support funding recommendations in the Update 2013 finance plan.
- Same sources and authors referenced under "Resource Management Strategies and Policies," above.
- Identify incentives, funding sources, and State actions to support regional strategies.]

The future of California depends on a reliable, high-quality water supply. In recent years, State agencies and stakeholders have increasingly recognized the need to develop new funding mechanisms to finance major investments in California water resources and infrastructure. With the convergence of the water

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reform legislation in 2009 and the ongoing State budget crisis, developing viable new funding mechanisms has become more urgent, and various parties are becoming increasingly vocal on how to finance future water investments (California Urban Water Agencies 2011).

Established in 1990, California Urban Water Agencies (CUWA) is a non-profit corporation of 10 major urban water agencies that are collectively responsible for about two-thirds of California's drinking water supply. As the voice for the largest urban water purveyors in California, CUWA has a vested interest in ensuring that any new approaches to public financing of water-related projects are equitable and do not create new systems of subsidies or other economic inefficiencies. The beneficiary pays concept has been widely embraced as a promising method of public financing, which has already been practiced by public water agencies at the local level for many decades.

Productive discussions begin with a shared definition of key terms and concepts which, up to now, have suffered from a lack of clarity and mutual understanding. CUWA offers the following suite of definitions for consideration.

- A Public Goods Charge is a method used to collect revenues to fund projects or programs that have a direct nexus to a public good or benefit. It is not meant to collect revenues to fund projects or programs that provide a private or local benefit.
- Public Goods or Public Benefits essentially represent goods and services that are available to everyone, whether or not they helped pay for them. In the water arena, public benefit is defined as the direct and indirect improvement(s) that do not accrue to a specific community, entity or group of entities that result from implementing water-resources-related projects and programs. In general, public benefits are widely dispersed among various communities and where specific beneficiaries cannot be readily identified. Project mitigations undertaken pursuant to obligations under CEQA, NEPA or other statutes are not considered public benefits because even though they may benefit a broad audience, they are required to offset potentially negative impacts of the project.
- Local/Private Benefit is defined as the measurable improvement that results from a specific water-resources-related project or program for a community or other entity. These benefits can be direct or indirect and are measured in comparison to conditions that exist without the project. Local/private benefits are limited to specific entities, in contrast to public benefit, as defined above. Local/private benefits include, but are not limited to, water supply, flood control, recreation, hydropower supply and water quality improvements. An example of a direct improvement is taking delivery from a new water storage or conveyance facility. An example of an indirect improvement is receiving increased water supply that results from a new project added to a complex system where an increase in delivery occurs away from the new project or as an indirect result.
- The Beneficiary Pays Principle means that a public or private entity who receives benefits from a specific project or program should pay a proportional share of the project's cost. Project costs include planning, design, environmental documentation, environmental mitigation, construction, operation, maintenance, and repair/replacement. The costs are to be shared by as many beneficiaries as are benefited by either a new project or the privilege of continuing an activity, in proportion to the benefit each receives. Beneficiaries may include urban and agricultural water users, as well as those who benefit from flood protection, recreation, and discharge of wastewater or runoff, among others. Depending on the project, the general public could also be a beneficiary.

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- The Polluter Pays Principle calls for parties who add pollutants to a system to pay proportionately into the costs of mitigation for that pollution. For water-related systems, the Polluter Pays Principle addresses polluters who contaminate water resources through their discharges of waste into streams and bodies of water and who are obligated under existing and future environmental laws to pay to mitigate adverse impacts. The concept of Polluter Pays fits into the Beneficiary Pays Principle from a prospective basis, where a new project provides mitigation of adverse impacts and thus enables the privilege of continuing the activity causing the pollution.
- The Stressor Pays Principle is a relatively newer concept used by some. It is a slightly broader concept than the Polluter Pays Principle and calls for parties who introduce other stresses on a system beyond pollution (i.e., adverse changes in flow conditions from upstream diversions of water) to pay proportionately into the costs of those adverse effects. Similar to Polluters Pay, the concept of Stressor Pays fits into the Beneficiary Pays Principle from a prospective basis, where a new project enables the privilege of continuing the activity causing stress on the system.
- Free Ridership occurs when an entity who is receiving a specific benefit or privilege granted is not charged appropriately for that benefit or privilege. To the extent that Free Ridership exists, other identified beneficiaries become burdened with costs that are not directly tied to their own benefits and privileges and thus pay disproportionately. Free Ridership is in direct conflict with the Beneficiary Pays Principle, which calls for all beneficiaries to pay proportionately for their benefits.

The beneficiary pays principle offers the best basis for establishing reliable funding for essential water-related investments. Many precedents exist that demonstrate the success of financing water infrastructure by direct beneficiaries, and ample potential exists to apply this method to more complex multi-beneficiary projects. CUWA defines the beneficiary pays principle as requiring those receiving a benefit from a given project or program to pay a proportional share of the cost.

A functional beneficiary pays system should:

- Identify all beneficiaries (including the public) and limit “free riders”
- Establish a clear nexus between charges and benefits received
- Provide specificity, such that charges are based on defined projects with defined costs
- Provide for a joint powers forum in which beneficiaries collaborate on the integrated design of given water projects.
- Be transparent in cost allocation and investment decisions
- Dedicate funds strictly to water-related projects and programs, with no redirection of funds to other purposes
- Reasonably assure that benefits will be proportional to charges assessed
- Allow for special situations, e.g., disadvantaged communities, in which a beneficiary might not pay in proportion to benefits received.

Water Planning and Governance

[This subsection will contain a discussion of the following topics.

- Institutional improvements, expansion of IRWM partnerships (e.g., tribal) and alternatives to IRWM where appropriate.]

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Current State of the Region

Setting

The North Coast Hydrologic Region encompasses coastal areas, redwood forests, inland mountain valleys, and the semi-desert-like Modoc Plateau. Most of the region is mountainous and rugged. The dominant topographic features in the region are the California Coast Ranges, the Klamath Mountains and Modoc Plateau. The mountain crests, which form the eastern boundary of the region, are about 6,000 feet elevation with a few peaks higher than 8,000 feet. Much of the region is mountainous and rugged; only 13 percent of the land is classified as valley or mesa, and more than half of that is in the higher- elevation northeastern part of the region in the upper Klamath River Basin. Runoff, which drains westward into the Pacific Ocean, includes five major rivers, seven lesser rivers, and numerous creeks.

The North Coast Region is defined in Section 13200(a) of Porter-Cologne as follows: "North Coast region, which comprises all basins including Lower Klamath Lake and Lost River Basins draining into the Pacific Ocean from the California-Oregon state line southerly to the southerly boundary of the watershed of the Estero de San Antonio and Stemple Creek in Marin and Sonoma Counties." The North Coast Region is divided into two natural drainage basins, the Klamath River sub Basin and the North Coastal sub Basin. The North Coast Region covers all of Del Norte, Humboldt, Trinity, and Mendocino Counties, major portions of Siskiyou and Sonoma Counties, and small portions of Glenn, Lake, and Marin Counties.

The North Coast Region encompasses a total area of approximately 19,390 square miles, including 340 miles of scenic coastline and remote wilderness areas, as well as urbanized and agricultural areas. The North Coast Region is characterized by distinct temperature zones. Along the coast, the climate is moderate and foggy and the temperature variation is not great. For example, at Eureka, the seasonal variation in temperature has not exceeded 63°F for the period of record. Inland, however, seasonal temperature ranges in excess of 100°F have been recorded.

Precipitation over the North Coast Region is greater than for any other part of California, and damaging floods are a fairly frequent hazard. Particularly devastating floods occurred in the North Coast area in December of 1955, in December of 1964, in February of 1986 and over New Years of both 1997 and 2006.

PLACEHOLDER Figure NC-1 North Coast Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Watersheds

The North Coast Region includes many watersheds and basins within its boundaries. Two main sub-basins exist including the Klamath River and North Coast.

The Klamath River sub-basin contains Klamath River and all of its tributaries, the Smith River and its tributaries, Applegate, Illinois and Winchuck Rivers and includes the closed Lost River and Butte Valley hydrologic drainage areas. The western portion of the sub basin is within the Klamath Mountains and Coast Range provinces, characterized by steep, rugged peaks ranging to elevations of 6,000 to 8,000 feet

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with relatively little valley area. The mountain soils are shallow and often unstable. Precipitation ranges from 60 to 125 inches per year in the western portion. The 45-mile coastline is dominated by a narrow coastal plain where heavy fog is common. The eastern portion of the basin receives low to moderate rainfall and includes predominantly high, broad valleys such as the Butte, Shasta, and Scott Valleys. The Lost River and Butte Valley hydrologic areas are located in the Modoc-Oregon Lava Plateau. This area is characterized by broad valleys ranging from 4,000 to 6,000 feet in elevation. Typical annual precipitation is 15 to 25 inches. The Shasta Valley hydrologic area lies principally within the Cascade Range. The valley floor elevation is about 2,500 to 3,000 feet, and surrounding mountains range up to 14,162 feet (Mt. Shasta). Annual precipitation ranges from below 15 inches in the valley to over 60 inches in the mountains. The Scott River hydrologic area is in the Klamath Mountains. The valley floor elevation is also about 2,500 to 3,000 feet, with surrounding mountains range up to approximately 8,500 feet. Annual precipitation ranges from below 20 inches in the valley to over 70 inches in the western mountains.

The North Coastal sub-Basin consists of rugged, forested coastal mountains, including six major river systems: the Eel, Russian, Mad, Navarro, Gualala and Noyo Rivers. In addition, among others, the North Coastal Basin includes the Mattole and Garcia Rivers and Redwood and Stemple Creeks. Soils are generally unstable and erodible and rainfall is high. The area along the eastern boundary of the Basin is mostly National Forest land administered by the United States Forest Service. Major population areas are centered on Humboldt Bay in the northern portion of the Basin and around Santa Rosa in the southern portion. The Santa Rosa area is on the northern fringe of the greater San Francisco Bay urban area and has experienced rapid population growth in the period following the Second World War. The economy of the remainder of the Basin has developed more slowly than other areas in California (North Coast Regional Water Quality Control Board 2011).

Smith River Watershed (Oregon and California)

The Smith River is formed by the confluence of its Middle and North forks in Del Norte County, in the extreme northwest corner of California, near the community of Gasquet. The Middle Fork originates in Del Norte County, approximately 60 miles northeast of Crescent City, and flows west. The North Fork Smith River originates in Oregon on the northeast slope of Chetco Peak in the Siskiyou Mountains. The South Fork Smith River enters the Smith River near the community of Hiouchi, California. The South Fork rises on the eastern edge of the Smith River National Recreation Area, approximately 30 miles east-northeast of Crescent City, flowing southwest and then northwest. From the confluence with the South Fork, the Smith River flows generally northwest, entering the Pacific Ocean near the community of Smith River, approximately 10 miles north of Crescent City.

The Smith River estuary is located in Del Norte County near the community of Smith River. The watershed is about 614 sq miles. The Smith is the longest wild and scenic river in the US, as such, there are no impoundments. The Smith River system is the second largest free flowing river in California next to the South Fork Trinity River. It is considered one of the best fishing regions in the United States with steelhead, Chinook and other game fishes present. The region receives from 80 to 120 inches of rainfall annually.

In the Smith River basin, no significant surface water development has occurred. Domestic, agricultural, and industrial water needs are supplied through surface water diversions and groundwater pumping. Further major developments on the Smith River and any of its tributaries are forbidden by the 1972 California Wild and Scenic Rivers Act. However, minor surface water supply projects for high value

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crops in the Smith River area are possible. Because of both its geology and its limited development, the Smith River is one of the healthiest river systems in California.

Federal land management dominates the Smith River Basin. Six Rivers National Forest manages the Smith River Recreation Area, which includes 305,000 acres, or 476 square miles of the watershed. Siskiyou National Forest manages 91 square miles of the basin within Oregon. Redwood National and State Parks have jurisdiction in 25 square miles of the watershed. The total land managed by government agencies is about 83 percent of the watershed, which leaves 126 square miles in private ownership, predominantly in the lower river basin (Smith River Advisory Council 2012; North Coast Regional Water Quality Control Board 2011; United States Geological Survey, Smith River Basin 2009; National Oceanic Atmospheric Administration 2012).

Klamath River Watershed (Oregon and California)

The Klamath is the second largest river in California with an extensive watershed of almost 16,000 square miles including portions of California and Oregon. The Klamath River begins North of Klamath Falls, Oregon and meets the Pacific Ocean near the town of Klamath, California. For the sake of this discussion, the Klamath is divided into 3 areas; the upper, middle, and lower Klamath sub-basins. Hydrologic sub-basins within the Klamath Basin include Butte Valley, Lost River, Salmon River, Scott River, Shasta River and Trinity River (Gannett M 2013; United States Bureau of Reclamation 2011).

The Upper Klamath sub-basin encompasses the area upstream of the Iron Gate Dam. Only a small part of this area is located in California. Bureau of Reclamation's Klamath Project is located in the upper Klamath sub-basin in California and Oregon. The primary sub-watershed in California is the Lost River watershed, which covers approximately 1,689 square miles and includes Clear Lake Reservoir in Modoc County. The area around Clear Lake is characterized by high desert streams and is sparsely populated. Land uses in the California portion of the basin are primarily cropped agriculture, grazing, and lands administered for the Klamath Basin National Wildlife Refuge. The basin is subject to many complex jurisdictional issues associated with water delivery and utilization of water infrastructure facilities including issues related to irrigation, hydropower, endangered species, tribal rights and lake level management demands for the Upper Klamath Lake.

The Middle Klamath sub-basin is contained wholly within California extending from Iron Gate Dam to the confluence of Scott River about 10 miles upstream from Seiad Valley, excluding the Shasta and Scott Rivers. However, the Mid Klamath sub-basin is influenced by adjacent Klamath River sub-basins (the Upper Klamath, Lower Klamath, and Trinity River drainages) and by the direct effects of tributary rivers (the Shasta and Scott Rivers) which flow into the Klamath within the area of the Mid Klamath sub-basin. The lower, more western portion has a coastal influenced climate and is dominated by United States Forest Service lands while the upper, more eastern portion has a drier climate with mixed federal and private ownership (Mid Klamath Watershed Council 2006).

The Lower Klamath sub-basin begins below the confluence of the Klamath-Scott River extending to the Klamath River delta at the Pacific Ocean. Trinity River watershed, although tributary to the Klamath in this sub-basin, is considered its own watershed and is not in the Lower Klamath sub-basin. The major industry in the watershed is silviculture and some limited mining. Salmon fishing has occurred in the basin since Native American occupation, although in 2006 the commercial fishery has been restricted due to record low populations (North Coast Integrated Regional Water Management Plan 2007). However, in

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2012, we saw a large jump in returning salmon to the Klamath River believed to have occurred due to the Pacific (inter) Decadal Oscillation effect (a weather pattern similar to the El Nino/ Southern Oscillation (ENSO), affecting sea surface temperatures and the marine ecological response, i.e., a change in phytoplankton and zooplankton populations, the base of the food chain in the oceans (Mantua NJ 1997).

Scott River Watershed

The Scott River watershed is a large area with substantial variation in geology and climate. The watershed drains approximately 520,600 acres of land. Major tributaries to the 58 mile long Scott River in Scott Valley include: Shackleford-Mill, Kidder, Etna, French, and Moffett Creeks, including the South and East Forks of the Scott River. There are no water storage dams on the Scott River. Native vegetation consists of riparian vegetation along the streams, mixed-conifer forest on the western mountain slopes, with scattered meadows and brush. The Scott River has about a nine mile stretch of large historic Yuba dredge tailing piles near the head of the Valley at Callahan. The eastern mountains are covered by extensive areas of brush, oak, western juniper, and both annual and perennial grasses. The confluence of Scott and Klamath Rivers is located approximately 10 miles upstream (along Klamath River) from Seiad Valley. The Scott River drainage is bordered to the west and south by 7,000 to 8,000 foot elevation mountain ranges, including the Marble, Salmon, Trinity Alps and Scott Mountains. These ranges exert a strong orographic lift effect on incoming storms (see section on Climate and Atmospheric Evaporative Demand for a description of orographic lift- near the end of section), which allows the higher elevation mountains, along the west and south side of the Scott drainage, to receive 60 to 80 inches of precipitation annually. In contrast, the rain-shadow effect that the west-side mountains create reduces the amount of annual precipitation to 12 to 15 inches on the eastside of the watershed. Fort Jones, located at the northern end of Scott Valley, averages 21 inches of precipitation although rainfall has ranged from 10 inches in 1949 to 35 inches in 1970 showing the variability in the climate. Most of the precipitation in the Scott River watershed falls on the west side, with snow prevailing during the winter above the 5,500 foot level. Snowfall is an important component of the water supply for the region (Scot River Watershed Council 2005).

Shasta River Watershed

The Shasta River watershed includes an 800 square mile area of Siskiyou County. Mount Shasta to the south dominates the landscape, towering over 14,000 feet. However, melting snow from Mount Shasta does not contribute significantly to surface flows in the upper Shasta River because run-off sinks into the porous volcanic soils and reappears as springs on the Shasta Valley floor. The headwaters of the Shasta River are near Mount Eddy in the southwest portion of the basin. Mount Eddy is the tallest mountain in Trinity County and the Klamath range at 9,025 feet. The upper Shasta River above Dwinnell Reservoir (Lake Shastina) is swift and falls in elevation rapidly. The river below Dwinnell Reservoir is much slower, and meanders along the Shasta Valley floor. Springs in this reach add to flows and provide much needed cool water for juvenile salmon and steelhead in summer. The Klamath Mountains to the west strip most of the moisture from ocean air currents as they move eastward. The Shasta Valley itself receives only 11-17 inches of rain annually. Because so little rain falls in the Shasta Valley during the growing season, ranchers rely heavily on streamflows and ground water to irrigate crops and to water their livestock. The economy of Shasta Valley, like that of Siskiyou County generally, relies on ranching, farming, tourism and timber harvesting. Sport fishing opportunities still draw visitors to Siskiyou County because of numerous mountain lakes and productive streams. Yreka and Weed contain the largest populations in this sub-watershed (Shasta River Coordinated Resources Management and Planning 2000).

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Salmon River Watershed

The Salmon River flows from the Trinity Alps, Marble, Russian and Salmon Mountains joining the Klamath River at Somes Bar, California and is the second largest tributary to the Klamath next to Trinity River. The watershed is almost entirely public land (Klamath National Forest) containing rugged topography that is deeply incised by the river and its tributaries. Nearly the entire watershed is forested. There are no dams, diversions, urban areas or major industry in the watershed so the water is very high quality. In addition, there are no dams between the Salmon River and the ocean, making it completely accessible to anadromous fish. The cool, clean waters of the Salmon River are critical to the overall health of the Klamath River fishery. The Salmon River provides genetic stock and quality habitat for fish and other aquatic life making this watershed of great importance to the recovery of larger Klamath River watershed. Elevations in the watershed range from 456 feet at its mouth to 8,560 feet at Caribou Mountain in the Trinity Alps. The Salmon River remains culturally significant to the Shasta and Karuk people, some of whom continue to reside on the river. Approximately sixty seven percent of the watershed is in the Karuk Tribe's Ancestral Territory. Mean annual precipitation in the Salmon River watershed ranges from about 35 inches in the South Fork Salmon River Canyon to about 85 inches in the headwaters of North Fork/Little North Fork and Wooley Creek. The amount of precipitation generally decreases in an easterly direction, and increases with elevation due to orographic effects. Seasonal precipitation patterns include considerable snow, particularly at higher elevations. Approximately 90% of the precipitation occurs from October to May. The remainder occurs during summer thunderstorms. Winter precipitation occurs mainly as snow above 4,000 feet, with rain below 4,000 feet elevation. Fluctuation of the snow level occasionally results in rain falling on snow, causing rapid snow melt. Intense, localized summer showers occur frequently, and have been associated with soil erosion and debris torrents (Salmon River Restoration Council c2012; North Coast Regional Water Quality Control Board 2005).

Trinity River Watershed

The Trinity River basin drains an area of approximately 2,900 square miles of mountainous terrain. The Trinity River is the largest tributary to the Klamath River; from its headwaters in the Klamath and Coast ranges, the river flows 172 miles south and west through Trinity County, then north through Humboldt County and the Hoopa Valley and Yurok Indian reservations to its confluence with the Klamath River at Weitchpec. Much of the watershed is prone to seismically induced landslides, especially during winter months when soils are saturated. Additionally, inner valley gorges are considered highly unstable. Ground water resources are relatively plentiful throughout the watershed, but are not well defined. Annual precipitation averages 57 inches/year with a low of 37 inches in Weaverville and Hayfork and a higher rainfall of 75 inches in Trinity Center and 85 inches in the Hoopa Mountains. There are occasional summer thunderstorms that produce extensive runoff and may start wild fires.

The Trinity River watershed is primarily rural with human populations centered near Trinity Center, Weaverville, Lewiston, Hayfork and Hyampom. Timber harvest has traditionally been a large factor in the economy on both federal and private land. The US Forest Service (USFS) and the Bureau of Land Management (BLM) manage approximately 80 percent of the land in the Trinity watershed; of the remaining 20 percent, about half are industrial timberlands.

In the early 1950s two major water-development features were installed above river-mile 112 and the community of Lewiston. This "Trinity River Diversion (TRD)" consists of Lewiston Dam and its reservoir and related facilities and Trinity Dam and its reservoir (known as Trinity Lake). The TRD

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project diverts a majority of the upper-basin's water yield at Lewiston for power generation and to support the US Bureau of Reclamation's (USBR) Central Valley Project (CVP). The hydrologic changes produced by the TRD project have altered stream-channel conditions and instream habitat for many miles below Lewiston. Trinity River downstream of the TRD provides habitat not only for anadromous salmonids and other native species, but also the non-native brown trout.

In 1955, Congress authorized the construction of Lewiston and Trinity Dams on the Trinity River for the export of water into the Central Valley – the Trinity River Diversion (TRD). Operations of the TRD began in 1964 and were integrated with operations of Shasta Dam (Trinity River Restoration Plan 2012; United States Department of Interior 2000).

Water quality in the Trinity River basin ranges from the high quality, pristine waters that emerge from the Trinity Alps wilderness to various degrees of impairment in the mainstem and southern tributaries which are caused in part by human activity. Timber harvest, road construction, and associated activities are recognized as sources of sedimentation and high summer water temperatures. Mining for gold, both currently and historically, is also a source of impairment. Recreational instream suction dredging (mining) causes sedimentation, especially in the mainstem and canyon areas, and legacy effects from historic gold mining include acid mine drainage and mercury pollution. Please see section on Governance for more information on instream mining (suction dredging).

Humboldt Bay Watershed

The Humboldt Bay watershed encompasses water bodies that drain to the Pacific Ocean from Humboldt Bay north to Redwood Creek. The major river systems in the watershed are the Mad River and Redwood Creek. Other water bodies within this watershed include Humboldt Bay and Mad River Slough, coastal lagoons (Big, Stone, and Freshwater Lagoons) and streams (Elk and Little Rivers and Freshwater, Jacoby, and Maple Creeks). In the east, the terrain is elevated hillslope with coastal plain occurring in the west. Precipitation ranges from 32 to 98 inches annually. The streams support production of anadromous salmonids, including steelhead and cutthroat trout, Coho and Chinook salmon. Humboldt Bay is an important commercial and recreational shellfish growing and harvest area and provides the largest port between San Francisco and Coos Bay, Oregon. Urbanized areas include Trinidad, McKinleyville, Arcata, and Eureka with rural residential areas scattered throughout the watershed. The majority of the population lives in the Humboldt Bay area cities of Arcata and Eureka.

The Mad River watershed has a long history of timber harvest on both USFS and private land. Gravel mining occurs in the lower portions of the watershed. Private landowners conduct grazing and limited agriculture in the flat areas around Humboldt Bay. The Mad River flows directly to the Pacific Ocean North of Arcata near McKinleyville.

The Mad River is Clean Water Act (CWA) section 303(d) listed for sediment and temperature impacts. The primary issues for water quality are forestry related, with urbanization and associated industrial and public nonpoint sources. The drinking water for most of the Humboldt Bay area is supplied by Ranney Collectors in Mad River with other coastal streams providing drinking water for other communities. Mad River is continuously supplied with water via releases from Ruth Reservoir (with 48,030 acre-foot storage capacity), although these supplies are dependent on adequate precipitation and flows through the season. The Eureka waterfront was the site of several industrial operations that left the soil and groundwater

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contaminated with heavy metals, petroleum products, and pentachlorophenol's (PCPs). The waterfront is now undergoing redevelopment and decontamination efforts continue.

Redwood Creek flows into the Pacific Ocean near the town of Orick located about 35 miles north of Eureka. Redwood Creek drains a 285 square mile area and is about 67 miles long. The watershed is located entirely within Humboldt County.

Redwood Creek is a basin of mixed ownership and contains a rich blend of industrial and non-industrial timberlands, coastal and upland agricultural lands, state and federal national parks, other federal properties, and the unincorporated town of Orick. Redwood Creek supports three federally listed as threatened salmonids species as well as the non-listed coastal cutthroat trout and resident fish species. The watershed also provides domestic water supplies to rural communities and recreational opportunities.

Redwood Creek is a model watershed where government agencies, private landowners, non-profit organizations and the local communities are cooperating to restore and protect water quality and the associated aquatic and riparian resources, providing economic opportunity to the Orick community. The watershed has a rich history of scientific studies that spans decades and well-established cooperation between groups with seemingly conflicting interests. The watershed is home to pioneering work in watershed restoration and erosion control.

The Redwood Creek watershed is a mixed ownership of private (56 percent) and public (44 percent) lands. More than 90 percent of the private lands are managed for timber production and ranching by eight private landowners. The upper two-thirds of the watershed contain vast expanses of timber and ranch lands managed primarily by seven landowners. Timberlands have been maintained in large unbroken tracts of lands, which have slowed rural residential development in upland areas. Located along the coast, the small town of Orick is the only municipality in the watershed and has a population of about 357 people (2010 US Census). Orick is relatively isolated from other north coastal communities and qualifies as a "disadvantaged community." The Orick Valley contains the coastal floodplain of Redwood Creek and is one of only two groundwater basins identified in the watershed. The town of Orick is located in Orick Valley and is the major socioeconomic center in the watershed. Orick is located along U.S. Highway 101 and is the southern gateway to Redwood National and State Parks.

Redwood National Park and Prairie Creek Redwoods State Park are located in the lower part of the Redwood Creek basin. This sub-basin has been extensively researched and is considered a "reference watershed" that displays nearly pristine conditions, and is home to significant old growth stands of coast redwood. In 1982 the park received international recognition when it was designated as both a World Heritage Site and International Biosphere Reserve. The protection of streamside redwoods along Redwood Creek was a central issue for the establishment and expansion of Redwood National Park and is linked to upstream watershed conditions (Redwood Creek Watershed Group 2006).

The Eel River and its tributaries comprise the third largest river system in California, and the largest river system draining to Humboldt County's coast. The Eel River encompasses roughly 3,684 square miles. The main tributaries to the Eel River are the Van Duzen River, the Bear River, Yager, Larabee, Bull and Salmon Creeks. Lake Pillsbury is located near the headwaters of the mainstem Eel. The upper watershed is mountainous and soils are steep and highly erodible. In the west, the river meanders on a coastal plain and is joined by the Salt River, near Ferndale, before entering the Pacific Ocean. Several dairies are

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located on the coastal plain, as well as several small towns. Other communities in the watershed include Scotia, Garberville/ Redway, Laytonville, and Willits. In many of the alluvial valleys, surface and ground water are closely connected, thus surface water withdrawals have a substantial effect on local groundwater supplies. A Northwestern railroad line following along the Eel River has fallen into disrepair due to numerous landslides and accidents. Currently, there are no plans to revive the railroad due to the high cost of highway re-alignment and construction. The Eel River watershed is a well-known recreation destination with numerous state and private campgrounds along its length; beneficial uses include water contact and non-contact uses such as swimming, boating and camping. The river also supports a large recreational fishing industry being the third largest producer of salmon and steelhead in the State of California. Due to the erodible soils, steep terrain, and land use history, there is significant concern for the viability of this anadromous fishery resource.

A longstanding transfer of water occurs downstream from Lake Pillsbury at Cape Horn Dam (Van Arsdale Reservoir) moving water from the Eel River to the Russian River watershed (Potter Valley Project). This out of basin transfer from the Eel River to the Russian River began in 1908 with the Eel River Power and Irrigation Company. The purpose of this project was to supply the nearby town of Ukiah with electricity and improve streamflows in the Russian River for municipal, industrial and agricultural uses.

The Potter Valley Project (Project) was first licensed as a hydroelectric power plant in 1922 by the Federal Power Commission. The original 50 year license expired in 1972. From 1972 until 1982, the Project was operated with a license that was granted annually while discussions regarding the operation were undertaken by PG&E, Federal Energy Regulatory Commission (FERC), Fishery Agencies and stakeholders. In 1978 a Final Environmental Impact Statement (EIS) was issued by FERC. Several years of discussion ensued until, in 1983, the Project was relicensed for 50 years (from the original expiration date of 1972). The 1983 settlement agreement was signed by PG&E, California Department of Fish and Game (CDFG, now Department of Fish and Wildlife, CDFW) and the counties of Humboldt, Mendocino and Sonoma. Part of the new license was Article 39 which required a 10 year study be undertaken to determine what the new Project flows impact was on salmon and steelhead and to adjust them accordingly. A Fisheries Review Group (FRG) was formed which consisted of scientists from PG&E, U.S. Fish and Wildlife Service (FWS), CDFG (CDFW) and the National Marine Fisheries Service (NMFS). In March of 1998, after ten years of studies, the FRG completed their findings and a report was filed with FERC recommending flow modifications. FERC began their EIS process. Over the next year, two other entities, including the Round Valley Indian Tribes (RVIT) and the Sonoma County Water Agency (SCWA), submitted proposals for minimum flow releases to FERC. FERC held public scoping meetings and many organizations, municipalities, water districts, environmental groups and governmental agencies joined as interveners in the process. A Draft EIS was completed by FERC in February 1999. After further public meetings, many comments, additional proposed alternatives and new modeling inputs; FERC issued their Final Environmental Impact Statement in May 2000.

The FERC recommendation was based predominately on the FRG proposal prepared by the scientists with the most history and knowledge of salmon and steelhead populations specifically in the section of Main Stem of the Eel River impacted by the Project. The resulting complex flow regimes were calculated in such a way as to make the Project nearly invisible to the environment by releasing flows below Cape Horn Dam to mimic natural flows as closely as possible.

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After a lengthy Section 7 Consultation between NMFS, PG&E and FERC, under the Endangered Species Act, NMFS produced a Biological Opinion and Reasonable and Prudent Alternative (RPA) for the Project flows and submitted it to FERC in November, 2002. The NMFS RPA generated extensive discussion between the agencies and stakeholders that had been involved in the license amendment proceedings since 1983. Ultimately, FERC issued a Final Order Amending the License for the Project January 28, 2004. The Project license expires April 14, 2022 (Potter Valley Irrigation District c2012).

North Coast River Watersheds

The North Coast Rivers not included in other watershed groups are included in this grouping. The major watersheds within this grouping include the Bear River, Mattole River, Ten Mile River, Noyo River, Big River, Albion River, Navarro River, Greenwood, Elk and Alder Creeks, Garcia River and Gualala River. The twelve Critical Coastal Areas in the North Coast Watershed are the Mattole River, King Range National Conservation Area, Pudding Creek, Noyo River, the Pygmy Forest Ecological Staircase, Big River, Albion River, Navarro River, Garcia River, the Kelpbeds at Saunders Reef, Del Mar Landing Ecological Reserve, and Gerstle Cove.

Bear River

Bear River is a coastal stream located to the north of the Mattole River watershed draining approximately 53,287 acres to the Pacific Ocean. The connection between the Bear River and the Pacific Ocean is periodically blocked by a temporary sand bar during summer low flow. The lagoon-type estuary is approximately one-quarter mile in length. The two major land uses in the basin consist of agricultural grazing and timber harvest. Humboldt Redwood Company (formerly Pacific Lumber) owns 16,537 acres of land in the upper portion of the watershed, all of which is covered by its 1999 Habitat Conservation Plan (HCP). The majority of remaining acreage in the watershed is in private ownership (36,839 acres), while 161 acres is owned by State Parks (National Oceanic Atmospheric Administration, National Marine Fishery Service 2012).

Mattole River

The headwaters of the Mattole River begin in Mendocino County, flowing northward 62 river miles, through steep, forested lands in Humboldt County and into the ocean ten miles south of Cape Mendocino. Tributaries to the Mattole River include Mill, Squaw, Bear, Thompson, Honeydew, and Bridge Creeks. The watershed encompasses approximately 304 square miles and is subject to varying rainfall; near the coast, the river receives about 50 inches per year while near the headwaters, about 115 inches of rain fall per year. The largest communities are Petrolia, Honeydew and Whitethorn, but the 2000-person population is scattered throughout the watershed. Small landowners (those with less than 450 acres) own about 43 percent of the watershed, the Bureau of Land Management (BLM) owns about 12 percent with commercial timber companies owning most of the remaining land. Silviculture and ranching are the predominant businesses; water quality problems are those associated with timber harvest, road building, forest conversion, and overgrazing. Fish species known to inhabit the Mattole River include Coho, Chinook, steelhead, rainbow trout, and brook lamprey; other species include the southern torrent salamander and tailed frog.

Ten Mile River

The Ten Mile River watershed covers approximately 120 square miles. It is about eight miles north of the City of Fort Bragg and shares ridges with Pudding Creek and the North Fork of the Noyo River to the south and Wages Creek and the South Fork of the Eel River to the north. Elevations range between sea

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level and 3,205 feet. Near the coast, the terrain is comprised of an estuary and a broad river floodplain with more rugged mountainous topography in the eastern portion of the watershed. Most of the basin, except the northeast grasslands, coastal plain, and estuary, is characterized by narrow drainages bordered by steep to moderately steep slopes. The watershed has abundant rainfall and cool temperatures during the winter with dry, warm summers interspersed with breezes and coastal fog. Precipitation in the western part of the watershed is about 40 inches per year while about 70 inches per year occurs in the eastern part of the watershed.

The watershed is entirely privately owned. Hawthorne Timber Company, LLC, which is managed by Campbell Timberland Management, LLC, owns about 85 percent of the watershed. Three small non-industrial timber owners and a few residences make up the remainder of the ownership. The watershed has a long history of timber harvest.

The coldwater fishery that supports Coho, Chinook, and steelhead is the primary and most sensitive beneficial use in the watershed. Protection of these species is considered to protect any of the other beneficial uses identified in the watershed that could be impaired due to water quality.

Noyo River

The Noyo River watershed encompasses the 113 square mile coastal drainage system immediately west of the City of Willits, flowing into the Pacific Ocean at the City of Fort Bragg. The climate consists of moderate temperatures – an annual average of 53 degrees F - and an average annual rainfall of 40 - 65 inches.

Silviculture is the primary land use within the watershed. Approximately 50 percent of the watershed is owned by two commercial silviculture operations: the Mendocino Redwood Company and Hawthorne Timber Company (managed by Campbell Timberland Management). The Jackson Demonstration State Forest (administered by the California Department of Forestry and Fire Protection) encompasses about 19 percent of the watershed. Critical Coastal Areas in the vicinity of the watershed include Pudding Creek, Noyo River, and the Pygmy Forest Ecological Staircase. Minor land uses in the basin include ranching and recreation. The mouth of the Noyo River contains a marina and fish processing facilities in support of the local commercial fishing industry. The Noyo is the primary drinking water source for the City of Fort Bragg and also provides habitat for steelhead, Coho, and Chinook. It is listed as impaired by sediment, due in part to timber harvest, grazing, and related human activities.

Big River

The Big River watershed drains about 181 square miles. The watershed drains from east to west, and shares ridges with the Noyo River watershed to the north, the Eel River watershed to the east, and the Little, Albion and Navarro River watersheds to the south. The Big River estuary is located immediately south of the town of Mendocino. The climate is characterized by a pattern of low-intensity rainfall in the winter and cool, dry summers with coastal fog. Mean annual precipitation is approximately 40 inches near the western part of the watershed and about 51 inches at Willits to the east.

The predominant current and historic land use is silviculture with less area used for ranching. The largest community is the town of Mendocino. Together, the five largest property owners –four private timber companies and Jackson State Demonstration Forest, own 83 percent of the watershed. Thirty-one property

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owners own another 14 percent of the land (parcels from 160 to 3,760 acres), and private residences make up the rest of the land use.

Albion River

The Albion River watershed drains approximately 43 square miles. It drains primarily from east to west, and shares ridges with the Big River watershed to the north and northeast and the Navarro River watershed to the south and southeast. The Albion River estuary is located near the town of Albion, about 16 miles south of the City of Fort Bragg. Elevations range from sea level to 1,566 feet and the watershed is dominated by relatively flat marine terraces that extend several miles inland and are incised by gorges carved by the major river channels and streams. The climate in the watershed is characterized by a pattern of low intensity rainfall in the winter and cool, dry summers with coastal fog. Mean annual precipitation is about 40 inches near the western margin of the watershed and about 51 inches to the east at Willits. The main tributaries of the Albion River include Railroad Gulch, Pleasant Valley Creek, Duck Pond Gulch, South Fork Albion River, Tom Bell Creek, North Fork Albion River, and Marsh Creek.

Over half of the watershed (54%) is owned by Mendocino Redwood Company. Smaller industrial timberland ownerships, some ranches, and numerous smaller parcels that are mostly residences comprise the other half. The predominant historic and current land use is silviculture, with some agricultural and recreational uses. The Albion River estuary, which remains open to the sea year round, is used as a commercial and sport fishing harbor for small boats. The river and estuary have historically served as habitat for Coho, Chinook and steelhead. Beneficial uses associated with the coldwater fishery are the most sensitive of the beneficial uses in the watershed; protection of these beneficial uses is thought to serve to protect other beneficial uses harmed by excessive sediment.

Navarro River

The Navarro River watershed encompasses approximately 315 square miles. The Navarro River flows through the coastal range, Anderson Valley, and into the Pacific Ocean. It is the largest coastal basin in Mendocino County. Rainfall averages about 40 inches per year at Philo, along Highway 128, and mostly occurs between December and March.

Land-uses in the watershed include silviculture (70%), rangeland (25%), and agriculture (5%) with a small percentage devoted to rural residential development. Timber production, ranching and other agricultural activities are historic activities that continue to the present day, while the fishery has decreased. Anderson Valley today supports orchards and a growing viticulture industry.

Greenwood Creek

The Greenwood Creek Watershed encompasses approximately 25 square miles and is located on the southern Mendocino Coast with Greenwood Ridge as its northern border, Clift Ridge as its southern border, and Signal Ridge as its eastern border. Greenwood Creek is a Class I coastal stream and provides habitat for steelhead and Coho salmon. Class I streams are streams where fish are always or seasonally present. Class II streams are streams where fish are not present, but aquatic non-fish vertebrates and /or aquatic benthic macro-invertebrates exist. Class III streams do not support aquatic life.

Land use in the watershed is primarily for timber production, viticulture, fruit orchards, residential and some cattle ranching. Most of the watershed is privately owned; Mendocino Redwood Company holds about 60% as Timber Production Zone (TPZ) land, and approximately 50 smaller landowners own the

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rest of the watershed. The only public land in or adjacent to Greenwood Creek is Greenwood State Beach, which contains the Greenwood Creek estuary, and a small parcel owned by the Elk County Water District.

Garcia River

The Garcia River watershed encompasses approximately 114 square miles in southwestern Mendocino County. The river forms an estuary that extends from the ocean to the confluence of Hathaway Creek. The floodplains of the lower portion of the watershed are primarily cropland.

The primary historic land uses include silviculture, dairy ranching, and gravel mining; these have not changed during the past two decades. Timber harvesting remains the dominant land use activity, but hillside vineyard development is becoming a concern for production of sediment as land is increasingly converted to new vineyards. The watershed is completely privately owned by multiple owners. The river and estuary provide habitat for salmonids and identified beneficial uses include commercial and sport fishing. The Garcia River has been listed as impaired due to sediment.

Gualala River

The Gualala River watershed encompasses about 300 square miles; the Gualala River flows from Mendocino County to Sonoma County in a north-south direction, reaching the ocean at the town of Gualala. The watershed contains mostly mountainous terrain where tributaries flow through steep valleys with narrow floors that contain erodible soil. Most of the annual precipitation occurs between October and April, with the greatest amounts in January. Rainfall averages about 38 inches per year at the coast and up to 100 inches per year on the inland peaks.

The primary historic land uses are silviculture, orchards, and ranching with timber harvest still an important industry. Timber companies own about one-third of the watershed; Gualala Redwoods Inc. is the largest commercial owner, holding about 30,000 acres. Orchards and ranching are on the decline while the watershed has seen an increase in hillside vineyard development, which threatens to continue to impair water quality with respect to sediment delivery. The Gualala River provides the primary source of drinking water for Sea Ranch and Gualala. The watershed supports an anadromous fishery that includes Coho salmon.

Russian River Watershed

The Russian River watershed encompasses 1,485 square miles in Mendocino and Sonoma counties. It is bounded by the Coast Ranges on both the east and west. The mainstem is about 110 miles long and flows from north of Ukiah southward through Redwood Valley (Mendocino County) to its confluence with Mark West Creek near Santa Rosa, where it turns west, passes through the coast range, and empties into the Pacific Ocean near Jenner, California. The summer climate is moist and cool near the coast with temperatures increasing in the valley areas which are isolated from the cooling coastal influence. During winter, average rainfall ranges from 30-80 inches, depending on locale.

Reservoirs that provide flood protection and water supply storage include Lake Sonoma (Warm Springs Dam) located at the confluence of Warm Springs Creek and Dry Creek west of Healdsburg and Lake Mendocino (Coyote Valley Dam) on the East Fork Russian River near Ukiah. A diversion from the Eel River via the Potter Valley Project (Van Arsdale Reservoir, Cape Horn Dam) for the purposes of power

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production and water supply provide considerable benefit to the overall water storage in Lake Mendocino. The Russian River watershed supplies drinking water for over 570,000 people.

The Russian River watershed is primarily an agricultural area with the greatest emphasis on vineyard and orchard crops. Major orchard crops include prunes, pears and apples, while other crops such as cherries and walnuts are also produced. Besides agriculture, there is a growing trend toward light industry and commercial development and a significant telecommunications industry within the region. The production and processing of timber, agricultural and animal products, gravel removal and processing, energy production and miscellaneous light manufacturing operations are additional industrial activities in the watershed. The Russian River watershed also has developed an international reputation for the production of premium wines, contributing to a strong tourism industry within the region (Sonoma County Water Agency 2003).

Bodega Watershed

The Bodega watershed contains streams with headwaters in the Coast Range entering the Pacific Ocean south of the Russian River. Salmon, Americano and Stemple Creeks and their associated estuaries are the main water bodies in this watershed. The terrain is relatively steep and erodible and is sensitive to disturbance. Cooler temperatures and relatively high winter rainfall due to coastal influences typify the climate of the Bodega watershed. Because of the Mediterranean climate, summertime flows are often nonexistent in Americano and Stemple Creeks, while Salmon Creek flow is low but sustained. Each of these watersheds have estuary areas, however, the Estero Americano (Americano Creek) and the Estero de San Antonio (Stemple Creek) are prized for their resemblance to fjords and the enhanced resource values associated with isolated estuarine environments.

Groundwater Aquifers

[Information for this section will be completed by Groundwater Enhancement Team]

[Alluvial Aquifers]

[Fractured Aquifers]

[Priority Basins]

[See GW plan developed parallel to Update 2013]

[Possible resources include Basin Plan, IRWM, KBRA, Flood Documents, Dan's report on Klamath Basin]

[Describe major or significant groundwater basins found in this region.]

[Description could include major agricultural served and municipal areas served.]

[Trends in the use of groundwater, such as more reliance.]

A 7 year plus static well study of 30 wells has been undertaken in the Scott Valley by the University of California Cooperative Extension. Dr. Thomas Harter (University of California Cooperative Extension,

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Davis) is near completion of a model for Scott River groundwater under a NCRWQCB grant to study interconnected relationships between ground and surface water in the Valley. Siskiyou County has a groundwater ordinance and a voluntary groundwater management plan for Scott Valley that will be considered by the Board of Supervisors (Scott Valley Ground Water Management Plan 2012). (Update this section.)

Ecosystems

[Placeholder – Additional content on Ecosystems is being developed.]

Natural ecosystems are the result of the interactions of the abiotic and biotic (non-living and living) components that interact as a unit. The climate, location, soil, biota, and topography of the North Coast Region have contributed to the development of large ecosystems that have come to characterize the region. Major ecosystems of the region include forests, estuaries and coastal tidelands, riverine, and sagebrush steppe.

Forests

Conditions in the region are conducive to forest ecosystems. From an ecosystem perspective, all plants, animals and other organisms as well as the natural woodland units comprise a forest ecosystem. Forests store large amounts of water because of their large size and physiological characteristics. They are important regulators of hydrologic processes, especially those involving groundwater, evaporation and precipitation patterns. Forests accumulate large amounts of biomass and have been referred to as the most effective land cover for the maintaining water quality. Forest cover has been directly linked to drinking water treatment costs; the more forest in a source watershed, the lower the treatment costs (Common Waters Fund c2012).

Estuaries and Coastal Tidelands

An estuary is a coastal area where fresh water from rivers and streams meets and mixes with salt water from the ocean. Estuaries and littoral (near shore) ecosystems are very significant to the North Coast region because they provide feeding and nesting habitat for many species of waterfowl and shore birds and are an important feature for migratory birds along the Pacific Flyway. Estuaries and coastal ecosystems are valuable to foraging sea birds and marine mammals. Estuaries function as feeding and sheltering habitats for salmonids. The North Coast hydrologic region includes 340 miles of coastline.

Tidelands and marshes too, are extremely important to many species of waterfowl and shore birds, both for feeding and nesting. Cultivated land and pasture lands also provide supplemental food for many birds, including small pheasant populations. Tideland areas along the north coast provide important habitat for marine invertebrates and nursery areas for forage fish, game fish, and crustaceans. Offshore coastal rocks are used by many species of seabirds as nesting areas (North Coast Regional Water Quality Control Board 2007).

Riverine Ecosystems

Riverine ecosystems are those environments that relate to, formed by, or situated on streams or rivers. These systems are complex, and result from the physical, chemical, and biological processes acting upon that system. Many of the rivers of the North Coast retain functional habitats and geomorphic processes

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but are affected by land use practices and invasion of non-native plants. The life cycle of salmonids is so closely interwoven with water quality and quantity; they are an excellent indicator of the "health" of streams and rivers.

Sagebrush Steppe

The common perception of the north coast ecosystems are related to the forests, rivers and proximity to the ocean. However, in the northeastern portion of this region, Modoc and Siskiyou Counties, Sagebrush Steppe ecosystems are predominant. A sagebrush steppe ecosystem is largely treeless and dry with dominant plant communities consisting of sagebrush shrubs and short bunchgrasses.

Ecosystem Restoration

Chapter 22 of the CWP Update 2013 discusses the role of ecosystem restoration as a resource management strategy. This strategy focuses on restoration of aquatic, riparian and floodplain management actions because they are the natural systems most directly affected by flood and water management actions, and are likely to be affected by climate change.

Nearly 49% of the North Coast region is permanently protected as open space and includes parks, reserves, recreation areas, national monuments, national forests, state forests, and other protected areas. Over a million acres in the region have been designated as National Wilderness Areas. The North Coast region also includes 21 area listed as Critical Coastal Areas, 12 Marine Protected Areas, and 8 areas of Special Biological Significance (North Coast Integrated Regional Water Management Plan 2007).

California Department of Fish and Game (Fish and Wildlife) recommends that priority be given to the following actions be taken in relation to water supply in the North Coast region:

- Restoration projects that facilitate the improvement of aquatic habitat, including deep and shallow open water;
- Actions that will offset, mitigate-for, or accommodate climate change related environmental issues such as sea water rise, temperature shifts, potential regime changes, etc…;
- Acquisition of conservation easements on lands;
- Protect or restore fish habitat through the improvement of fish passage conditions, gravel augmentation, hydrology, fish screens, min/max flow, etc…;
- Development, collection and publication of instream flow data, including recommended instream flow levels and minimum instream flow requirements;
- Prevent or reduce negative impacts from invasive non-native species including those associated with water supply and conveyance projects such as quagga and zebra mussels, *Egeria densa* (Dense waterweed, Brazilian Waterweed, Elodea), water hyacinth, and others;
- Restoration projects that facilitate the increase of populations and improvement of habitat for salmon, especially Coho;
- Restoration projects that improve upon existing wetlands, or create new wetlands in appropriate areas;
- Improvements in the transparency and availability of environmental data;
- Acquisition of water for wildlife areas to assure health of the area;
- Water quality improvements (sediment, oxygen saturation, pollution, temperature, etc…) to support healthy ecosystems;
- Improvements in coordination, management and implementation of watershed administration.

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Restoration efforts that support or are undertaken in conjunction with projects related to water supply contribute to the protection and sustainability of ecosystems in the region. Presently, there are many efforts to restore ecosystems in the region and to list them all is beyond the scope of this regional report. This section describes a few representative projects that are being implemented in the region. They are notable in that they are collaborative undertakings, involving state, federal, local agencies and communities in the North Coast region.

Sagebrush Steppe Ecosystem Restoration

Restoration efforts in the upper Klamath Basin include the eradication of juniper within the sage steppe ecosystem and associated vegetative communities of Northeastern California. The effort began with a series of information discussions between the Modoc National Forest, the Bureau of Land Management and local resource agencies in the region. In April of 2008, the final Environmental Impact Statement (EIS) was issued for the Sage Steppe Ecosystem Restoration Strategy. The restoration strategy EIS affects Modoc, Lassen, Shasta, and Siskiyou Counties as well as a portion of Washoe County in Nevada.

The action was undertaken because of the loss of sagebrush ecosystem processes and vegetation conditions where the density of western juniper has created a shift in dominant vegetation in the region. The purpose of the restoration strategy is to improve watershed function and condition, restore biodiversity and productivity, manage fire fuel loads, and to implement, where appropriate, national renewable energy directives. Projects have been completed recently to implement this strategy. A similar effort is underway in Southern Oregon as well (Bureau of Land Management, Modoc National Forest 2008).

Klamath Basin National Wildlife Refuge Complex

The Klamath Basin National Wildlife Complex is a wildlife refuge operated by the USFWS located in the Klamath Basin in southern Oregon and Northern California. The complex consists of Lower Klamath NWR (National Wildlife Refuge), Clear Lake NWR, Upper Klamath NWR, Tule Lake NWR, Klamath Marsh NWR and the Bear Valley NWR. Klamath Basin habitats include freshwater marshes, open water, grassy meadows, coniferous forests, sagebrush grasslands, agricultural lands and rocky cliffs and slopes. These habitats support large numbers of resident and migratory wildlife. The refuge also serves as a major stopping point for fall concentrations of Pacific Flyway waterfowl. See the next section for information relating to the effect of the Klamath Basin Restoration Agreement on the refuges (United States Fish and Wildlife Service 2012).

Klamath Basin National Wildlife Refuge Complex is governed by the Kuchel Act which specifically designates agriculture as a use of the Wildlife Refuges. In 1964, the Kuchel Act established the purposes of the refuge to be "dedicated to wildlife conservation...for the major purpose of waterfowl management, but with full consideration to optimum agricultural use that is consistent therewith"

"The Secretary shall, consistent with proper waterfowl management, continue present patterns of leasing.... Leases for these lands shall be at a price or prices designed to obtain the maximum leasing revenues. The leases shall provide for the growing of grain, forage and soil building crops, except that not more than 25 per centum of the total leased lands may be planted to row crops."

Grains are grown that help to feed the migrating birds and are an important deterrent from birds moving further south to eat rice and other central valley crops. It is also governed by the bi-state Klamath

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Compact approved by Congress in 1957 to establish a hierarchical priority of use for conflicting water appropriations: (a) domestic use; (b) irrigation use; (c) recreational use, including use for fish and wildlife; (d) industrial use, and (e) generation of hydroelectric power (Klamath Basin Crisis 2009).

PLACeHOLDER Photo NC-1 Geese and Mt. Shasta as seen from the Klamath Basin National Wildlife Refuge

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

River Restoration

Klamath River

The Klamath Basin Restoration Agreement (KBRA), if implemented, will contain as its name implies, strategies for restoring the fisheries and associated habitats for the Klamath River Watershed. The tentative agreement is the result of a collaborative effort of a large group of stakeholders who have worked together to find solutions to water conflicts in the region. The plan was tentatively adopted in January of 2010 and will implement fisheries restoration with the removal of four dams that were constructed in the early 1900's as part of the United States Bureau of Reclamation's Klamath Reclamation Project.

The KBRA is intended to result in effective and durable solutions which:

1. In concert with the removal of four dams, will restore and sustain natural production and provide for full participation in ocean and river harvest opportunities of fish species throughout the Klamath Basin;
2. Establish reliable water and power supplies which sustain agricultural uses, communities, and National Wildlife Refuges; and
3. Contribute to the public welfare and the sustainability of all Klamath Basin communities.

According to the agreement, the dam removal would begin in 2020. Although the agreement has been tentatively adopted, there are controversial issues and highly charged reactions to this plan (Klamath River Restoration 2012).

Siskiyou, Del Norte and Modoc Counties did not endorse the KBRA and the Klamath County Oregon Commissioners recently voted to remove their endorsement. Siskiyou County actively opposes the agreement and has indicated its intention to file suit if a Secretarial determination is made to remove the four hydropower dams (Secretary of the Interior, Ken Salazar failed to make such a determination before the planned deadline).

In excess of 75% of the voters in Siskiyou and Klamath Counties opposed dam removal in advisory measures on the ballot. The Hoopa tribe also opposes it. Legislation necessary for Congressional approval and federal endorsement of the KBRA has failed to pass out of committee. In addition, California has been unable to produce its promised water bond money. There have also been several scandals regarding scientific integrity surrounding the EIS/EIR and the BoR. In all likelihood, it appears this unfair and poorly conceived agreement will founder. If not, it will be tied up in court for many years (Klamath Facilities Removal Comments Nov 2011; Klamath Basin Settlement Agreement documentation 2013).

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Furthermore, according to the Camp Dresser & McKee, Incorporated (CDM 2008) report, and depending on whether there is contamination in the sediment, the cost of dam removal has been estimated as follows: J.C. Boyle from $14-21 million; Copco 1 and 2 from $11 million -3 billion; Iron Gate from $50 million - $2 billion. Siskiyou County also has a demolition ordinance which will impose additional costs not yet considered. From an economic impact report done by EcoTrust, the annual replacement costs for the lost power are estimated to be: $27.7 million for natural gas; $31 million for cogeneration; $26.7 million for wind and $21.6 million for coal. California is also finding out that its emphasis on wind and solar for alternative energy will possibly cause power brown outs and that generation sources such as hydropower are invaluable in stabilizing the stream of energy as water can be stored and released during periods when needed most (Camp Dresser & McKee 2008; Siskiyou County Ordinances 2009; EcoTrust 2006).

In addition, the Klamath River Dam Removal process fails to protect Siskiyou County from the impacts of removing the dams. Impacts to roads plagued by poor underlying soils, bridges, subsequently inundated lands, property values of people who live behind the reservoirs, loss of tax revenues, dropping domestic well levels in the areas, loss of a mature recreational bass fishery, disposal of thousands of tons of debris from the dams, un-restored raw banks delivering sediment for decades and other subsequent environmental damage.

Shasta and Scott Rivers

During the past 20 years, extensive restoration has been completed by the Shasta Resource Conservation District and Coordinated Resource Management Program in the Shasta Valley and by the Siskiyou RCD and Watershed Council in the Scott Valley. There are also water trusts in both valleys with Scott River Water Trust beginning in 2007 and Shasta River Water Trust beginning in 2012. Every water diversion accessible by Coho has a fish screen. Diversions have headgates and most are managed by a watermaster. Ninety percent (plus) of the mainstem Scott River is fenced to keep cattle from entering the stream. There have been numerous riparian plantings, bank stabilizations and hundreds of projects on both rivers. As part of the Five County Salmonid Conservation program, hundreds of miles of barriers to fish passage have been removed; road culverts and conditions have been inventoried and treated to improve overall habitat and migration (Scott River Water Trust 2013; Shasta River Water Trust 2013; Shasta River Water Association 2013; Five Counties Salmonid Conservation Program 2013).

Excerpt from the 2009 California Tribal Water Summit

Interconnection of the Trinity and Sacramento Rivers adds Federally Reserved Indian Water and Fishing Rights to California's Central Valley Water Issues.

Since time immemorial, the fishery resources of the Klamath and Trinity rivers have been the mainstay of the life and culture of the Hoopa Valley Tribe. The fishery was "not much less necessary to the existence of the Indians than the atmosphere they breathed." Blake v. Arnett, 663 F.2d 906, 909 (9th Cir. 1981). The salmon fishery is central to Hoopa culture and its economy. The lower twelve miles of the Trinity River and a stretch of the Klamath River flow through the Hoopa Valley Reservation, established in 1864.

The Trinity River Division of the Central Valley Project ("CVP", USBR) was authorized in 1955 and completed in 1963. The Division is the only source of water imported by the CVP. Congress included area-of-origin protections for the Trinity River, including one establishing flow release procedures for Trinity River fish and wildlife preservation and propagation. The Bureau of Reclamation informed Congress that it would divert approximately 50% of Trinity River water into the Sacramento River.

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However, until the 1992 enactment of the Central Valley Project Improvement Act, Pub. L. 102-575 ("CVPIA"), the Bureau consistently diverted 90% of the Trinity River water. That procedure not only created undue reliance on water resources in the Central Valley, but it also devastated the Trinity River fishery.

Several legislative, judicial and administrative initiatives culminated with the enactment of a Trinity River restoration provision in the CVPIA. Public Law 102-575 § 3406(b)(23) required the Secretary of the Interior and the Hoopa Valley Tribe to develop a Restoration Plan. If the Secretary and the Tribe concurred in the plan, the Secretary was required to implement it according to its terms.

In 2000, the Secretary of the Interior and the Hoopa Valley Tribe concurred in a plan that retained approximately 47% of the Trinity River Division's water in storage for scheduled releases to the Trinity River for fisheries restoration. To enable that amount of water to be effective for restoration, the plan identified funding requirements to carry out habitat restoration and construction, gravel replenishment, and various monitoring programs that would have to remain in place so long as CVP diversions continued. Restoration got underway in 2003 when the Federal Court of Appeals rejected challenges by irrigation and utility interests and declared the restoration to be "unlawfully long overdue." Westlands Water Dist. v. Hoopa Valley Tribe, 376 F.3d 853 (9th Cir. 2004). However, the restoration program has been persistently underfunded and consequently delayed.

The 1955 Trinity River Division Act also included a provision requiring that "not less than 50,000 acre-feet shall be released annually from the Trinity Reservoir and made available to Humboldt County and downstream water users." That water supply could be critical to instream as well as out-of-stream uses in the Klamath Basin but it has been the practice of the Bureau of Reclamation to disregard the provision. Instead, Reclamation has treated that water as available for export to the Central Valley thus increasing the Central Valley's dependence upon water dedicated to Klamath River Basin purposes.

Because most of California's water is used for irrigation purposes, water service contracts with the Bureau of Reclamation have become a critically important part of allocating California water. The Hoopa Valley Tribe has consistently urged the Bureau of Reclamation to include in its water service contracts language that recognizes the priority held under federal law for water needed for fisheries restoration purposes. Thus, the Hoopa Valle Tribe has requested that CVP contracts declare that all water deliveries pursuant to the contract are subordinate to the Secretary of the Interior's fiduciary duty, referred to in § 3406(b)(23) of the CVPIA, to meet the instream fishery flow requirements of the Trinity River. The Bureau of Reclamation has been reluctant to state things so clearly. However, in its responses to comments on environmental impact statements, the Bureau of Reclamation has conceded that the Trinity restoration decision flow mandates have the force of law and that, even in dry years, Reclamation may not take additional water from the Trinity River in order to meet contract delivery objectives in the Central Valley.

Issues of sustainable water quantity and quality are significant in the Klamath River. Three Indian reservations were established by the United States within the Klamath River Basin in 1855-1864; one in south central Oregon and two downstream in California. About 50 years later, the Federal Klamath Irrigation Project was established in Oregon, between the Klamath Indian Reservation and the Hoopa Valley Reservation.

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Between 1912 and 1961, five dams were built in the mainstem of the Klamath River including three in California with no upstream or downstream fish passage facilities whatsoever. These projects came to be licensed by the Federal Power Commission in 1956 and the license expired in 2006.

A utility seeking a new license under the Federal Power Act must comply with law as it exists at the time the utility applies for a license. Thus, the application for a new license for the Klamath Hydroelectric Project now must take into account the National Environmental Policy Act, the Clean Water Act, the Endangered Species Act, the Electric Consumer Protection Act and certain state laws and standards which did not exist in 1956. In part for this reason, the relicensing process can last for many years. Under the Federal Power Act, annual licenses extending the terms and conditions of the old license, are automatically issued.

The Energy Policy Act, Pub. L. 109-58 (2005), entitles FERC license applicants to a trial-type hearing before an administrative law judge regarding conditions and prescriptions that may be imposed by federal agencies under § 4(e) (land use and instream flow conditions) and § 18 (fish passage prescriptions). In the case of Klamath, PacifiCorp requested such a hearing and put forth alternative conditions and prescriptions. In 2006, the federal Administrative Law Judge substantially upheld the conditions and prescriptions imposed by the Bureau of Land Management and the U.S. Fish and Wildlife Service which, among other things, require full volitional upstream and downstream fish passage through all project facilities and reaches.

The subsequent Final Environmental Impact Statement prepared by FERC calculated that relicensing all of the dams in compliance with applicable law would cause the utility to lose approximately $20 million per year whereas removal of two of the dams would reduce the negative net benefits to $7 million per year. The deeply negative economic effects of relicensing all of the hydroelectric project facilities while complying with environmental laws and tribal water quantity and quality requirements, created an opportunity for the parties to negotiate concerning removal of some or all of the dams. A long series of negotiation sessions have followed, resulting in draft agreements which might partially reconcile the conflicting interests, if sufficient funding and political will exists to enact legislation in Oregon, California, and Congress. See generally, http://www.schlosserlawfiles.com/TrinityRiver/CVInterests071204.htm.

The Klamath River flows through California's Hoopa Valley Indian Reservation at approximate river mile 45 (distance from the ocean), so its conditions directly affect the Hoopa Tribe. Some people, however, do not understand the adverse effects that the proposed Klamath River agreements have on the Trinity River. The Trinity River is the largest tributary and fish-producer of the Klamath River. It flows through the heart of the Hoopa Valley Reservation and enters the Klamath approximately 42 miles above the river's mouth. Its successful restoration, pursuant to the CVPIA, is key to fish restoration success in the Klamath River Basin as a whole.

The proposed Klamath River Restoration Agreement (KBRA) and the Klamath Hydroelectric Settlement Agreement (KHSA) threaten success of the Trinity River Restoration Program in several ways. The most important adverse effect arises from the $1 billion price tag for the KBRA, a cost that will divert funds from the already under funded Trinity restoration program, (for example, the FY 2010 budget is $11.02 million, $6.4 million below the Program requirements.)

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A second threat arises from the KBRA's guaranteed irrigation diversions of water for the Klamath Irrigation District Project in Oregon. Those diversions--330,000 to 385,000 acre-feet per year--would trump the in-stream flow needs of fish and other aquatic organisms. Fish would get whatever water flow remains after those diversions. Analysis of those diversions makes clear that the water flows in the vicinity of Iron Gate Dam (near Interstate 5, in California) would frequently fail the requirements of the National Marine Fisheries Services' Biological Opinion for protection of salmon in the mainstem Klamath River. Such low flows caused the fish die-off in 2002, adversely affecting Trinity River spring and fall Chinook populations. The 2002 event was the largest adult salmon die-off in recorded history--in September 2002 up to 70,000 adult salmon, principally of Trinity River origin, died in the lower Klamath River.

A third adverse effect of the Klamath agreements on Trinity restoration arises from the lengthy dam removal planning process authorized by the KHSA and the minimal operational changes which will be made by PacifiCorp to its fish blocking dams during the next 11 to 25 years. None of the measures prescribed by the federal and tribal fisheries agencies pursuant to the Federal Power Act will be implemented except a few items listed in Appendices C and D of the KHSA called the "interim measures." Thus, nearly all of the river's flow (and fish) will pass through PacifiCorp's turbines. A minimal addition of gravel to the Klamath River below Iron Gate Dam will not aid fish survival. This is important because that area is a major disease breeding ground for the parasites that infect both juvenile and adult Trinity River salmonids when they enter the Klamath. Despite the concerns expressed by fisheries biologists, the PacifiCorp interim measures will not be re-examined for a number of years, far longer would be the case if the PacifiCorp Project proceeded through the normal Federal Energy Regulatory Commission relicensing/decommissioning process.

In the 1980s and 1990s, Congress responded to the revitalization of Indian tribal government, particularly in the area of federal environmental regulatory laws, by establishing mechanisms by which tribal governments could be treated as States for the purposes of key statutes such as the Clean Water Act. The consequence of these factors is that Indian tribes have a key role in the sustainable use of water both in terms of quantity and quality. Tribes must be accorded the respect due to a government and dealt with on a government-to-government basis if successful accommodation of the competing interests is to be achieved (Hoopa Valley Tribe 2009).

Salt River

The Salt River Ecosystem Restoration Project is collaborative effort to restore fish habitat, improve water quality, and provide for flood protection. The project affects restoration of the Salt River, Francis Creek, and Williams Creek near the City of Ferndale in Humboldt County. Sediment monitoring is also conducted to provide guidance on how much suspended sediment can be expected to enter the Salt River from Francis Creek watershed. The data will be used to enhance sediment routing and provide planning data for future dredging downstream. The project is considered to be of ecosystem scale that includes the restoration of a large tidal wetland that will create a succession of biologically rich and diverse tidal wetland habitats, including transitional wetlands and adjacent uplands as part of a sustainable estuary system. The mission of the project is to restore natural hydrologic function to the Salt River for the improvement of water quality, waste water treatment, flood control, wetlands and fisheries enhancement (Humboldt County Public Works 2005; Humboldt County Resource Conservation District c 2012; North Coast Integrated Regional Water Management Plan 2007).

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Big River

The Big River Program undertaken by Mendocino Land Trust and California State Parks seeks to provide permanent protection of the estuarine, wetlands, wildlife, and associated seral stage forest of the Big River Units of the Mendocino Headlands State Park. Activities that contribute to these goals include invasive plant control, greenhouse development for seed collection, trails and road monitoring, research and resource monitoring, outreach and education.

In 2002, most of the Big River Estuary, and some associated upland areas were added to the California State Park System. The Big River Parcel consists of 7,334 acres, which, when added to the surrounding State Park system, creates a 74,000-acre wildlife corridor linking coastal and inland habitats into the largest piece of connected public land contained entirely within Mendocino County.

Coho, steelhead, and Chinook currently inhabit the Big River watershed, but population numbers are low compared to historic levels. The estuary and lower river provide critical habitat for spawning, rearing, and staging for adult, juvenile, and smolting salmonids (Mendocino Land Trust 2005).

Salmon Creek

Another collaborative effort to address the decline of salmonid runs on the north coast includes restoration projects on Salmon Creek in Sonoma County. This restoration project provides for the instream placement of large woody debris at critical locations in the Salmon Creek estuary. Post construction monitoring on a similar project on the Mattole River indicated high utilization by juvenile salmonids and lower water temperatures contributing to project success (Salmon Creek Watershed Council 2010).

Russian River

US Army Corps of Engineers, Russian River Ecosystem Restoration study. The Russian River Watershed encompasses 1,485 square miles (approx. 950,000 acres) within Sonoma and Mendocino Counties, California. This watershed study will look at opportunities to prevent or reduce flood damages, to restore riverine ecosystem values and the wise use of floodplains, to restore watershed functions through restorative land-use practices, and to conserve remaining hydrologic and ecological resources. The result of Phase I was the formation of the Russian River Watershed Council, with the mission to protect, restore, and enhance the biological health of the Russian River and its watershed through a community-based process, by facilitating communication and collaboration among all interested parties. The Plan of Action for Phase II (POA) articulates critical issues and potential actions, and can be found at website http://www.rrwc.net. Phase II will include the completion of a Russian River Watershed Adaptive Management Plan (WAMP). The WAMP Synthesis Report was completed to provide the watershed community with a catalog of existing data and a ranking of over 1800 watershed areas in the Russian River Watershed.

2009 accomplishments: Completion of the WAMP Synthesis Report, Task 1. The Corps collaborated with Mendocino County Resources Conservation District to incorporate Synthesis Report into Task 2, the Draft Russian River Watershed Adaptive Management Plan.

2010 accomplishments: With additional funding, continue work on the Draft Russian River Watershed Adaptive Management Plan and begin work on the Implementation Plan, and the Monitoring Plan (United States Army Corps of Engineers 2009).

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Laguna de Santa Rosa

The Laguna de Santa Rosa (a tributary to the Russian River and a sub-set of the Russian River Watershed), in Sonoma County, California, is a biologically rich freshwater wetland complex which has retained much of its wild land character even as its surrounding neighborhoods have been converted to agriculture, commerce and housing. The Laguna has remained relatively strong and resilient in the face of severe pressures from habitat fragmentation, water pollution, floodplain encroachment, and urban development. Meanwhile, the general public perception of the area as a "wetlands jewel" has resulted in a widespread outpouring of public sentiment in support of its protection and restoration.

But a deeper look at the wetlands reveals a long list of ecological imbalances that portend a darker future. The need for enhancing the Laguna becomes clearer when the historical record is examined—most notably the record of the land's great fertility and its former abundance of wildlife and diversity of plant life. When compared to today's remaining, simpler, less-diverse, plant and animal communities, the contrast is sharp.

Enhancing the Laguna, by removing invasive plants, by planting native plants, by re-contouring man-made water channels and by reducing water pollutants, is a fundamental goal of the area's citizens. Caring for the Laguna includes monitoring for changes, wisely stewarding the land, educating our children, studying the ecological processes of the Laguna and enacting public policy. Restoring and managing the Laguna, or enhancing and caring for the Laguna, are complementary sets of activities that together will strengthen the Laguna's ability to reach a balanced state of flux and resiliency (Laguna de Santa Rosa Foundation 2011).

[Other efforts in the Russian River watershed?]

Mattole River

Restoration efforts on the Mattole River (in Humboldt County) include the replacement of poorly designed and installed culverts to improve fish passage and stabilize sediment. The Mattole Integrated Water Management program is a watershed wide effort to meet water supply, water quality, and fish habitat goals for the coastal Mattole River. Benefits of the project will include increased water supply in a drought prone area, reduction in sediment load, invasive plant eradication, and riparian ecosystem restoration at 47 sites (North Coast Integrated Regional Water Management Plan 2007; American Rivers 2012).

Trinity River Restoration Program

The Trinity River Restoration program is a collaborative effort of federal, state, tribal, and local stakeholders who are working together to restore the physical processes of the Trinity River as a foundation for the recovery of the fishery. Methods of restoration include the management of flows through releases from Lewiston Dam, construction of channel rehabilitation sites, spawning gravel augmentation, watershed projects to control fine sediments, infrastructure improvements, environmental compliance and science based adaptive management. More information about the Trinity River can be found in the Watershed, Water Governance and Project Operations sections of this regional report (Trinity River Restoration Program 2012).

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Shasta River

Recent projects in the Shasta River area include projects that are designed to reduce agricultural tailwater runoff to the river. Other efforts are considering the feasibility of providing water users in the Shasta River Watershed with an incentive based approach that relieves certain regulatory pressures in exchange for leaving water instream to support the fishery (Shasta Valley Resource Conservation District 2012).

Climate

Weather conditions vary dramatically within the North Coast Hydrologic Region from the cooler coastal areas to the arid inland valleys in Siskiyou and Modoc counties. In the western coastal portion of this region, average temperatures are moderated by the influence of the Pacific Ocean and range from highs in the mid-80s in the summer to lows in the mid-30s during the winter. In the inland regions of Siskiyou and Modoc counties, temperatures are more variable, where summer high temperatures usually reach the 100-degree mark and winter low temperatures are often in the low-30-degree range. The heavy rainfall over the mountainous portions of the region makes it the most water-abundant area of California. Mean annual runoff is about 29 million acre-feet, which constitutes about 41 percent of the State's total natural runoff, which is the largest volume compared to all other hydrologic regions of California. The major rivers in decreasing order of average annual runoff are: the Klamath with 11 million acre-feet (maf); the Eel, 6 maf; the Smith, 3 maf; the Russian, 1.6 maf; the Mad, 1 maf, and the Mattole, 1 maf. The principal reaches (and tributaries) of the Klamath, Eel, and Smith Rivers have been designated wild and scenic under federal and State law. Annual average precipitation in the North Coast Region is 53 inches, ranging from over 100 inches per year in eastern Del Norte County to less than 15 inches annually in the Lost River drainage area of Modoc County. A relatively small fraction of the precipitation is in the form of snow; only at elevations above 4,000 feet does snow remain on the ground for appreciable periods.

Climate and Atmospheric Evaporative Demand

Plant water use is dictated by climate (weather), soil properties, plant genetics and available water. Weather has a direct effect on water use by plants and this variation in water use can be described by understanding atmospheric evaporative demand.

In the North Coast Region, atmospheric evaporative demand ranges from low near the coast to high in the inland valleys and upper plateaus. In addition, atmospheric evaporative demand is higher in the warmer periods and lower during colder periods. The effects that plant genetics and soil conditions, type and structure have on water use are complex and will not be discussed in this chapter. For more information, please refer to web article and texts listed in the reference section for this chapter (Palomar College 2012; United States, Food and Agriculture Organization 1995; Jones HG 1992; Rosenberg NJ 1983).

Atmospheric evaporative demand is a term used to quantify the force exerted by the atmosphere on a plant or surface to cause water to change to its gaseous state. Atmospheric evaporative demand relates to all liquids and their change of state from liquid to gas when acted upon by the earth's atmosphere. However, in this context, atmospheric evaporative demand is mentioned as it relates to the use of water by plants (transpiration) and through evaporation from soil and plant surfaces. Soil and plant surface evaporation and plant transpiration combined is termed evapotranspiration or ET.

Atmospheric evaporative demand is measured in terms of depth (millimeters, inches of water, etc.) or energy (joules, watts per square meter per day, etc.). Greater depths of water or higher amounts of energy are associated with higher atmospheric evaporative demand. In practical application, depth of water is the

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predominant unit utilized to represent water demand or use (ET). Because evapotranspiration is difficult to measure directly, historically, it has been common practice to observe the evaporation of water from an open water container with a known volume over time as in a National Weather Service Class A Evaporation Pan (Department of Water Resources, Bulletin 73-79 1979).

Atmospheric conditions create a demand for water from soil, plant and vegetative surfaces. This demand, modified by existing surface conditions, finally determines the actual rate of water vapor exchange between the given surface and the atmosphere. This, in turn, represents the water used by a crop (planting) in an agricultural or urban setting. When plant roots have an adequate supply of water, there is an upper limit to the rate of water vapor exchange between atmosphere and vegetation. This upper limit is determined primarily by atmospheric conditions and is atmospheric evaporative demand (aside from genetic influences) (de Jager JM and van Zyl WH 1988).

When plants do not have enough available water, the plant experiences water stress and a soil water deficit is occurring. Water stress will limit the use of water by the plant and will slow or stop subsequent growth. Plant water stress, often times caused by drought, can have major impacts on plant growth, development and disease resistance. When it comes to crops, plant water stress can be the cause of lower yields and possible crop failure. The effects of plant water stress vary between plant species. Early recognition of water stress symptoms can be critical to maintaining the growth of a crop. The most common symptom of plant water stress is wilt. As the plant undergoes water stress, the water pressure inside the leaves decreases and the plant wilts. Drying to a condition of wilt will reduce growth on nearly any plant.

The main drivers of atmospheric evaporative demand are solar radiation, wind speed, air temperature and relative humidity. The following discussion attempts to describe these separate processes that work together to affect atmospheric evaporative demand. In addition, a discussion of vapor pressure is included since vapor pressure is such an important factor to plant water use and is related to air temperature, relative humidity and dew point.

Solar radiation is the main source of energy at the earth's surface and accounts for over 80% of the energy available (as heat) for evaporation. Cloud cover, particulates in the air and the many gases that make up the atmosphere lowers the amount of solar radiation that reaches the earth's surface. In other words, the existence of clouds and dust in the atmosphere affects how much energy is available at the surface. Solar energy that reaches the ocean surface warms the water causing it to convert to its gaseous form. This warmer, moisture laden air rises in elevation then cools forming clouds. When enough water vapor collects in the clouds, and other conditions are right, precipitation is formed, eventually returning the water to the oceans. This is the hydrologic cycle that continues year-round as viewed from the stand point of available energy.

Wind speed over time, or the quantity of wind passing over a site, affects the physiology of plants along with water availability and air temperature. Plant leaves have pores called stomata that allow water vapor (water picked up by the roots, utilized and converted to a gaseous form) to pass out of the plant to the atmosphere. This process is called transpiration in plants and is similar to perspiration in humans. During the day when wind speed, water deficit and air temperature are moderate, the stomata open fully allowing the moisture within the plant to pass out of the leaves unabated. As the wind increases, the stomata react

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by closing up partially, or totally, to prevent excessive moisture loss from the plant. This is the plants main defense against drying out during periods of extreme winds, water stress or high air temperatures.

Over the oceans, air temperature is affected by the water depending on the season. During the warmer periods, air temperatures are lowered (moderated) over the oceans through the utilization of available energy (heat from the sun) converting water from its liquid form to vapor. This process lowers the air temperature during the day by removing heat energy from the system through evaporation. During cooler periods, when the air above the water is cooler (than the water), energy in the surface waters is released to the air through radiation, convection and conduction. This release of energy previously held in the ocean water increases (moderates) the air temperature over the water. Year round, winds from sea to land bring this moderated air inland cooling the coastal areas in the warmer periods and warming the coastal areas in the cooler periods.

In inland areas, air temperature is affected by elevation, the type of ground cover and urban development. Variable elevations, landscapes and extent of development have local affects on the air temperature causing a decrease or increase in air temperatures depending on what exists. As the elevation increases, temperature decreases during the same time period. Compared to natural settings, actively growing plantings help to cool local areas, while urban development with high density and paved streets increase local air temperatures. During the day, plateaus, wide valleys and other open spaces can increase local air temperatures throughout the year through advection. Advection is the movement of air towards a higher elevation through heat transfer from the surface. When a large surface area is warmed by the sun to levels above the ambient air temperature in that local, heat will transfer from the surface to the air. This heat transfer can be very dominant in terms of increasing the air temperature downwind. The Santa Ana winds in Southern California are a good example of this heat transfer causing increases in wind temperature (and wind speed).

Relative humidity (RH) is the amount of moisture in the air compared to the maximum amount of moisture the air can contain at a given temperature. The conversion of liquid to gas and back to liquid is a dynamic process and is occurring all the time. When the RH is rising, it means more of the water molecules are converting to gas than to liquid. The opposite is true as well. When the RH is dropping, more of the water molecules are converting to liquid than to gas. When the air cannot contain additional moisture, some of the water vapor then condenses as dew or precipitation. When this condition occurs, water molecules are entering the liquid phase faster than entering the gaseous phase. At this time, the air temperature at the surface or within the clouds will be at the dew point temperature. In other words, when dew is formed on surfaces or rain is falling, the air masses are at the temperature where water vapor is condensing on the surface (dew) or water droplets are forming in the air (precipitation). This is not to say the air cannot get colder, it does; it is simply stating that at the dew point temperature the conversion of water vapor to liquid will begin to take place faster than the conversion of liquid to vapor. RH is expressed as the percentage of water vapor within an air mass. Air is made up mostly of nitrogen and oxygen (~78% and ~20% respectively) and many other gases in very small amounts. This shows how little water vapor is actually contained in the air at any given time. Nonetheless, the percentage of water vapor contained in the air, or RH, has a profound effect on plants and animals (Georgia State University 2000).

Vapor pressure is a function of air temperature and directly effects humidity. As air temperature increases, so does vapor pressure (although not linear). In addition, the higher the vapor pressure of a

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liquid at a given temperature, the lower the normal boiling point of the liquid (conversion of liquid to gas) increasing the amount of water vapor the air can contain (increasing RH). An example of this is how water will boil at a lower temperature at sea level than at higher elevations where the air pressure is lower. In the micro-environment of plants, vapor pressure plays an important role in the conversion of water from its liquid to gaseous states. Higher vapor pressures allow more water vapor to be held in the air, increasing humidity. Lower vapor pressure causes water in the air to condense to the liquid state and precipitate, lowering humidity. When water stress and wind speed are low and air temperature is ideal for the specific plant, vapor pressure limits the quantity of water able to be converted from liquid to gas.

Due to the warming of the surface of the oceans and land by solar radiation, air bodies above the surfaces are warmed causing the air to rise in elevation. The predominant wind pattern along the coast moves the air from sea to land. The heated air, full of moisture, moves over the coast on its way inland. While the moist air moves inland, it hits the mountains forcing it to rise in elevation even further. This process is called orographic lift. When the air mass hits the mountains, it is forced upward causing it to cool down, lowering the vapor pressure and creating rainfall. Furthermore, in California, as the air mass moves inland, more and more water drops out of the atmosphere leaving the air drier and drier as it moves farther inland. This is why the high mountains in the Klamath and Trinity ranges (and coastal ranges) receive so much rainfall and snow while the land further inland from the mountains receives relatively little rain; the drier land is in a "rain shadow" of the mountains.

Discussion on ET, CF, AW, EP, and ETAW

What is applied water? What is the difference between applied water and evapotranspiration of applied water? What is effective precipitation? For an explanation of these and other water use terms depicting water consumption, please read on.

In the water industry, whether it is urban or agricultural water use, terms like applied water (AW), evapotranspiration (ET), evapotranspiration of applied water (ETAW) or effective precipitation (EP) are mentioned but not always used correctly nor fully understood. Often, people hear the term applied water with the speaker intending to represent the water required *accounting for precipitation, irrigation system efficiency and cultural practice water*, while often, the listener assumes the amounts quoted are amounts necessary to meet crop demand. These amounts are not the same. The main difference is the contribution from rainfall that partially meets crop demand; which is accounted for in the AW amount. In addition, the efficiency of water application and any cultural practice water necessary to achieve a healthy crop are included in the AW value. These later two applied water amounts together are termed Consumed Fraction (CF) and include an irrigation system efficiency and cultural practice water for frost control, post season irrigation in orchards and vineyards, spraying, equipment cleaning, etc.

ET

Crop evapotranspiration, or ETc, is the combination of soil evaporation and crop transpiration (water movement from the plant roots to the air via the leaves). ETc is the total amount of water that must be available to meet the specific crop water requirement. This amount represents the water necessary to meet the demand of the crop (based on past research), not accounting for rainfall contribution, application efficiency of the irrigation system and any cultural practice water necessary to apply. Many methods have been utilized to estimate crop ET. Generally, all of the methods use a reference crop such as grass

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or alfalfa with correlations from the reference crop to the specific crop being grown (crop coefficient or Kc). The crop coefficient is a factor used to convert the reference ET to crop ET or ETc. Note: it has been suggested that since the real world is not the same as found in research studies, a stress factor can be applied to the ETc calculation to account for variances from "perfect" conditions. This stress factor can be thought of as a Ks coefficient that is multiplied by the ETc value to reflect any site specific variance from typical conditions. The Ks factor is site specific and requires an understanding of the local conditions, i.e., soil constraints, water stress and nutritional or pest influences. The Ks value requires site specific review and development from observation.

CF

The consumed fraction (CF) represents the amount of water necessary to apply with an irrigation system in order to overcome irrigation system inefficiencies and account for cultural practice water above the requirement of the crop. Irrigation system inefficiencies are intrinsic to water movement due to friction, system pressure, maintenance and surface irrigation conveyance evaporation and evapotranspiration. Generally, pressurized systems have a higher efficiency than surface irrigation methods. In a pressurized system, the water is contained within the system until applied by the drip or sprinkler nozzles, minimizing evaporation. A trade-off for the increased efficiency of pressurized systems is the need to pressurize and filter the water, especially with surface water or sandy ground water. Due to the small orifice size of sprinklers and especially in drip and micro-spray, the water running through the system needs to be clean so as to not wear or plug the orifices. The main driving factor in selecting an irrigation system is the cost associated with the method utilized. Surface systems are generally supplied with surface water requiring less energy input than pressurized systems. In addition, surface irrigation methods normally do not require filtering of the water prior to being applied. On the other hand, pressurized systems require a pump to lift the water from its source (ground water or surface water source) and pressurize the system. Generally, ground water is used in pressurized systems since the water normally does not require additional filtration, minimizing costs and labor. However, farmers will use whatever method they find cost-effective. Although filtration will add expense to an irrigation system using surface water, farmers will sometimes choose this method when using surface water due to lower pumping costs associated with running the system.

Cultural practice water is water necessary to apply to the crop that either does or does not help to meet crop demand. When cultural water is applied in *sufficient amounts* during the growing season, the effective amounts (amount minus initial evaporation, run off and deep percolation) will contribute to crop demand. Cultural practice water can include frost control, spraying of fertilizers and pesticides, cleaning of equipment and post harvest irrigation. Concerning post harvest irrigation, this water will not help to meet crop demand during the current growing season but does add to the soil moisture storage for the following season; an important consideration in perennial crops.

AW

Applied water is the amount of water necessary to meet crop demand accounting for the consumed fraction and effective precipitation. This value can be lower or higher than the crop demand due to natural rainfall, inefficiencies in water application and cultural practice water applied. Rainfall will lower the applied water demand but must be scrutinized to account for amounts that actually become available to the plant. Intensity of rainfall events vary considerably and amounts available to the plant are affected by

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the infiltration rate of the soil. Water will enter the soil at a maximum rate depending on the soil type and chemical status. Any water that does not enter the soil will run off the land making it unavailable to the plant. In addition, water that enters the soil but moves beyond the root zone of the crop is also unavailable. Natural rainfall that becomes available to the plant is termed Effective Precipitation.

Inefficiencies in the irrigation system increase the amount of water necessary to apply to meet crop demand. Normal irrigation system efficiencies can vary from 60 to 95 percent depending on the type of irrigation method utilized, skill of the operator, age of system and maintenance procedures. A crop demand of one (1) unit of water applied by an irrigation system with an efficiency of 70 percent will require 1.43 units of Applied Water to meet the crop water requirement. Furthermore, as time passes, maintenance becomes increasingly important due to wear on the equipment and algae growth. The efficiency of an irrigation system will decrease over time if not properly maintained. The result of poor maintenance is either the need to irrigate with more water to meet the crop demand or a situation of unintended deficit irrigation will begin, lowering potential yields.

Applied water is the amount of water a farmer needs to divert from supply, to apply to the field, on a site specific basis considering effective precipitation and the consumed fraction.

EP

Effective Precipitation (EP) is

ETAW

[Explain water use calculation methodologies including water balances]

Precipitation

Precipitation, or rainfall, varies greatly within the North Coast Region depending upon location and time of year. The combination of mountainous terrain with high peaks and steep narrow valleys compared to higher elevation plateaus present conditions favorable to variable rainfall patterns. In general, precipitation is higher in the northwest mountains and decreases toward the east and southeast.

In the coastal communities to the north near Crescent City in Del Norte County, average precipitation for the period from 1971 thru 2000 is about 64 inches with the highest rainfall normally during December. At Eureka in Humboldt County, average precipitation for the same period is about 48 inches. At Fort Bragg in Mendocino County along the coast, it is about 43 inches and at Bodega Bay in Sonoma County it is about 37 inches.

In the mountains within the coastal counties, precipitation increases (compared to the coastal communities) due to the orographic effect causing moisture in the air to condense and fall as rain or snow. At Ship Mountain in Del Norte County with an elevation of approximately 5320 feet, about 145 inches of rainfall occurs annually with the highest rainfall during the month of December. Moving south to Spike Buck Mountain in Humboldt County at approximately 5480 feet, about 61 inches of rainfall occurs on average. In Mendocino County along Chamberlain Ridge at 2020 feet elevation, about 48 inches of

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rainfall occurs with the highest precipitation during the month of January. At Sonoma Mountain in Sonoma County, at 2460 feet elevation, precipitation averages about 29 inches with the heaviest amounts falling during January.

Moving inland toward northeast California, at Boulder Peak in Siskiyou County at 8300 feet, about 47 inches of rainfall normally occurs with the heaviest rainfall happening in January. Moving further east to Mount Shasta in Siskiyou County at about 14,160 feet, average rainfall and snow amounts to near 56 inches with the highest rainfall occurring during January. In contrast, at Weed in Siskiyou County at approximately 3550 feet elevation and only 10 miles away from Mount Shasta (air miles), the average rainfall is about 31 inches. Moving to eastern Siskiyou County at Mount Hoffman near 7910 feet elevation, about 47 inches of rainfall occurs.

In western Modoc County (the eastern portion of the North Coast Region), representative precipitation in the Tulelake agricultural area at the town of Newell, 4042 feet elevation, amount to near 12 inches annually with November, December and January having the highest amounts. At Blue Mountain near the eastern edge of the North Coast Region at 5750 feet elevation (about 27 air miles from the town of Newell and an increase of about 1700 feet in elevation), precipitation amounts to an average of about 21 inches per year (Oregon State University 2010).

Demographics

[Placeholder for additional and new demographics information.] Note: This section will be updated with demographics information from the last census and will include the locations and extent of disadvantaged communities in the region.

The North Coast Region includes all residents of Del Norte, Humboldt, Trinity, and Mendocino counties, the majority of Modoc, Siskiyou, and Sonoma counties, and a small percentage of the populations of Glenn, Lake and Marin counties.

Population

The population of the entire North Coast Region was about 670,700 in year 2010 (DOF), which is less than 2 percent of California's total population. More than half of this region's population lives in the southern part, primarily in Santa Rosa and the surrounding communities of Cotati, Healdsburg, Rohnert Park, Sebastopol and Windsor along the Russian River watershed. Urban growth in these cities, 261,485 people in year 2010 (DOF), is heavily influenced by the overall urban expansion of the adjacent San Francisco Bay region. Other smaller communities in the northern portions of the region include Eureka, 27,191; Ukiah, 16,075; Arcata, 17,231; Crescent City, 7,643; and Yreka, 7,765 (California Department of Finance, United States Census Data 2010).

When compared with the 2000 regional population of 636,000, the 670,300 in 2010 represents a growth rate of 5.4 percent over the 10 years, which is a little over half the statewide growth rate of about 9.7 percent over the same period. Projections today indicate that the regional population is expected to grow to about 809,400 by year 2050, which represents approximately 21 percent increase from year 2010 totals. Figure NC-2 provides a graphical depiction of the North Coast region's total population from year 1960 through year 2010, with current projections to year 2050. More than half of this projected growth is anticipated to occur in the Santa Rosa region, as urban populations from the San Francisco Bay area continue to expand north. Population increases in the rural communities in the northern portion of this

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region are projected to grow more slowly due to the geographic location, few transportation corridors and a lack of adequate harbors.

PLACEHOLDER Figure NC-2 Total Population 1960-2010 (2050)

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

The majority of the North Coast Region's population (2010 US Census, DOF) is concentrated in the southern portion of the Region, in Sonoma and Marin counties, with 370,025 and 316 residents respectively, or approximately fifty-five percent of all inhabitants in the Region. Marin County and part of Sonoma County are also considered part of the nine-county Bay Area Association of Bay Area Governments (ABAG). For additional information on ABAG, please see: http://www.abag.ca.gov/. Mendocino and Humboldt Counties comprise 87,812 and 134,623 residents, respectively. The remainder of the population is distributed in the north/northeast and southeast sections of the Region. In the north/northeast areas, Del Norte County had 28,610 residents and Siskiyou County included 44,900 citizens. Three counties represent the southeast section's population: Glenn with 0, Lake with 61 and Trinity with 13,881 residents (Association of Bay Area Governments 2008).

The North Coast Region has experienced steady population growth over the past two decades and is projected to continue positive growth through the year 2050 (CA Department of Finance (DOF) 2010). Due to the rural nature of much of the region and the fact that there is a lower associated cost of living, many communities within the region are seeing an influx of retirees from larger, more urbanized settings. This has placed pressure on existing community services. Additionally, as population densities encroach in the more urban settings, some of the more rural communities are becoming bedroom communities. There is also a rise in migrant workers within the region. Modoc County has a county operated migrant camp. The trend for both Modoc and Siskiyou counties is that many of the migrant workers are becoming permanent residents, while younger non-migrant residents continue to leave the area.

Despite the overall growth rates of the Region, population growth rates are not as great as those of the rest of the State, reflecting the rural character of the Region. In fact, some of the more remote counties of the region - Modoc and Siskiyou - are projected to lose overall population in the coming decades. The most populated area of the Region, Sonoma County, experienced a higher growth rate than the State's average in 1980 and 1990, and is estimated to continue this pattern with population increases of 15% and 14% by 2010 and 2020, respectively. Figure NC-3 describes the historic and projected population growth trends for the North Coast Region.

PLACEHOLDER Figure NC-3 Population Growth Trends

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Tribal Population

The North Coast Region has a significantly higher percentage of Native American residents than that of the state's 1.7%, with 4% of residents identifying as tribal members. [Note: Confirm numbers.] The two largest Native American reservations within California are in the North Coast Region and include the Hoopa Reservation in Humboldt County and the Round Valley Reserva-

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tion in Mendocino County. See section on Tribal Communities for a description of these two reservations and a list of all federal and state recognized tribes in the North Coast Region. For more information on Tribes in the Pacific Region and California, see http://www.bia.gov/WhoWeAre/RegionalOffices/Pacific/WeAre/Tribes/index.htm and http://www.bia.gov/WhoWeAre/RegionalOffices/Pacific/WeAre/NorthernCalifornia/index.htm

Age

According to State Department of Finance 2010 US Census and projections, the North Coast Region's median age is significantly higher than that of the state. While the Region's overall birthrate continues to fall, estimates point toward an increasingly aging population in most of the North Coast Region. The median age for residents in the Region was 42.5 years old and will continue to increase over the next 20 years. In contrast, California's median age is expected to remain stable at 35–36 years, due to continued high birthrates throughout the state.

Increasingly, retirees are settling in the North Coast Region as they value the area's rural quality of life. This may lead to an increase in the demand for health-related services and related construction. The present lack and projected decline of population age 25 and younger is indicative of a region that is unable to provide living wage jobs that retain local youth.

Tribal Communities

Many tribes exist in the North Coast Region. Many of these tribes are federally recognized while some are not (see Tables NC-1 and NC-2). Two of the largest reservations in the North Coast Region are discussed briefly below.

Hoopa Valley Reservation

The People of Hoopa Valley are one of California's first cultures. The first American trappers and gold miners entered Hoopa in 1828. They came up the Trinity River into the rich valley which has always been the center of the Hupa World, the place where the trails return. Legends say this is where the people came into being. A treaty was signed providing the whole Hoopa Valley as a reservation. In 1876 an executive order was signed acknowledging this treaty. Since first European contact, the culture and traditions remain to this day. According to the 2010 U.S. Census, the Hoopa Valley Reservation includes 3,041 people with 82.4 percent being of Native American heritage.

In 1864, a Peace and Friendship Treaty was negotiated with the United States. In 1896, the Department of the Interior began preparing a land allotment list and in 1909 a Proclamation was handed down by President Theodore Roosevelt. This list was not completed and approved until 1923. The Hupa People successfully avoided the physical destruction of their valley homeland, and in modern times created one of the first successful Self-Governance Tribal structures in the nation.

The Hupa people traditionally occupied lands in the far northwestern corner of California. The boundaries of the reservation were established by Executive Order on June 23, 1876 pursuant to the Congressional Act of April 3, 1864. The boundaries were expanded by Executive Order in 1891 to connect the old Klamath River (Yurok) Reservation to the Hoopa Valley Reservation. Further confirmation of the ownership by the Hupa Tribe of the Hoopa Valley Reservation came on October 31, 1988 with President Ronald Regan's signature on Public Law 100-580, the Hoopa/Yurok Settlement Act.

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The Hupa People have occupied their lands since time immemorial, and the past century has really been the shortest in their history. However up until the late 1800's there is little or no written record on the rich history and culture that is now the Hoopa Valley Tribe. Much of the tradition and lore that still exists today has been passed along between generations via an extensive oral tradition. The ceremonies and traditions continue in the similar manners as they have since the beginning, and will continue into the future (Hoopa Valley Indian Tribe 2003).

Round Valley Reservation (A Sovereign Nation of Confederated Tribes)

The Round Valley Indian Reservation is a federally recognized Indian reservation lying primarily in northern Mendocino County with a small part of it extending northward into southern Trinity County. The total land area, including off-reservation trust land, is 36.27 sq mi. More than two-thirds of this area is off-reservation trust land, including about 405 acres in the community of Covelo. Population estimates for 2010 show just over 3000 people are tribal members with about half living on the reservation (Center for Applied Research 2010).

The Round Valley Indians consists of the Covelo Indian Community. This community is an accumulation of small tribes; the Yuki (who were the original inhabitants of Round Valley), Concow, Little Lake and other Pomo, Nomlaki, Cahto, Wailaki, and Pit River peoples. These tribes were forced onto the land formerly occupied by the Yuki tribe.

From years of intermarriage, a common lifestyle and a shared land base, a unified community emerged. The descendants of Yuki, Concow Maidu, Little Lake and other Pomo, Nomlaki, Cahto, Wailaki and Pit River peoples formed a new tribe on the reservation, the Covelo Indian Community, later to be called the Round Valley Indian Tribes. Their heritage is a rich combination of different cultures with a common reservation experience and history.

The Mission Statement for the round valley Indian tribes includes: Promoting the social and economic welfare of the members of the Tribe; Protecting the rights of the members; Protecting land, timber, fish, wildlife, water and natural resources; Preserve and protect the Tribes heritage including cultural values and traditions to build a stronger tribal government; Promote honor, dignity and respect among the Tribe; and Acquire additional lands for the benefit of the Tribe and its members to promote tribal business and enterprises (Round Valley Indian Tribes 2010, 2011).

PLACEHOLDER Table NC-1 Federally Recognized Tribes in North Coast Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

PLACEHOLDER Table NC-2 California Native American Tribes (Non-Recognized) in North Coast Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Federal Clean Water Act Programs and Tribal Involvement

Under the Clean Water Act (CWA), the US Environmental Protection Agency (US EPA) administers programs that support federally recognized tribes to address nonpoint source (NPS) pollution, water

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pollution control programs, and watershed based planning efforts. In the United States, there are approximately 565 federally recognized tribes. In California, there are 110 federally recognized tribes which is 20% of the national total within the 46 contiguous states.

According to the Bureau of Indian Affairs," federally recognized" means that most of today's federally recognized tribes received federal recognition status through treaties, acts of Congress, presidential executive orders or other federal administrative actions, or federal court decisions. In addition, in 1994, Congress enacted Public Law 103-454, the Federally Recognized Indian Tribe List Act (108 Stat. 4791, 4792), which formally established three ways in which an Indian group may become federally recognized: 1) by Act of Congress; 2) by the administrative procedures under 25 C.F.R. Part 83; or 3) by decision of a United States court. However, a tribe whose relationship with the United States has been expressly terminated by Congress may not use the Federal Acknowledgment Process. Only Congress can restore federal recognition to a "terminated" tribe.

Because of unique and extremely complex historical circumstances, there are a large number of non-recognized tribes in California, including terminated tribes that may be seeking restoration or recognition by the United States. Tribal existence and identity do not depend on federal recognition or acknowledgement of a tribe. However, in order to be eligible for CWA programs, a tribe must be federally recognized, along with additional requirements. One of the requirements is receiving treatment as a state (TAS) authorization pursuant to §518(e) of the CWA.

For the federal fiscal year 2012 there were 170 tribes nationally that had TAS authorization. In California, 60 federally recognized tribes have TAS status which is over one third (35%) of the national total, and 55% of the total of federally-recognized tribes in California.

Section 319(h) of the CWA authorizes federal grants to states and tribes in order to implement approved programs and on-the-ground projects to reduce nonpoint source pollutions problems. In the North Coast Hydrologic Region, nearly two-thirds of the federally recognized tribes (18 tribes) have TAS status and are eligible for Section 319 program funding: Bear River Band of the Rohnerville Rancheria; Blue Lake Rancheria; Cahto Indian Tribe of the Laytonville Rancheria; Cher-Ae Heights Indian Community of the Trinidad Rancheria; Coyote Valley Band of Pomo Indians of California; Dry Creek Rancheria Band of Pomo Indians of California; Elk Valley Rancheria; Hoopa Valley Tribe; Hopland Band of Pomo Indians of the Hopland Rancheria; Karuk Tribe; Kashia Band of Pomo Indians of the Stewarts Point Rancheria; Pinoleville Pomo Nation; Pit River Tribe; Quartz Valley Indian Community of the Quartz Valley Indian Reservation; Sherwood Valley Rancheria of Pomo Indians; Smith River Rancheria; Wiyot Tribe; and Yurok Tribe.

Section 319(h) funding supports the development of watershed-based plans for tribes with Treatment as a State (TAS) status. Requires tribes and states that wish to receive section 319 funding to prepare an assessment of their NPS pollution problems and develop a management program to address the problems. Section 319 also creates a grant program for states and tribes to implement their approved programs, including implementation of on-the-ground projects to reduce NPS problems.

Section 319(h) funds NPS program staff, outreach and education activities, travel and training associated with NPS activities, NPS ordinance development and various on-the-ground Best Management Practices (BMPs). Proposed activities must implement management measures identified in the management plan.

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Tribes and states are eligible to receive direct funding from EPA through congressional appropriations. Tribes must have TAS and an approved NPS assessment report and NPS management program to receive 319 funds. Tribes and states must make satisfactory progress to continue receiving 319 funds every year, in addition to developing approved work plans (United States Environmental Protection Agency 2010).

Section 106 of the CWA authorizes federal grants to assist state and interstate agencies in administering water pollution control programs. Tribes with TAS status can receive Section 106 funding. This program allows tribes to address water quality issues by developing monitoring programs, water quality assessment, standards development, planning, and other activities intended to manage reservation water resources. In California, 73 tribes and one inter-tribal consortium are involved in Section 106 programs.

In the North Coast Hydrologic Region, over three quarters of the federally recognized tribes (79%) are involved in Section 106 programs and activities. Tribes with two or more grants and consistently good performance may be eligible to apply for a Performance Partnership Grant (PPG). Nine (9) tribes in the North Coast Hydrologic Region have PPGs: Bear River Band of the Rohnerville Rancheria; Blue Lake Rancheria; Coyote Valley Band of Pomo Indians of California; Dry Creek Rancheria Band of Pomo Indians of California; Hoopa Valley Tribe; Karuk Tribe; ; Pit River Tribe, Wiyot Tribe, and Yurok Tribe.

Additional information for Clean Water Act Programs and Tribes can be found at the following web site: Department of the Interior, Bureau of Indian Affairs: http://www.bia.gov/FAQs/index.htm (United States Environmental Protection Agency 2011a, 2011b).

Selected legislation affecting Tribes and Tribal water rights:

The three court cases establishing the tribal status referenced above were Montana v. US EPA 450 U.S. at 565-66; (9th Circuit Appelate Ct No. 96-35505) which upheld the right of Confederated Salish and Kootenai Tribes to grant discharge permits under the National Pollutant Discharge Elimination System (NPDES), permits for dredging and filling under CWA 404, and to set water quality standards under section 303 of the CWA within the boundaries of their reservation (33 U.S.C. 1377 (1988); see 58 Fed. Reg. 67966-67985 (Dec. 22, 1993) (United State Court of Appeals, Montana v. United States Environmental Protection Agency 1998).

In 1987, Congress added §518(e) to the CWA which authorized EPA to permit tribes "to be treated as a state" (TAS) for purposes of promulgating Water Quality Standards: 33 U.S.C. S 1377(e). "The Administrator is authorized to treat an Indian tribe as a State for purposes of subchapter II . . . to the degree necessary to carry out the objectives to this section, but only if -- (1) the Indian tribe has a governing body carrying out substantial governmental duties and powers; (2) the functions to be exercised by the Indian tribe pertain to the management and protection of water resources which are held by an Indian tribe, held by the United States in trust for Indians, held by a member of an Indian tribe if such property interest is subject to a trust restriction on alienation, or otherwise within the borders of an Indian reservation; and (3) the Indian tribe is reasonably expected to be capable, in the Administrator's judgment, of carrying out the functions to be exercised in a manner consistent with the terms and purposes of this chapter and of all applicable regulations"

EPA issued a final rule in 1991 implementing the provision by setting forth the standards for processing tribal requests for TAS status and concomitant authority to institute. (1991) (codified at 40 C.F.R. §131.8(b)(3)) 1). The tribe must be federally recognized and exercising governmental authority; 2). The

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tribe must have a governing body carrying out "substantial governmental duties and powers;" 3.) The water quality standards program which the tribe seeks to administer must "pertain to the management and protection of water resources," which are "within the borders of an Indian reservation;" 4.) The Indian tribe is reasonably expected to be capable of carrying out the functions of an effective water quality standards program in a manner consistent with the terms and purposes of the Clean Water Act and regulations.

To demonstrate authority over the activities of nonmembers on non-Indian fee lands, EPA requires a tribe to show that the regulated activities affect "the political integrity, the economic security, or the health or welfare of the tribe." Final Rule, 56 Fed. Reg. at 64,877 (quoting Montana, 450 U.S. at 566, 101 S. Ct. at 1258). The potential impacts of regulated activities on the tribe must be "serious and substantial."

EPA believes that tribes will normally be able to demonstrate that the impacts of regulated activities are serious and substantial due to "generalized findings" on the relationship between water quality and human health and welfare. Nonetheless, under the Final Rule EPA will make a case specific determination on the scope of each tribal applicant's authority. Because EPA's generalized findings will be incorporated into the analysis of tribal authority, the factual showing required under §131.8 is limited to the tribe's assertion that (1) there are waters within the reservation used by the tribe, (2) the waters and critical habitat are subject to protection under CWA, and (3) impairment of waters would have a serious and substantial effect on the health and welfare of the tribe.

Once the tribe meets this initial burden, EPA will, in light of the facts presented by the tribe and the generalized statutory and factual findings regarding the importance of reservation water quality, presume that there has been an adequate showing of tribal jurisdiction over fee lands. Unless the party objecting demonstrates the tribe's lack of jurisdiction, the EPA will determine there is inherent authority.

State of Wisconsin v. Environmental Protection Agency and Sokaogon Chippewa Community, United States Court of Appeals for the Seventh Circuit No. 99-2618, involved EPA TAS (Treated as States) status grant to a reservation and its extraterritorial effects 33 U.S.C. sec. 1377(e). The EPA has developed the mechanism called for by the statute, which allows it to mediate conflicting interests when a tribe's standards differ from those of a state. See also 33 U.S.C. sec. 1341(a). In addition, once a tribe is given TAS status, the Act gives it the same right as that given to states to object to permits issued for upstream off- reservation activities. See 56 Fed. Reg. at 64887. In deciding whether to issue a permit for discharge within a state that may violate the water quality standards of a downstream tribe, the EPA may ask the parties to engage in mediation or arbitration, in which the decision-maker and the EPA administrator, who has the final authority over the issuance of the permit, will consider such factors as "the effects of differing water quality permit requirements on upstream and downstream dischargers, economic impacts, and present and historical uses and quality of the waters subject to such standards." 33 U.S.C. sec. 1377(e). The EPA may then ask the tribe to issue a temporary variance from its standards for the particular discharge or may ask the state to provide additional water pollution controls. See 54 Fed. Reg. at 39099-101; 56 Fed. Reg. at 64885-89; 40 C.F.R. secs. 121.11 through 121.16. The tribe cannot impose any water quality standards or take any action that goes beyond the federal statute or the EPA's power (United States Court of Appeals, Wisconsin v. Environmental Protection Agency 2001).

Arizona Public Service Co. v. EPA, .No. 98-1196, Ruling: Agency did not err in finding delegated authority to Native American nations to regulate all land within reservations, including fee land owned by

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nonmembers. The Clean Air Act grants states primary responsibility for assuring that air quality meets national standards. See 42 U.S.C. § 7407(a) (1994). States meet this burden by submitting state implementation plans ("SIPs") that "provide… for implementation, maintenance, and enforcement" of these standards. Id. § 7410(a)(1) (1994). SIPs must be approved by the Agency before they may be federally enforced. In 1990, § 7410 was amended to authorize Native American nations to submit tribal implementation plans ("TIPs") "applicable to all areas ... located within the exterior boundaries of the reservation." Id. § 7410. 1990 Amendments added language to the Act granting EPA the "author[ity] to treat Indian tribes as States under this chapter," id. § 7601(d)(1)(A) (1994), provided tribes meet the following requirements: (A) the Indian tribe has a governing body carrying out substantial governmental duties and powers; (B) the functions to be exercised by the Indian tribe pertain to the management and protection of air re- sources within the exterior boundaries of the reservation or other areas within the tribe's jurisdiction; and (C) the Indian tribe is reasonably expected to be capable, in the judgment of the Administrator, of carrying out the functions to be exercised in a manner consistent with the terms and purposes of this chapter and all applicable regulations (United States Court of Appeals, Arizona Public Service Company v. United States Environmental Protection Agency 2000).

Legislative History Affecting Tribes:

All Indian treaties became a nullity as Aboriginal rights were extinguished under Mexican rule. This is why the Senate never ratified the treaties and the reservations were created by Executive Order. California differs from Oregon and other states where the Tribes have aboriginal rights from time immemorial and actually ceded land to the federal government through treaties (Oregon Klamath Tribe.) With the exception of pueblo rights, this is why the California tribes with reservations have “Winters Doctrine” reserved rights dating back to the date their reservations were created and for water inherent for the purpose that the reservation was created (Winters Doctrine 1908).

The eighth article of the treaty of Guadalupe Hidalgo (9 Stat. 929) between the United States and Mexico ceding land to the United States stipulated: 'In the said territories, property of every kind, now belonging to Mexicans not established there, shall be inviolably respected. The present owners, the heirs of these, and all Mexicans who may hereafter acquire said property by contract, shall enjoy with respect to it guaranties equally ample as if the same belonged to citizens of the United States' (Treaty of Guadalupe Hidalgo 1848).

Under the California Land Settlement Act of 1851, "each and every person claiming lands in California by virtue of any right or title derived from the Spanish or Mexican government" was required to submit a claim to a three-person commission or tribunal. This commission investigated claims to land, and made a determination of their validity as respected the United States. The California Powder Works Co. v. Davis (1894) Supreme Court decision was interpreted to include Indian tribes. In 1900, the Supreme Court affirmed a California court's confirmation of title of non-Indian claimants against Mission Indians claiming a right of permanent occupancy to the same lands. In Barker v. Harvey (1901), the Supreme Court indicated that the Indian right of occupancy should be considered as a "right or title derived from the...Mexican government" even though that right may have antedated the establishment of the Mexican government. The Indians' right of occupancy was deemed abandoned for failure to present it to the land claims commission. Twenty-three years later, the Supreme Court declined to overrule Barker because of the unsettling effect it would have upon property titles in California in United States v. Title Insurance & Trust Company (1924). In Summa Corp. v. California Ex Rel. Lands Commission (1984), as a consequence of Article VIII, some Mexican land grants to "pueblos" or Indian cities were recognized by

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the lands commission (California Land Settlement Act of 1851; California Powder Works Co v. Davis et al 1894; Barker v. Harvey 1901; United States v. Title Insurance & Trust Company 1924; Summa Corporation v. California Ex Rel. Lands Commission 1984).

In Hayt v. United States, et al. "...the King of Spain made no concessions respecting Indian titles in Mexico, but claimed the whole country for his own; that this claim by virtue of conquest was maintained until Mexico acquired its independence and that Government in turn never acknowledged the existence of aboriginal title. The significance of the proposition is that if the Indian title to occupancy was never recognized by Spain and Mexico the title acquired by the United States was obtained free of encumbrance by virtue of previous Indian occupancy." "...as for Mexico, neither the researches of counsel nor the investigation of the court disclose recognition of aboriginal title by that Government." In 1955, the Tee-Hit-Ton Indians, an identifiable group of American Indians belonging to the Tlingit Tribe of Alaskan Indians, were held not entitled to compensation under the Fifth Amendment for the taking by the United States of certain timber from Alaskan lands in and near the Tongass National Forest allegedly belonging to the Tee-Hit-Ton Indians (Doctrine of Indian Right to Occupancy and Possession of Land 1927; Hayt Charles D v. United States et al [date unknown]; Tee-Hit-Ton Indians v. United States 1955).

In 1851, 18 treaties were signed with 400 California Indian leaders whereby millions of acres of land were ceded to the federal government in exchange for perpetual use and occupancy to 8.5 million acres in reservation land, plus goods and services. According to the CA Water Plan DWR bulletin 160-05, in mid-March 1852, the California Assembly (35 to 6) and Senate (19 to 4) voted to submit resolutions opposing the ratification of the treaties to California's U.S. Senators. The President submitted the treaties to the U.S. Senate on June 1, 1852. On June 7, the Senate read the President's message, and referred the treaties to the Committee on Indian Affairs. The treaties were then considered and rejected by the U.S. Senate in secret session. The treaties did not reappear in the public record until January 18, 1905, after an injunction of secrecy was removed (Eighteen Unratified Treaties 1852; Tribes of the Lower Klamath River System - Question of Treaties and Land Title [date unknown]; SUPER et al. v. WORK 1926).

"The United States has accepted the fact that it long ago acquired the lands of the California Indians, extinguishing their Indian title. The Jurisdictional Act of May 18, 1928, 45 Stat. 602, authorized the attorney general of the state of California to bring suit in the Court of Claims on behalf of the "Indians of California" for claims they might have against the United States "by reason of land's taken from them in the state of California by the United States without compensation . . .," any decree to be based upon the compensation proposed in certain ratified treaties of 1851-1852. Section 3 of that act provides: "Any payment which may have been made by the United States or moneys heretofore or hereafter expended . . . for the benefit of the Indians of California, made under specific appropriations for the support . . . of Indians of California, including purchases of land, . . . may be pleaded by way of set-off`" (Jurisdictional Act of 1928).

"The Court of Claims decided October 5, 1942, that the California Indians were entitled to recover as compensation the sum of $10,648,625, for 8,518,900 acres taken, less $764,033.50 for lands "set aside by the United States for the plaintiff Indians as reservations and otherwise, by Executive Orders, Acts of Congress . . ." 98 C. Cls. 583, Cert. Den. 319 U.S. 764, 102 C. Cls. 837. The court held that whatever lands those Indians may have held "became a part of the public domain . . ." because the Indians did not qualify before the Commission set up by the Act of March 3, 1851 (9 Stat. 631) to settle private land claims in California. "It will be noted that this action in favor of the California Indian's is not a payment

for money due the Indians, since the basis of the litigation and judgment is that these Indians lost their rights by reason of lathes. Nor did this involve all lands of the California Indians. The payment is in the nature of a gift, equitable because the United States Senate failed to ratify an agreement with the Indians concerning those particular lands. The claims of the California Indians, based upon aboriginal title, are now in process of litigation" (California Indians K-344 1942).

In 1946, the Federal Indian Claims Commission was created by an act of Congress for the purpose of tribes seeking compensation for lost tribal lands. Claimants had 12 years to file, after which suit was to be barred by the federal statute of limitations. Once claim was settled, according to a 1985 decision of the U.S. Supreme Court regarding the Shoshones, Northwestern Bands v. U.S. 324 U.S. 335 (1945), further claims to regain possession were barred. By August of 1951, twenty-three separate petitions had been filed by attorneys on behalf of tribes in California. These were consolidated and a settlement of $29,100,000 was offered. In 1964 the offer was accepted and in 1968, about $600 was distributed to nearly 65,000 Indians in California. This was in reimbursement for non-treaty land claims that were not already settled (Indian Claims Commission Act of 1946; 50 years past the deadline 2001; Northwestern Bands of Shoshone Indians v. United States 1945).

See Solicitor's memo 8/1/1960 suit in the Court of Claims on behalf of the "Indians of California" for claims they might have against the United States "by reason of land's taken from them in the state of California by the United States without compensation . . .,"(Request for opinion on "Rancheria Act" of August 18, 1958, 1960).

In HYNES V. GRIMES PACKING CO., 337 U.S. 86 (1949) the Court stated:
"An Indian reservation created by Executive Order of the President conveys no right of use or occupancy to the beneficiaries beyond the pleasure of Congress or the President. Such rights may be terminated by the unilateral action of the United States without legal liability for compensation in any form even though Congress has permitted suit on the claim. Sioux Tribe v. United States, 316 U.S. 317 ; see United States v. Santa Fe Pacific R. Co., 314 U.S. 339 , at page 347, 252. When a reservation is established by a treaty ratified by the Senate or a statute, the quality of the rights thereby secured to the occupants of the reservation depends upon the language or purpose of the congressional action. Since Congress, under the Constitution, 3 of Art. IV, has the power to dispose of [337 U.S. 86 , 104] the lands of the United States, it may convey to or recognize such rights in the Indians, even a title equal to fee simple, as in its judgment is just. Shoshone Indians v. United States, 324 U.S. 335, 339, 340, 692, 693. When Congress intends to delegate power to turn over lands to the Indians permanently, one would expect to and doubtless would find definite indications of such a purpose" (Hynes v. Grimes Packing Company 1949).

California Native American Heritage Commission Strategic Plan

This strategic plan has been developed to focus the growth of the Native American Heritage Commission to assist the public, the development community, local and federal agencies, educational institutions and California Native Americans to better understand problems relating to the protection and preservation of cultural resources. It is hoped that the document will serve as a tool to resolve these problems and create awareness among lead agencies and developers of the importance of working with the people that are directly affected by their actions.

The Mission of the Native American Heritage Commission is to provide protection to Native American burials from vandalism and inadvertent destruction, provide a procedure for the notification of most likely

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descendants regarding the discovery of Native American human remains and associated grave goods, bring legal action to prevent severe and irreparable damage to sacred shrines, ceremonial sites, sanctified cemeteries and place of worship on public property, and maintain an inventory of sacred places (California Native American Heritage Commission c2012).

Challenges Tribes are facing regarding water (or water-related) conditions include: Pressure from urban dwellers, irrigation farmers, and industrial water users to divert ever increasing quantities of water from traditional environmental uses; Impacts from gravel mining; Impacts from in stream gold dredging; Illegal marijuana farms on watersheds above and below tribal lands; Need for local agencies to be educated about how to work with tribes and appropriate cultural sensitivity; and Establishment of long term water quality monitoring needs in watersheds.

Collaborative efforts that the Tribes are involved with regarding water management or watershed stewardship include the following:

- The Klamath Basin Tribal Water Quality Work Group (KBTWQWG) conducts coordinated surface water sampling activities. KBTWQWG member tribes also participate in the Klamath Basin monitoring program which contributes to the body of science focused on the Klamath River and its tributaries.
- On August 28, 2012, the Karuk Tribe and the U.S. Forest Service signed a Memorandum of Understanding (MOU) regarding the land management of the Katimiin Cultural Management Area. The management strategies outlined in the MOU are consistent with both Karuk cultural environmental management practices and the Klamath National Forest Land and Resource Management Plan, which is administered by the Six Rivers National Forest. The Katimiin Cultural Management Area (KCMA), near present day Somes Bar, California, is where the Tribe's Pikyawish, or World Renewal, ceremonies are concluded each year. Both the Tribe and US Forest Service are working to restore and revitalize one of the Karuk's most sacred landscapes (Department of Water Resources 2012).

California Designated Centennial Ranches

Siskiyou County

Siskiyou County farmers and ranchers have a rich cultural history. Many of the family ranches are California Designated Centennial Ranches and have existed for 150-170 years since California entered the Union as a State. Currently, many of these ranchers are fifth or sixth generation farmers. In 1904, the Newlands Reclamation Act distributed, by lottery, drained lake and marshlands in the Tulelake area to returning WWI and WWII veterans. These lands are still utilized for farming and produce some of the best alfalfa, barley, garlic and potatoes California has to offer (Veteran Homesteaders and Settlers in the Klamath Basin 2001; Stories of Klamath Basin Settlers 2012).

During the 2001-2 cut off of irrigation water to the farmers in the Klamath Basin (by the Bureau of Reclamation), many family farms were destroyed, communities were devastated and migrant row crop harvesters (workers) were stranded without work. In Oregon, near the beginning of the irrigation season, affected farmers, and those sensitive to the farmer's plight, formed a "Bucket Brigade". This public effort was attended by approximately 20,000 people who lined the streets of Klamath Falls, and in an act of civil disobedience, handed buckets of water from hand to hand from Klamath Lake, around the Bureau of Reclamation headgates and into the main irrigation canals (Klamath Basin Water Crisis 2001).

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Disadvantaged Communities

Disadvantaged communities (DAC) status is determined based on the DAC definition provided in DWR's Proposition 84 and 1E IRWM Grant Guidelines (see: http://www.water.ca.gov/irwm/docs/Guidelines/GL_Final_07_20_10.pdf), dated August, 2010. A Median Household Income (MHI) of less than $48,706 is the DAC threshold (80% of the Statewide MHI). In 2010, households in California included an average of 2.89 people.

PLACEHOLDER Figure NC-4 Disadvantaged Communities in the North Coast Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

The North Coast IRWMP places a strong emphasis on ensuring the inclusion of DACs in the planning and implementation process. DACs have been involved in all aspects of the NCIRWM planning effort from its inception, including plan review and input, attendance and participation at meetings, and DACs comprise a substantial portion of the priority project proponents who are currently implementing projects. See http://www.northcoastirwmp.net/Content/10344/North_Coast_IRWMP_Implementation_Projects.html for more information (North Coast Regional Integrated Water Management Plan, Phase III c2012).

Land Use Patterns

[Placeholder – Content in development for Land Use Patterns.] [to be updated]

Forest and rangeland represent about 98 percent of this region's land area. Much of the region is identified as national forests, state and national parks, under the jurisdiction of the federal Bureau of Land Management, and American Indian lands such as the Hoopa Valley and Round Mountain reservations. The major land uses in the North Coast region consist of timber production, agriculture, fish and wildlife management, parks, recreational areas, and open space. In recent years, the timber industry has declined as a result of economic issues and the expansion of environmental regulations (Timber Harvest Levels on the Major National Forests in Siskiyou County 1978-2009, National Forest Growth 2009).

Failure to manage the National Forests by thinning and harvesting has caused an unnatural massive build up of biomass which has reduced water available to our streams by canopy interception of snow and evapotranspiration.

Vacationers, boaters, anglers, and sightseers are attracted to the region's 340 miles of scenic ocean shoreline, including nearby forests with more than half of California's redwoods. The inland regions are mountainous and include 10 wilderness areas run by the U.S. Forest Service. More than 40 state parks, numerous Forest Service campgrounds, the Smith River National Recreation Area and the Redwood National Park are within this hydrologic region. It is an area of rugged natural beauty with some of the most renowned fishing in North America.

Climate, soils, water supply, and remoteness from markets are factors that limit the types of agricultural crops that can be grown in the North Coast Region. In the inland valley areas, there is more irrigable land than can be irrigated with existing water. The trend in land use has been one of land consolidation and the conversion of prime agricultural land to urban growth. This trend is a result of low crop values,

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the lack of additional inexpensive surface water, and the ability to use only the most economically developable groundwater. The greatest driver of land conversion from agriculture has been the cost of environmental regulation and uncertainty of continued water supply for irrigation.

Irrigated agriculture in the North Coast Region uses most of the region's developed water supplies. Irrigation today accounts for about 81 percent of the region's non-environmental water use, while municipal and industrial use is about 19 percent. About 422,300 acres, or about 3.4 percent of the region, is irrigated. Of that, 276,840 acres lie in the Middle and Upper Klamath River Basins, above the confluence of the Salmon and Klamath Rivers, where the main irrigated crops are pasture and alfalfa, grain, potatoes, garlic and a few other assorted truck crops. Agricultural areas in these basins include Scott, Shasta and Butte Valleys and Tulelake region and account for approximately 65 percent of irrigated agriculture within the North Coast Region. Even though the predominant crops in the remainder of the North Coast Region are pasture and alfalfa, there are significant acreages of other crops including orchards, vineyards and various row and truck crops. The highest value crops in the region are the substantial acres of grapes and orchards in the Russian River Basin and ornamental flowers and bulbs in Del Norte County.

In the southern portion of the Region, the total acreage of fruit and nut orchards decreased over a fifteen year period. For example, in Sonoma County, orchards declined from 48,800 acres in 1992 to approximately 3,600 acres in 2007. However, the amount of irrigation water used on orchards did not decrease in the same proportion because many of the apple, prune, and walnut orchards taken out of production were not irrigated. In addition, as the acreage of orchards declined, the acreage planted in vineyards increased. In Sonoma County, grape acreage increased from 34,399 acres in 1992 to 57,568 acres in 2007, an increase of 23,169 acres.

Most of the newer grape vineyards use drip irrigation systems for irrigation allowing plantings in areas previously unavailable, i.e., sloping hillsides. However, in addition to irrigations for production, overhead sprinklers are used in vineyards for frost protection in the spring and for post-harvest irrigation in the fall, increasing the water demand for this crop over the direct water use by the crop. Land previously non-irrigated and subsequently placed in production increases the water demand of the Region beyond historic levels. With the development of low pressure drip irrigation systems, farmers are able to move in to areas unavailable prior to the low pressure technologies. This places a greater demand on the available water resources requiring surface water infrastructure improvements or reliance on ground water (National Agricultural Statistics Service 1994, 2008, 2011; Sonoma County Agricultural Commissioner 2008).

The new vineyard installations use the latest technologies ensuring the optimum use of resources. However, NPS pollution from vineyards, including pesticides, is still a concern. Current cultural practices recommended by UC Cooperative Extension include minimum tillage to prevent soil transport and minimum applications of fertilizer and pesticide at an agronomically proper rate. The goal of these recommendations is to minimize the impact agricultural (vineyard) management has on the environment. Although most vineyards with microspray and drip irrigation systems do not have much runoff, agricultural tail water return systems and settling basins for runoff help to conserve and protect water supplies.

According to the 2007 Census of Agriculture, the North Coast Hydrologic Region contained 249 dairy farms with 54,234 milk cows. This amounted to about 11.5 percent of the dairy farms in California and

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about 2.9 percent of the milk cows. The majority of the dairy farms in the North Coast Region in 2007 were in Humboldt County with 82 farms and Sonoma County with 93 farms. Comparing 2007 data to 2002, we find that 343 farms and approximately 57,000 milk cows existed in the North Coast Region, showing a trend of fewer and larger dairy farms in the region over this five year period (National Agricultural Statistics Service 2002, 2007).

Dairies can have water quality impacts resulting from discharges of waste and/or whey to streams, and from the presence of animals in waterways. The North Coast Regional Water Board Dairy Regulation Program offers three permitting options: an NPDES permit*, a Waste Discharge Requirements Order, and a Waiver of Waste Discharge Requirements, depending on the level of risk to water resources. Unlike most other Regions, the dairies in the North Coast are mostly small, family-run dairies, concentrated in southern Sonoma County and the Eel River delta in Humboldt County. Groundwater impacts (such as nitrates) from dairies have not been documented, but groundwater monitoring will be performed, pursuant to the Dairy Program requirements.

* National Pollutant Discharge Elimination System (NPDES); As authorized by the Clean Water Act (CWA), 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. Point sources are discrete conveyances such as pipes or man-made ditches. Since its introduction in 1972, the NPDES Program has been responsible for significant improvements to our Nation's and State's water quality.

Urban acreage in the North Coast Region is located primarily in the Eureka area and Russian River basin. According to annual estimations produced by California Department of Finance (DOF) and 2010 Census data, in 2007 the Eureka area had 114,362 people accounting for about 85 percent of the population in Humboldt County. The Eureka area includes Blue Lake, Eureka, Ferndale, Fortuna, McKinleyville and adjacent towns. In 2007, the Russian River Basin had 400,722 people accounting for about 70 percent of the population in Mendocino and Sonoma Counties. The Russian River Basin includes Redwood and Potter Valleys, Ukiah, Talmage, Hopland, Cloverdale, Healdsburg, Sebastopol, Windsor, Forestville, Graton, Guerneville, Monte Rio, Occidental, Santa Rosa, Cotati, Rohnert Park and adjacent towns. Together, the areas accounted for about 77 percent of the total population in the North Coast Region in 2007.

Land use issues in the region include activities causing soil erosion such as road construction, logging and hillside agriculture (vineyards) which affects native fish spawning. However, since the principal reaches of the Klamath, Eel, and Smith rivers have been designated wild and scenic under federal and State law, they are protected from additional large-scale water development. Many of the region's watersheds support threatened and endangered species of plants and animals, and many North Coast streams and rivers support runs of salmon and steelhead trout.

[Placeholder – Additional discussion on major crops by area/county]

Humboldt Bay Nuclear Power Plant: Decommissioned

Humboldt Bay, Unit 3 was a 65 MWe (Megawatt electrical) boiling water reactor plant located 4 miles southwest of Eureka, CA. The plant operated commercially from 1963 to 1976. On July 2, 1976, Humboldt Bay Power Plant (HBPP) Unit 3 was shut down for annual refueling and to conduct seismic

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modifications. In 1983, updated economic analyses indicated that restarting Unit 3 would probably not be cost-effective, and in June 1983, PG&E announced its intention to decommission the unit. On July 16, 1985, the U.S. Nuclear Regulatory Commission (NRC) issued Amendment No. 19 to the HBPP Unit 3 Operating License to change the status to possess-but-not-operate, and the plant was placed into a SAFSTOR status. SAFSTOR is the decommissioning method in which a nuclear facility is placed and maintained in a condition that allows the safe storage of radioactive components of the nuclear plant and subsequent decontamination to levels that permit license termination. In December 2003, PG&E formally submitted a license application to the NRC for approval of a dry-cask Independent Spent Fuel Storage Installation (ISFSI) at the Humboldt Bay site. A license and safety evaluation for the Humboldt Bay ISFSI were issued on November 17, 2005. The transfer of spent fuel from the fuel storage pool to the ISFSI was completed in December 2008, and limited decontamination and dismantlement of HBPP Unit 3 decommissioning commenced.

In 2010 the construction of a new power generation facility on site was completed. Radiological surveys of the area of the new plants were performed by the licensee. The NRC, with staff from ORISE, performed confirmatory surveys prior to construction. The licensee has begun decontamination and dismantlement of the non-nuclear Units 1 and 2 as well as the nuclear Unit 3. Estimated date of closure is December 31, 2015 (United States Nuclear Regulatory Commission 2012).

Flood Management

In the North Coast Hydrologic Region, forest management practices are the most significant issue impacting flood management. Maintaining the natural attenuation and function of floodplains in this hydrologic region will help to protect more than 320 sensitive species that live in the floodplains. Another issue is coastal flooding, including tsunamis, which can impact more than $4 billion in assets (crops, buildings, and public infrastructure). In addition, illegal cultivation of marijuana in the forests, with over fertilization and pesticide use, land clearing and illegal water diversions, sets the stage for increased runoff during rain events carrying toxics and sediment into the streams and rivers, degrading the environment.

Communities in the North Coast Hydrologic Region have suffered frequent flood damage since the winter of 1861 when devastating floods were recorded. Torrential rains caused flooding throughout the hydrologic region in 1937. Winter floods between 1935 and 1945 in Sonoma County spurred the USACE to develop a flood management plan and construct Coyote Valley Dam, which impounded Lake Mendocino upon completion in 1957 (United States Army Corps of Engineers, Coyote Valley Dam 2010).

Regional Resource Management Conditions

[This subsection contains a discussion of the following topics. (Primary authors are regional entities who wish to partner with Regional Office staff, the water supply and balances work team, the integrated flood management work team, and the ecosystem planning work team.)

- A characterization of environmental water use and demands.
- Water portfolios (1998-2009).
- Change in groundwater storage.
- An updated write-up from the Update 2009 regional report flood appendix.]

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Water Governance

The North Coast region contains water service providers of all types, from small, private facilities that provide water for just a few neighboring residences to large municipal suppliers and wastewater treatment facilities. Private water districts include those representing counties or portions of counties, municipalities, irrigation districts, or particular water bodies. The only federal water boundaries in the region are Redwood Valley District in Mendocino and in the Klamath Lake and Tule Lake area as part of the Klamath Project, which are administered by the US Bureau of Reclamation. A large number of North Coast residences are in rural areas with no water service and rely on groundwater wells and onsite wastewater disposal systems; usually septic systems (North Coast Integrated Regional Water Management Plan, Phase III c2012).

PLACEHOLDER Table NC-3 North Coast Hydrologic Region Water Management Agencies

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Flood Governance

California's water resource development has resulted in a complex, fragmented, and intertwined physical and governmental infrastructure. Although primary responsibility might be assigned to a specific local entity, aggregate responsibilities are spread among more than 85 agencies in the North Coast Hydrologic Region with many different governance structures. For a list of the entities that have responsibilities or involvement in flood and water resources management, refer to California's Flood Future Report Attachment E: Information Gathering Technical Memorandum. Agency roles and responsibilities can be limited by how the agency was formed, which might include enabling legislation, a charter, a memorandum of understanding with other agencies, or facility ownership.

The North Coast Hydrologic Region is the site of many flood management infrastructure including floodwater storage facilities and channel improvements funded and/or built by the State and Federal agencies. Flood management agencies are responsible for operating and maintaining approximately 1,200 miles of levees, more than 110 dams and reservoirs, and other facilities within the North Coast Hydrologic Region. For a list of major infrastructure, refer California's Flood Future Report Attachment E: Information Gathering Technical Memorandum. See http://www.water.ca.gov/sfmp/ for more information on the California Flood Future Report.

Siskiyou County Water Conservation and Flood Control District

"All of that territory of the County of Siskiyou lying within the exterior boundaries thereof, exclusive of the area in Siskiyou County within the Upper Klamath River Basin, as delineated on the Official Map of the Upper Klamath River Basin approved September 6, 1956, and made a part of the Klamath River Basin compact between the States of Oregon and California, ratified by said states on April 17, 1957."

"(r) To control flood and storm waters within the district and the flood and storm waters or streams outside the district, which flow into the district; to conserve such waters by storage in surface reservoirs, to divert and transport such waters for beneficial uses within the district; to release such waters from surface reservoirs to replenish and augment the supply of water in natural underground reservoirs and otherwise to reduce the waste of water and to protect life and property from floods within the district; to commence, maintain, intervene in, defend or compromise, in the name of the district, on behalf of the

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landowners therein, or otherwise to assume the cost and expenses of any action or proceeding involving or affecting the ownership or use of waters or water rights within or without the district, used or useful for any purpose of the district or of the common benefit of any land situated therein, or involving the wasteful use of water therein; to commence, maintain, intervene in, defend and compromise and to assume the cost and expenses of any and all actions or proceedings now or hereafter begun; to prevent interference with or diminution of, or to declare the rights in natural flow of any stream or surface or subterranean supply of waters used or useful for any purpose of the district or of common benefit of the lands within the district or to its inhabitants; to prevent unlawful exportation of water from said district; to prevent contamination, pollution or otherwise rendering unfit for beneficial use the surface or subsurface water used or useful in said district, and to commence, maintain and defend actions and proceedings to prevent any such interference with the aforesaid waters as may endanger or damage the inhabitants, lands, or use of water in, or flowing into, the district provided, however, that said district shall not have power to intervene or take part in or to pay the costs or expenses of actions or controversies between the owners of lands or water rights which do not affect the interests of the district" (Klamath River Basin Compact 1957a, 1957b; Siskiyou County Flood Control and Water Conservation District Act 1957; Siskiyou County Flood Control and Water Conservation District 1959).

Surface Water Ambient Monitoring Program (SWAMP)

SWAMP is a program administered by the California State Water Resources Control Board. SWAMP is tasked with assessing water quality in all of California's surface waters. The program conducts monitoring directly and through collaborative partnerships; and provides numerous information products, all designed to support water resource management in California. SWRCB works on this program in cooperation with several statewide and local work groups including the Klamath Basin Water Quality Monitoring Coordination Group. Recent programs in the North Coast Region (Regional Work plans), as of the writing of this document, include the Russian River- Freshwater Beaches Program (2012), Water Quality Status and Trends (2012), Garcia River Watershed Condition Monitoring (2012), Toxicity in California Waters- North Coast Region (2012) and the Regional Work plan for 2006 and 2007 (2007).

The Russian River, Redwood Creek (Humboldt County) and Klamath Basins have long-term water quality data sets, which is necessary to evaluate water quality changes over time. The current Surface Water Ambient Monitoring Program (SWAMP) sampling will contribute to these data sets (California Environmental Protection Agency 2012).

Gravel Mining

Historical gravel mining along many of the North Coast's rivers and streams has presented a particular problem concerning sediment transport. Many (if not all) of the waterways have been affected by silt and clay deposition causing a negative impact on local and regional fish spawning areas. Several major gravel mining operations along the Russian River have been curtailed in recent years. Improvements, such as settling basins, have been implemented to control the amount of sediment outflow from these mining areas to help improve downstream water quality. The issuance of 401 water quality certifications is the primary mechanism for regulating water quality impacts from instream gravel mining. Some of the counties in our region (Humboldt and Sonoma) have gravel regulation programs in place that also play a significant role.

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Statewide Instream Mining (Suction Dredging)

Instream mining (specifically, suction dredge mining) has been curtailed in California as of 2008 with no set ending date on the moratorium. The legislature and Governor have enacted SB 1018 (2012). A part of this legislation applies to suction dredge mining. The law now requires the Department of Fish and Game (Fish and Wildlife) to report to the legislature on or before April 1, 2013 on suggested legislative changes and a fee structure. The previously established date of June 30, 2016 for the current moratorium on suction dredge mining to end has been removed from law. Suction dredging, including the method known as "booming", is prohibited within 100 yards of any California river, stream or lake (Fish & Game Code, § 5653 subd. (d).).

DFG (DFW) has not yet determined the exact steps or time-frame for meeting the requirements of this legislation. Further, there are also several existing lawsuits which will likely affect the future of suction dredge gold mining. For these reasons, the DFG (DFW) cannot currently predict when, or if, suction dredge mining will be lawful in California or when permits may be available to interested miners.

The current moratorium originally established by SB 670 and extended by AB 120 and SB 1018 does not prohibit or restrict non-motorized recreational mining activities, including panning for gold. It also does not prohibit or restrict some other forms of mining, including, for example, practices known as high banking, power sluicing, sniping or using a gravity dredge, so long as gravel and earthen materials are not vacuumed with a motorized system from the river or stream.

It is important to know that other environmental laws may apply to some of these mining practices. Fish and Game Code section 5650 prohibits the placement of materials deleterious to fish, including sand and gravel from outside of the current water level, into the river or stream. Discharge of muddy water from a high banker or power sluice into a live river, stream or lake, is prohibited by this code section. Further, Fish and Game Code section 1602 requires that any person notify the Department of Fish and Game before substantially diverting or obstructing the natural flow of, or substantially changing or using any material from the bed, channel or bank of any river, stream or lake. These activities may be subject to the authority of the appropriate Regional Water Quality Control Board. If you have questions about the authority of the Regional Water Quality Control Board, or how to comply with any permitting requirements, please contact them directly. You can determine the appropriate office at the following website, http://www.waterboards.ca.gov/waterboards_map.shtml.

Small-scale suction dredge mining activity in California began in the 1960s and peaked during high gold prices in the late 1970s and early 1980s. The existing regulatory framework governing the activity as administered by DFG (DFW) is rooted in statutory amendments to the Fish and Game Code that took effect originally in the late 1980's. Under the statute and regulations, any California resident or non-resident could (i.e., before the current moratorium) obtain a suction dredge mining permit from DFG upon payment of a fee required by statute. On average, DFG issued approximately 3,200 suction dredge mining permits/year to California residents, and another 450/year to non-residents, from 1995 through 2009.

DFG's previous regulations governing suction dredge mining were promulgated after preparing and certifying an environmental impact report under CEQA in 1994. DFG considered proposed amendments to the existing regulations governing suction dredge mining in 1997, releasing a draft subsequent environmental impact report for public review that same year. However, the 1997 Draft SEIR was never completed or certified.

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DFG's recent effort to amend the regulations and comply with the California Environmental Quality Act (CEQA) was required by a court order issued in a lawsuit brought against DFG by the Karuk Tribe of California. The lawsuit focused on the Klamath, Scott and Salmon River watersheds in northern California; included allegations regarding impacts to various fish species, including Coho salmon; and contended that DFG's administration of the suction dredging program violated CEQA and various provisions of the Fish and Game Code.

In December 2006, the Alameda County Superior Court issued an order with the consent of all parties, directing DFG to "conduct further environmental review pursuant to CEQA of its suction dredge mining regulations and to implement, if necessary and via rulemaking, mitigation measures to protect Coho salmon and/or other special status fish species in the watershed of the Klamath, Scott, and Salmon Rivers, listed as threatened or endangered after the 1994 EIR."

Based on information DFG collected from interested parties, DFG informed the Alameda County Superior Court in early 2008 that DFG could not proceed with the court-ordered environmental review in reliance on an addendum to the 1994 EIR. DFG informed the court at the same time that more than minor additions or changes to the 1994 EIR would be necessary and that statewide issues would need to be addressed in a subsequent environmental document in order to fulfill DFG's obligations under CEQA. As a result, DFG informed the Alameda County Superior Court that it intended to prepare a subsequent environmental impact report to comply with the December 2006 Court Order (California Department of Fish and Game 2012).

Irrigated Lands Program

California's Porter-Cologne Water Quality Control Act (Porter-Cologne Act) established the State Water Resources Control Board (State Water Board) and divided the state into nine regional basins, each with a Regional Water Quality Control Board (RWQCB) (California Water Code [Water Code] Section 13200).

The State Water Board is the "principle state agency with the primary responsibility for the coordination and the control of water quality" in California (Water Code Section 13201).

The Porter-Cologne Act authorizes the State Water Board to draft state policies regarding water quality and, in accordance with Water Code Section 13263, to develop general waste discharge requirements (WDRs) and project-specific WDRs for projects that would discharge into state waters. The Water Code requires that RWQCBs adopt water quality control plans (Basin Plans) in accordance with Section 13240. The State Water Board is allowed, but not required, to adopt Basin Plans in accordance with Section 13170 of the Water Code.

In January 2000, the State Water Board, in its continuing efforts to control nonpoint source (NPS) pollution in California, adopted the Plan for California's Nonpoint Source Pollution Control Program (NPS Program Plan). The NPS Program Plan upgraded the State's first Nonpoint Source Management Plan adopted by the State Water Board in 1988 (1988 Plan). Upgrading the 1988 Plan with the NPS Program Plan brought the State into compliance with the requirements of Section 319 of the federal Clean Water Act (CWA) and Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA). On May 20, 2004 the State Board adopted the NPS Implementation and Enforcement Policy. The NPS Implementation and Enforcement Policy was adopted by the State Board to be in compliance with the 1999 amendment of the Porter-Cologne Water Quality Control Act (Porter-Cologne Act) to

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enforce the state's NPS pollution control program. The program entitles the Water Boards to regulate all NPS pollution, and must meet five key elements:

1. A NPS control implementation program's ultimate purpose must be explicitly stated and at a minimum address NPS pollution control in a manner that achieves and maintains water quality objectives.

2. The NPS pollution control implementation program shall include a description of the management practices (MPs) and other program elements expected to be implemented, along with an evaluation program that ensures proper implementation and verification.

3. The implementation program shall include a time schedule and quantifiable milestones, should the RWQCB so require.

4. The implementation program shall include sufficient feedback mechanisms so that the RWQCB, dischargers, and the public can determine if the implementation program is achieving its stated purpose(s), or whether additional or different MPs or other actions are required.

5. Each RWQCB shall make clear, in advance, the potential consequences for failure to achieve a NPS implementation program's objectives, emphasizing that it is the responsibility of individual dischargers to take all necessary implementation action to meet water quality requirements.

The RWQCBs have primary responsibility for ensuring that appropriate NPS control implementation programs are in place throughout the State. RWQCB responsibilities include, but are not limited to, issuing WDRs or a waiver of WDRs for individual discharges or a category of NPS discharges, or adopting a Basin Plan amendment that addresses NPS discharges (Irrigated Lands Discharge Program 2006).

Staff of the North Coast Regional Water Quality Control Board (Regional Water Board) are developing an Agricultural Lands Discharge Program (Program) to address water quality impacts associated with irrigated agricultural lands in the North Coast Region (Region). Agricultural lands have the potential to contribute to water quality problems through the over-application of fertilizers and pesticides, human-caused erosion of sediment, pollutants in tailwater return flows, and the removal and suppression of riparian vegetation. The Regional Water Board staff are developing the Program to address these water quality issues and to meet the requirements of the California Water Code, the State Nonpoint Source Policy, and the Klamath River Total Maximum Daily Loads (TMDLs).

While the scope of the Program has not been finalized, it will include certain types of agricultural lands in the North Coast Region and address discharges of waste to waters of the State. Staff expects the Program to address, at minimum, waste discharges from agricultural lands such as row crops, vineyards, orchards, medicinal marijuana farms, nurseries, forage crops, and irrigated pasture. Dairies and dryland grazing are not included in the Program as dairies are being addressed through a separate Regional Water Board program and dryland grazing is likely to be addressed through a statewide effort that is currently under development. Additionally, this effort will be coordinated with existing Regional Water Board programs, such as the TMDL programs in the Scott, Shasta, and Garcia watersheds and grazing on US Forest Service allotments.

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The elements listed below provide a basic framework and starting point for developing the Program, and must be included for the Program to comply with state law.

Implementation of best management practices: Landowners select and implement the appropriate management practices to address identified discharges of waste. The Program will rely on local technical expertise to identify appropriate practices.

Implementation Timelines: The implementation of management practices must be done on a schedule. There is flexibility in scheduling to account for individual circumstances and factors such as threat to water quality, local priorities, cost and availability of grant programs or cost share funds.

Monitoring: This can be accomplished by tracking the implementation of management practices and monitoring them for effectiveness and/or participating in a group monitoring program where water quality trends related to discharges from agricultural lands are tracked by sampling in representative locations.

Reporting to the Regional Board: Reporting to the Regional Water Board can be done by the individual, by a group, or through a third party certification program. In addition, the Program will recognize the work that has already been accomplished.

Enforcement: Program enforcement will be consistent with the State Water Resources Control Board Water Quality Enforcement Policy. This policy directs the Regional Water Board to be fair, firm, and consistent in taking enforcement action while recognizing the unique facts of each case.

Regional Water Board staff intends to develop a program that adapts this framework to the North Coast Region through a stakeholder involvement process. The Program must be protective of water quality and reasonable to implement. It is not intended to duplicate efforts or impose redundant requirements. Throughout the development process, staff will consider how existing water quality efforts might fit into the framework and will also coordinate the Program with existing regulations (Agricultural Lands Discharge Program 2012).

Water Supplies

Many of the smaller communities and rural areas in the North Coast region are generally supplied by small local surface water and groundwater systems. Larger water supply projects in this region include the U.S. Bureau of Reclamation's Klamath Project, the U. S. Army Corps of Engineers' Russian River Project (Potter Valley Project including Lake Mendocino and Lake Sonoma), and the Humboldt Bay Municipal Water District's Ruth Reservoir, which serves coastal communities from Eureka to McKinleyville. Because the Upper Klamath River watershed is in both California and Oregon, the federal Klamath Project includes water supply facilities in both states. Facilities within the California portion include Clear Lake Reservoir for water supply, Tule Lake and Lower Klamath Lake as waterfowl refuges, and Iron Gate Reservoir as a hydroelectric facility of Pacific Power and Light Company. The primary water supply facilities on the Oregon side are Gerber Reservoir and Upper Klamath Lake. The Klamath Project is the largest agricultural irrigation project in the region, and supplies water to about 240,000 acres, of which 62 percent is in Oregon and 38 percent is in California. To maintain adequate instream fishery flows for the lower Klamath River, water releases must be coordinated among the various reservoirs operated by different agencies within both states.

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Two of the largest water supply reservoirs in the North Coast region are the U.S. Bureau of Reclamation's 2.437 million acre-foot Trinity Lake on the Trinity River, and the U.S. Corps of Engineer's 380,000 acre-foot Lake Sonoma in the Russian River watershed. These facilities provide water for instream flows, recreation, hydropower, and water supply purposes. Water from Trinity Lake is exported from the North Coast region to the Sacramento River region through the U.S. Bureau of Reclamation's Clear Creek Tunnel. Lake Sonoma is operated to provide flood control and instream flows in the Lower Russian River in Sonoma County. An intra-basin water transfer system known as the Potter Valley Project has been in existence since 1908 and diverts water from the upper reaches of the Eel River at Cape Horn Dam through a tunnel to the East Fork Russian River upstream from Lake Mendocino. The water stored behind Coyote Dam (Lake Mendocino, built in 1958) is used to meet instream flow requirements, urban and agricultural needs in the lower Russian River watershed and the Santa Rosa area.

Groundwater development is sporadic throughout the mountainous areas of the region, and wells are generally along the valleys of rivers and streams. As described in "California's Groundwater" (California Department of Water Resources Bulletin 118-03), there are very few significant aquifers in the coastal mountains that are capable of providing reliable water. In the coastal areas, most groundwater is developed from shallow wells that are typically installed in the sand and gravel beds adjacent to the region's rivers. However, significant groundwater basins do exist in the upper Klamath River valley along the border with Oregon and also in the southern tip of this region underlying the Santa Rosa area.

Early gold mining activities in the Scott and Shasta River valleys established water rights as early as the 1850's and 60's. These rivers have been declared "fully appropriated" and are adjudicated under decree of the Superior Court of Siskiyou County.

[Placeholder-Discussion of the Water Balance information.]

PLACEHOLDER Figure NC-5 North Coast Water Balance for Water Years 2006–2010

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

PLACEHOLDER Table NC-4 North Coast Hydrologic Region Water Balance Summary (Thousand Acre-Feet)

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Surface Water

According to DWR (2011), surface water storage in the North Coast Region in 2006, a wet year, was 2,060 thousand acre-feet (TAF) at the end of November. In 2007, during the beginning period of the most recent drought, surface water storage at the end of November was 1,621 TAF. In November 2008, reservoir storage was 1,257 TAF, in 2009 it was 1,169 TAF, in 2010, 1,892 TAF and in 2011 it was 2,308 TAF showing how variable the water supply can be. For comparison, reservoir storage at the end of November 1977 (the driest period in recent years) was 304 TAF. Whereas the wettest period in recent times was in 1983 when the North Coast had 2,264 TAF of storage (although less than in 2011). This water is used for urban, municipal, rural residential needs, agriculture, state and federal water supply projects, managed wetlands, required Delta outflow, instream flow, and Wild and Scenic Rivers flow.

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When water supplies fall short, as they did in 2008 and 2009, the Wild and Scenic Rivers and environmental uses receive the largest reductions (California Department of Water Resources 2011).

The amount of surface water in the North Coast Region is extremely dependent upon precipitation as described above. In very wet years, there may be a surplus, but in drought years, quantity is limited and can become a source of contention between water users. For example, the Klamath Basin has had water shortage problems in the recent past that have led to confrontations between farmers and regulators and farmers and environmentalists. As the population of the North Coast Region grows, drinking water will continue to experience increases in demand, making the identification of alternative sources for agricultural and landscape irrigation a high priority. The North Coast Regional Water Management Group (NCRWMG) provides the framework for regional cooperation and collaboration to determine the optimal strategies to ensure that surface water supply is able to meet environmental and human-related beneficial uses during both surplus and drought water years.

Groundwater

There are 63 groundwater basins/subbasins delineated in the North Coast region, two of which are shared with Oregon (DWR, Bulletin 118-03). These basins underlie approximately 1,022 million acres (1,600 square miles) (see Figure NC-6, North Coast Region Groundwater Basins).

There is limited large-scale groundwater development in the North Coast Region due to the small number of significant coastal aquifers. Most of the groundwater development that has occurred comes from shallow wells installed adjacent to rivers. There are, however, significant groundwater basins underlying the Klamath River valley along the Oregon border and the southern tip of the Region underlying Santa Rosa in Sonoma County (See Figure NC-6, North Coast Region Groundwater Basins). Despite the limits on large-scale infrastructure, groundwater is used widely throughout the region for individual domestic, agricultural, and industrial water supply. Many rural areas rely exclusively on private wells for residential water. There are also an unknown number of small dams, and water-related infrastructure, which may have a large cumulative impact on groundwater.

In California, regulation of extraction and appropriation of groundwater is the responsibility of local agencies. As with surface water, recharge to groundwater supply is highly dependent on precipitation. The amount of groundwater available varies yearly with precipitation, infiltration, and the amount of withdrawals from groundwater basins. Withdrawals, in turn, are in part dependent on the amount of surface water available for municipalities that use both surface and ground water for supply needs. Groundwater is a significant water source for some small rural communities that rely on residential wells for water, but the total amount of groundwater use in the region is small compared to surface water use.

Identified groundwater basins in the Redwood Creek watershed are the Redwood Creek Area and Prairie Creek Area groundwater basins (DWR, Bulletin 118-03). The Orick Community Services District provides domestic water through a centralized distribution system that includes two wells located adjacent to Redwood Creek in the northern part of town. In the Redwood Creek watershed, there are no water development projects such as dams and surface water diversions.

Siskiyou County has developed several codes regarding groundwater. A Groundwater Advisory Committee has been appointed and is active for Scott Valley (Siskiyou County Code of Ordinances 2012).

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PLACEHOLDER Figure NC-6 North Coast Groundwater Basins

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Reclaimed Water

Water recycling, also known as reclamation or reuse, is an umbrella term encompassing the process of treating wastewater, storing, distributing, and using the recycled water. Recycled water is defined in the California Water Code to mean "water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur."

Existing uses of reclaimed water including landscape irrigation and holding tanks for fire suppression are currently being used by the City of Santa Rosa, the City of Arcata, the Town of Windsor and other entities within the region. The use of reclaimed water is a positive, proactive method that can increase surface and groundwater quantity by reducing demand on both sources.

Promoting Water Recycling

On a regional scale, the North Coast Regional Water Board's Basin Plan recommends recycling portions of urban and agricultural water to help meet water demands for quality and supply. Urban water recycling occurs along highways, as supply for agricultural fields (for forage), and on some municipal landscaping. Agricultural and dairy wastes are treated to reduce pathogen and nutrient loading prior to application to farmland for reuse and groundwater recharge or salt water intrusion barriers. Water recycling in urban areas normally includes both active and passive water treatment. Active water treatment consists of any method where energy is necessary to process the effluent. Passive water treatment includes the use of settling ponds, wetlands and field rotation (of irrigation water) in pastures. In practice, when water is destined to be recycled, any effluent is first actively processed through a purification system, than applied directly to landscaping or agricultural fields. Passive treatment of discharged water requires planning considerations specific to the original water use. In irrigated agriculture, one current trend is to create small areas adjacent to crops designed to have all tail water (which would normally flow off the owner's property) pass through these strips. In urban areas, storm water runoff catchment basins are being used to help filter water potentially containing NPS pollution. These tail water and catchment basin areas help to slow water flow allowing for greater settling of solids that in turn helps to prevent sediment, nutrient and pesticide transport in the watershed.

Geysers Recharge Project

The Santa Rosa Sub-regional Reclamation System reclaims water, treats it to a tertiary level, and distributes it to agricultural users, golf courses, public and private landscaping, and the Geysers steamfield. Santa Rosa's reclamation system is one of the largest reclaimed water agricultural irrigation systems in the country. For the Geysers Recharge Project, reclaimed water is piped through a 42-mile pipeline and injected into underground wells in the Geysers steamfield in Sonoma and Lake Counties. Once within the wells, the water is gradually heated by geothermal activity to produce a steam that is then utilized to produce electricity at nearby power plants. The Geysers Recharge Project was chosen as a means to dispose of treated wastewater during the winter months, when there is no demand for agricultural irrigation. The Sub-regional Reclamation System had previously been discharging the unused water to the Russian River, but stricter water quality regulations removed this option. The Sub-regional

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Reclamation System is currently exploring other means of reusing or disposing of current and future amounts of reclaimed water in order to best manage water resources.

In November 2003, the Geysers Recharge Project began pumping 11 million gallons per day of highly treated wastewater from the Laguna Treatment Plant to The Geysers steamfields, high in the Mayacamas Mountains. In January 2008, the delivery was up to 12.62 MGD helping to generate enough electricity for 100,000 households in Sonoma and other North Bay counties.

The Geysers Expansion Project builds on the Geysers Recharge Project and will increase recycled water deliveries to the Geysers steamfield up to 19.8 MGD or as much as an additional 3,209 million gallons (MG) per year. The City has completed negotiations with Calpine, the steamfield operator, and has signed a contract to send more water to the Geysers.

The City of Santa Rosa developed the Geysers Recharge Project, which has been recognized and lauded worldwide, as a weather-independent component of their reuse system. Other reuse components include agriculture and urban irrigation, and river discharge in winter months when irrigation opportunities are minimal and water levels are high (City of Santa Rosa 2010).

Imported / Exported Water

The North Coast Region does not import water, but water transfers do occur within the region. For example, Eel River water is diverted at the Van Arsdale Dam into the Russian River (Potter Valley Project). The North Coast generally exports more water to other regions than the volume of water consumed within the Region for agriculture and urban uses. Two out-of-Region transfers include Central Valley Project (Trinity River Diversion) and the north San Francisco Bay Area (Petaluma Aqueduct). Please refer to the Project Operations section of this document for additional information on these projects.

Water Uses

[Placeholder – Additional information will be included in this section to include agricultural, commercial, industrial and environmental water uses]

The principal developed uses of environmental water occur in the Lower Klamath Lake, Tule Lake, and Clear Lake National Wildlife Refuges, and the Butte Valley and Shasta Valley Wildlife Areas. In Butte Valley, most of the water for wildlife comes from about 3,000 acre-feet of groundwater. As a result of the passage of both federal and State wild and scenic rivers acts in 1968 and 1972, many of the major rivers in the North Coast region have been preserved to maintain their free-flowing character and provide for environmental uses. Most of the Eel, Klamath, Trinity and Smith Rivers are designated as wild and scenic, which preserves these river resources and protects them from new water development. On the Trinity River, efforts to restore the fishery led to a federal Record of Decision in year 2000 to increase the fishery flow releases from Trinity Lake. After several years of legal challenges, this decision was upheld by a July 2004 federal court decision. The water allocated to downstream fishery flows is now being increased from the previous 340,000 acre-feet per year, to a new schedule that ranges between 368,600 acre-feet in a critically dry year to more than 700,000 acre-feet per year in a wet water year. Biologists and Central Valley Project operators are still working on the development of daily, weekly and monthly water release schedules that will make the best use of these new water allocations.

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The water balance tables and the narrative discussion below provide a detailed summary of the actual region-wide water supplies and water uses from years 2006 through 2010 for the entire North Coast region. [Note: Content will be added here.] Figure NC-5 summarizes the dedicated and developed urban, agricultural and environmental water uses in the region for 2006 thru 2010. The figure also provides a graphical presentation of all of the water supply sources that are used to meet the developed water uses within this hydrologic region for these years. As shown on the first graph, the volume of water dedicated to wild and scenic rivers, called "statutory required outflows," is the largest component of dedicated water uses in the region. The information presented in Table NC-4 also indicates that the volume of water exported to other regions is generally greater than all the water consumptively used for urban, agriculture and wildlife refuges within the North Coast Region.

Drinking Water

The region has an estimated 262 community drinking water systems. The majority (over 85%) of these community drinking water systems are considered small (serving less than 3,300 people) with most small water systems serving less than 500 people (see Table NC-5). Small water systems face unique financial and operational challenges in providing safe drinking water. Given their small customer base, many small water systems cannot develop or access the technical, managerial and financial resources needed to comply with new and existing regulations. These water systems may be geographically isolated, and their staff often lacks the time or expertise to make needed infrastructure repairs; install or operate treatment; or develop comprehensive source water protection plans, financial plans or asset management plans (United States Environmental Protection Agency 2012).

In contrast, medium and large water systems account for less than 15% of region's drinking water systems; however these systems deliver drinking water to over 80% of the region's population (see Table NC-5). These water systems generally have financial resources to hire staff to oversee daily operations and maintenance needs, and hire staff to plan for future infrastructure replacement and capital improvements. This helps to ensure that existing and future drinking water standards can be met.

PLACEHOLDER Table NC-5 Summary of Community Water Systems within the North Coast Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

[AW, ETAW, EP definitions…; Overview of water balance methodology…]

Evapotranspiration (ET) Rates for Selected Growing Areas within the North Coast Hydrologic Region

Background

Several methods of determining when to irrigate and how much water to apply have been in use ever since people grew crops. The methods have varied greatly from the simple use of a shovel and direct observation to sophisticated data logger controlled monitoring equipment. Currently, keeping track of soil moisture status is the most common method used when estimating how much water to apply (i.e., crop water use demand). This method assumes a full moisture profile at the beginning of the growing season then subtracts hourly, daily or weekly amounts of crop ET from the soil moisture balance to keep a tally of the soil moisture status. When the soil is close to the management allowable depletion level (MAD - how dry the soil can become before stressing the plants), an irrigation event is scheduled to

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prevent the crop from being water stressed and damaged. Several methods are available to estimate soil moisture status. Direct readings on-site can be obtained using soil moisture probes and an understanding of the specific soil properties. Indirect readings can be obtained stemming from research on the weathers influence on crops and the crops potential maximum water use demand. Although the soil moisture balance method has flaws pertaining to the spatial applicability of the available data and the many micro-climates within California, the method does afford a fairly simple methodology anyone can use if they have the internet available to them and an understanding of soil-plant water relationships.

ET rates vary depending upon location, time of year, water availability and plant species. In recent history (aside from a shovel and experience), potential crop ET was estimated using evaporation pan values and an adjustment factor (crop coefficient, k_c) to convert pan ET to crop ET. E-Pan data was difficult to obtain on a localized scale and difficult to apply to specific soils and crops preventing the widespread use of the methodology. In the 1980's, the University of California began a study to utilize local weather data to estimate ET. By the mid 1980's, the California Irrigation Management Information System (CIMIS) Reference Evapotranspiration (ETo) technology had began. CIMIS Reference Evapotranspiration or ETo is a water use value base on a standard reference crop (normally a pasture containing actively growing cool season grass, clipped to within six inches of the ground, well irrigated with good exposure to the weather). CIMIS weather stations exist for many areas in California and provide usable estimates for irrigation and planning purposes. However, many areas in California, particularly the north coast and northern inland valleys, do not have any CIMIS weather stations. Until CIMIS locates additional weather stations in these areas, an alternative is available called Spatial CIMIS.

Spatial CIMIS ETo

Daily reference evapotranspiration (ETo) at 2 km spatial resolution was calculated statewide using the American Society of Civil Engineers version of the Penman-Monteith equation (ASCE-PM). Required input parameters for the ASCE-PM ETo equation are solar radiation (Rs), air temperature (Ta), relative humidity (RH), and wind speed at two meters height (U2). These parameters are estimated at each pixel (2 km, or 1.24 mile, square grid) using various methods.

Daily Rs is generated from the visible band of the National Oceanic and Atmospheric Administration's (NOAA) Geostationary Operational Environmental Satellite (GOES) using the Heliosat-II model. Heliosat-II is a European model designed to convert images acquired by the Meteosat satellite into maps of global (direct plus diffused) irradiation received at ground level. The model has also been used with other geostationary satellites such as the GOES. For details on the Heliosat-II model and its accuracy, please refer to: (http://www.helioclim.org/heliosat/heliosat2_soft_descr.pdf).

Air temperature, relative humidity, and wind speed values at each pixel were obtained by interpolating between point measurements from the CIMIS stations. Two interpolation methods, DayMet and Spline, were selected based on accuracy of results, code availability, and computational efficiency. DayMet is an interpolation method that was developed at the University of Montana to generate daily surfaces of temperature, precipitation, humidity, and radiation over large regions of complex terrain http://www.daymet.org. It determines the weights associated with a given weather station for each point where weather parameters are to be determined depending on the distance and density of the stations. Spline is an interpolation method that fits a surface through or near known points using a function with continuous derivatives. Two- and three-dimensional Spline is used based on which weather parameter is

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to be interpolated. The accuracies of the results obtained from both methods have been tested using cross-validation analysis.

The accuracy of ETo values estimated from these methods depends on many factors. One such factor is the accuracy of the remotely sensed data, which is significantly affected by such factors as cloudiness and snow cover. Therefore, mountainous areas with snow cover and coastal areas with cloud and fog are more susceptible to errors. Another factor is the accuracy of the interpolation methods used. Interpolation methods are affected by the density of the weather stations and geographic features of the region. Since most of the CIMIS stations are concentrated in lowland agricultural and urban areas, the mountains are again more susceptible to errors resulting from data interpolation due to the low density of weather stations. Despite these potential problems, however, we believe the ETo estimates provided using this method will be superior to only using data from a distant weather station with a different microclimate.

Annual Reference ET rates (Spatial ETo) for selected locations in agricultural areas within the North Coast Region; according to Spatial CIMIS:

Smith River (Del Norte County) 42.36 inches, Fortuna (Humboldt County) 44.58 inches, Ukiah (Mendocino County) 43.64 inches, Santa Rosa (Sonoma County) 40.24 inches, Etna (Siskiyou County, Scott Valley) 44.62 inches, Montague (Siskiyou County, Shasta Valley) 44.19 inches, MacDoel (Siskiyou County, Butte Valley) 43.50 inches, Tulelake (Modoc and Siskiyou Counties) 42.99 inches.

Values estimated by CIMIS and Spatial CIMIS do not account for rainfall, light rain (trace), fog or dew formation. These values are site specific and require direct observation by those applying the information. Rainfall entering the crop-soil profile (effective precipitation) can be subtracted from the water use demand on a daily basis. Effective precipitation (EP) is the amount of rainfall actually entering the soil and available to the plant, not running off as surface water or percolating through the soil beyond the root zone. EP requires an understanding of the local soils and rooting depth of the crop. EP can be estimated by disregarding any rainfall amounts below 0.2 inches or any amounts above 0.5 inches per day or multi-day rainfall event. The idea behind this is any amount of precipitation during a rain event below 0.2 inches will evaporate too soon to increase the soil water availability while amounts above 0.5 inches form any event will runoff due to the soil being saturated and unable to hold any more water. Amounts below 0.2 inches can be treated as light rainfall (see below). For additional information on Effective Precipitation or rainfall see the following web page, http://www.fao.org/docrep/S2022E/s2022e03.htm.

Trace precipitation, fog and dew formation require analysis as well. Light rain, fog and dew contribute to lowering the crop water demand by lowering the temperature and increasing the humidity in the micro-environment of the plant. When present, trace precipitation, fog and dew only form for short time periods requiring frequent observation and good record keeping. This is most important along the coast as fog and dew in these areas can contribute a great deal to meeting the water use demands of the crop. When using a soil moisture balance approach to irrigation scheduling, it is important to account for these factors when present. For more information on light rain, fog and dew accounting for crop water use demand, see: Correcting soil water balance calculations for dew, fog, and light rainfall by R. Moratiel, D. Spano, P. Nicolosi and R.L. Snyder, Irrigation Science paper: DOI 10.1007/s00271-011-0320-2 (California Department of Water Resources 2009).

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Blaine Hanson, Extension Specialist (Emeritus), Land, Air and Water Resources (University of California, Davis), in cooperation with Steve Orloff, Siskiyou County Farm Advisor (University of California Cooperative Extension), et.al., have been working on a study of alfalfa water use in California (including Scott and Shasta Valleys) from 2007 through 2010. The intention of the study was to develop new crop water use values for alfalfa to be used by agriculture and planning and to compare these findings to historical text book assumptions. Unfortunately, as of the writing of this document, study results are not yet published. However, preliminary results from this study indicate that historical, seasonal ET rates for alfalfa in California have been overestimated, with the amount dependant on where the crop is grown and the type of soil. Observed seasonal alfalfa water use from this study for the Scott and Shasta Valleys ranged from 32.8 to 39.6 inches whereas historical estimates ranged from 36.5 to 44.0 inches. The average seasonal difference between these two methods yielded a 3.25 inch over-application when using the historical values compared to the observed amounts. The median difference between the two methods was 2.25 inches for the season. As an example, if one were to apply an additional 3.25 inches of water over a typical 160 acre field for the season, the additional water necessary to apply would amount to 520 acre-inches or 43.3 acre-feet of additional water. This would be additional water required to meet expected seasonal crop demand if using the historical values. Furthermore, this additional water would need to be diverted or pumped during the irrigation season in order to meet the expected demand (not counting for the water necessary to overcome the irrigation system efficiency and assuming a good uniformity of application), requiring additional expense.

Water in the Environment

The North Coast Integrated Regional Water Management Plan identifies six primary objectives for the North Coast Region. These NCIRWMP objectives are consistent with State water management elements, State priorities and objectives and IRWM Program Preferences. The primary objectives are: 1) conserve and enhance native salmonid populations by protecting and restoring required habitats, water quality and watershed processes; 2) protect and enhance drinking water quality to ensure public health; 3) ensure adequate water supply while minimizing environmental impacts; 4) support implementation of Total Maximum Daily Loads (TMDLs), the North Coast Regional Water Quality Control Board's (NCRWQCB) Watershed Management Initiative, and the Non-Point Source Program Plan; 5) address environmental justice issues as they relate to disadvantaged communities, drinking water quality and public health; 6) provide an ongoing, inclusive framework for efficient intra-regional cooperation, planning and project implementation.

Instream Fisheries Requirements

The State Water Resources Control Board adopted the North Coast Instream Flow Policy on May 4, 2010. It applies to applications to appropriate water, small domestic use and livestock stock pond registrations, and water right petitions. This policy applies to water diversions from all streams and tributaries discharging to the Pacific Ocean from the mouth of the Mattole River south to San Francisco, and all streams and tributaries discharging to northern San Pablo Bay. The policy area includes approximately 5,900 stream miles and encompasses 3.1 million watershed acres (4,900 square miles) in Marin, Sonoma, portions of Napa, Mendocino, and Humboldt counties.

This policy establishes principles and guidelines for maintaining instream flows for the protection of fishery resources. It does not specify the terms and conditions that will be incorporated into water right permits, licenses, and registrations. It prescribes protective measures regarding the season of diversion, minimum bypass flow, and maximum cumulative diversion. Applicants may choose to implement the

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policy principles through the regionally protective criteria or site-specific studies. Site-specific studies may be conducted to develop alternative site-specific protective criteria. The policy also limits construction of new on-stream dams and contains measures to ensure that approval of new on-stream dams does not adversely affect instream flows needed for fishery resources. The policy provides for a watershed-based approach to evaluate the effects of multiple diversions on instream flows within a watershed as an alternative to evaluating water diversion projects on an individual basis. Enforcement requirements contained in this policy include a framework for compliance assurance, prioritization of enforcement cases, and descriptions of enforcement actions. The policy contains guidelines for evaluating whether a proposed water diversion, in combination with existing diversions in a watershed, may affect instream flows needed for the protection of fishery resources (State Water Resources Control Board 2012).

[What are the implications of the above policy, how does it affect the region?]

Levee and Channel System

The North Coast Hydrologic Region has four major flood management reservoirs—Lake Mendocino on the East Fork Russian River, Lake Sonoma on Dry Creek, Spring Lake off Santa Rosa Creek, and Matanzas Creek Reservoir on Matanzas Creek; two smaller flood management reservoirs on Paulin Creek and Middle Fork Brush Creek, and seven other reservoirs providing non-dedicated flood retention space. Other flood management projects include levees in the Eel River delta, levees and channel modifications on East Weaver Creek, Redwood Creek, the Klamath River, and the Mad River, and channel modifications on Santa Rosa Creek. Measures to mitigate the effects of tsunamis were part of Humboldt Harbor improvements, the Crescent City project, and Crescent City Harbor improvements.

Project Operations

Potter Valley Project

The northern edge of Potter Valley separates the Russian River watershed from the Eel River watershed. The Eel River at this point is 475 feet higher in elevation than the headwaters of the Russian, and the hills are relatively narrow. In 1900, it was an ideal place to build a hydroelectric power plant. The upper Mainstem Eel River is a rain-driven watershed, collecting and releasing enormous amounts of water during significant winter and spring storms. Therefore, during the rainy season, the river quickly swells and then recedes until the next storm. This area of California, the southernmost section of the Eel River watershed, only rarely receives rain in summer. Early summer flows are produced from snow and retained groundwater. However, snow only persists on peaks over 5,000' in this region and include Hull Mountain and Snow Mountain that hold snow into the spring.

As mentioned above, annual flows in the Eel River are quite variable. In the relatively dry year of 2009, the peak flow in the beginning of March, as measured passing Cape Horn Dam at gage E-11 (downstream of the diversion), for one day, was over 5,000 cfs, quickly dropping to approximately 1,000 cfs and then back to the winter steady state of around 150 cfs before the next major rain. Peak winter flows can occasionally exceed 100,000 cfs. It is these winter storm events that are captured and stored in Lake Pillsbury for later use. Water for diversion to the PVP is not at the expense of natural flows down the Eel, but is maintained from the early season storage behind Scott Dam (Lake Pillsbury).

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The flow rate required for each day also takes into account the level of water storage at Lake Pillsbury. The gates on the dam are typically open in winter months to maintain the State Division of Dam Safety required flood control pool until April 1st. The Reasonable and Prudent Alternative (RPA) target storage curve has a preferred lake elevation for every day of the year, and flows through the Potter Valley Project are reduced when Lake Pillsbury falls below this level.

Between October 16th and April 1st, (winter season) the gates on Scott Dam are kept open. This means maximum lake storage at the dam spill crest, at an elevation of 1900 feet, equals 54,338 acre feet. All flows after this free flow over the top as if the dam wasn't there. As long as the RPA target storage level for Lake Pillsbury remains below 54,338 acre feet for that date, the Potter Valley Project diversion at E-16 can be increased above the minimum. On the day the target curve climbs above 54,338 acre feet, the E-16 diversion drops to the RPA required minimum of 40 CFS. That date, under normal year conditions, is March 8th, regardless of the spill rate over the dam. Even though a significant amount of water is flowing down the Eel River towards Van Arsdale, if Lake Pillsbury is below its target storage level for that date, water cannot be sent through the diversion to the PVP.

In addition, the top gates on Scott Dam cannot be closed until April 1st, for dam safety reasons. Due to the conflicting regulations, the required target storage for the lake continues to climb while another set of rules require that the dam gates are wide open, preventing further water accumulation. Even after the flood gates are closed, April 1st through October 15th, all RPA required minimums must be met and the target storage curve continues to rise. The elevation at the top of the gates is 1910 feet which equals 74,993 acre feet of storage. PG&E must hold storage to 1909 feet which equals 72,744 acre feet, to ensure that water never overtops the gates. After this level, the target storage curve continues to climb into mid air above the dam to an unattainable level of 83,300 acre feet! Per the 2006 bathymetric survey, the maximum storage at the lake is 74,993 acre feet (Potter Valley Irrigation District 2010).

Coyote Valley Dam and Lake Mendocino

Lake Mendocino is located on the East Fork of the Russian River (downstream of the Potter Valley Project), about 5 miles northeast of Ukiah in Mendocino County. The Coyote Dam (also known as Coyote Valley Dam) project was authorized by the Flood Control Act of 1944 and completed in 1958 for purposes of flood control, water supply, recreation and stream flow regulation. Lake Mendocino has a flood storage capacity of 122,400 acre-feet and a total surface area of 1,822 acres. The lake has an un-gated spillway, designed for a maximum release of 35,800 cubic feet per second. Major facilities include an anadromous endangered/protected fish species egg collection and imprinting facility, visitor cultural center complex, park headquarters, sponsor run electrical power-plant (hydropower), developed campgrounds (300 sites), 18 primitive boat-in/hike-in campsites, a trail system, two boat launch ramps, swim beach, and picnic areas. Six hundred and eighty nine acres of the park’s 5,110 acres are devoted to wildlife management (United States Army Corps of Engineers, Coyote Valley Dam 2010).

Warm Springs Dam and Lake Sonoma

Warm Springs Dam and Lake Sonoma is located on Dry Creek in Sonoma County, approximately 14 miles above the confluence with the Russian River. The project is located on 15,966 acres of land, situated approximately 14 miles northwest of Healdsburg.

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Warm Springs Dam forms Lake Sonoma, which has a design capacity of 381,000 acre-feet and drains an area of approximately 130 square miles, or about 9 percent of the total Russian River basin. Construction started in 1967 and was completed in 1982.

The dam is operated and maintained by USACE. The storage space for water conservation is owned by the Sonoma County Water Agency (SCWA), while the remaining part of the project is owned by USACE, which directs flood control releases from Warm Spring Dam.

Warm Springs Dam is a rolled earth embankment. The dam crest is 319 feet above the streambed and 6 feet above the maximum spillway flood water surface elevation. The dam crest extends 3,000 feet across the stream channel and is curved on a 6,000 foot radius. The top of the dam is 30 feet at the crest and 2,600 feet at the base.

The Don Clause Fish Hatchery (Warm Springs Fish Hatchery) is located on Dry Creek at the base of Warm Springs Dam. This facility is operated by Fish and Game (Fish and Wildlife, CDFW) under a cooperative agreement with USACE. The hatchery was created as part of the Warm Springs Dam Project to compensate for loss of spawning and rearing habitat that was impounded and made inaccessible to anadromous fish by the dam.

SCWA owns and operates the Warm Springs Dam hydroelectric facility. The hydroelectric facility was completed in December 1988. SCWA operates the facility under a 50-year license issued by FERC on December 18, 1984. The 3,000 KW Francis turbine generators have a power rating of 2.6 MW (United States Army Corps of Engineers, Warm Springs Dam 2010).

Petaluma Aqueduct

Sonoma County Water Agency, SCWA, owns and maintains a series of underground pipes that run from water collectors at Wohler Bridge near Forestville on the Russian River to northern Marin County; the Petaluma Aqueduct, serving the greater Santa Rosa area and the City of Petaluma and North Marin Water District.

The Petaluma Aqueduct carries over 90 percent of the water used by the City of Petaluma, over 8 million gallons a day. The underground structure is 50 years old, has exceeded its predicted lifespan, and could rupture during an earthquake.

While the Petaluma Aqueduct itself warrants monitoring and study, Petaluma is just part of an 85-mile system of water transmission lines. With Petaluma at the south end of the system, this means that any breakdown along the conveyance affects everyone downstream. SCWA staff recalled times over the years when the water agency had to shut down its system. By implementing conservation measures and using water held in storage, Petaluma was able to manage the temporary loss of its primary supply. SCWA has two or three days supply in storage along the aqueduct, while the City of Petaluma has a couple of days of storage and ground water wells.

Like most Sonoma County cities, Petaluma drew its own water from municipal wells for decades. According to the Department of Water Resources, the original water source for the community was the headwaters of Adobe Creek. In 1960, Petaluma leaders signed an agreement to receive water from SCWA

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and the Petaluma Aqueduct was completed in December 1961. As a contractor of SCWA, Petaluma agrees to purchase water at guaranteed rates while SCWA handles the two-county distribution system.

Petaluma does have its own source of municipal water. Typically, it only comprises 2 percent of the city's water use, but in recent drought years, local wells were run more often and made up 10 percent of the city's average water use (Petaluma 360 2012).

North Marin Aqueduct

The North Marin Aqueduct is an extension of the Petaluma Aqueduct to supply water to North Marin Water District and Marin Municipal Water District for the city of Novato and surrounding communities.

Russian River water, which provides about 80% of Novato's water demand, originates in Mendocino County from both the Eel River and the Russian River watershed. Eel River water flows from the Potter Valley Project diversion on the Eel River to the east fork of the Russian River. Then, downstream at a point about 10 miles upstream of Guerneville, near Forestville, water is collected by five Ranney water collectors. This water is then pumped directly into the Petaluma Aqueduct system to supply treatable water for potable use to a two county area.

Stafford Lake, which provides approximately 20% of Novato's water demand, lies four miles west of downtown Novato and collects runoff from 8.3 square miles of watershed property located upstream at the upper tributary reaches of Novato Creek.

Since 2007, the Deer Island Recycled Water Facility near Novato, located adjacent to Highway 37, has produced treated recycled water supplies to offset Russian River water and help improve Novato's water supply for large landscape and fire protection (North Marin Water District 2013a, 2013b).

R.W. Matthews Dam, Ruth Lake and Mad River

R.W. Matthews Dam forms Ruth Lake in southern Trinity County. It impounds runoff from the upper quarter of the Mad River basin, an area of approximately 121 square miles. The lakes capacity is 48,030 acre-feet (AF).

A portion of the water stored in Ruth Lake is released each summer and fall to satisfy the Humboldt Bay Municipal Water District's (HBMWD) downstream diversion requirements, as well as maintain minimum bypass flow requirements in the Mad River below Essex. Although the HBMWD impounds water at Ruth Lake and diverts water at Essex, the operations do not significantly affect the natural flow regime in the Mad River (Essex is located on the Mad River 3.5 miles northeast of Arcata at an elevation of 75 feet).

The total volume of water impounded and diverted by HBMWD represents a small percentage of the natural yield of the Mad River watershed. The Mad River's average annual discharge into the Pacific Ocean is just over 1,000,000 acre-feet. Ruth Lake, in its entirety, represents less than 5% of the total average annual runoff from the Mad River basin. The entire 48,030 AF capacity of Ruth Lake is not drawn down each year, so the amount of winter-season runoff captured in the reservoir is yet a smaller percentage of the total runoff. With respect to diversions, the current withdrawal rate at Essex is approximately 25 to 30 MGD (28,000 to 34,000 acre-feet per year), which is only 3% of the total annual average runoff of the Mad River watershed. The full diversion capacity of 75 MGD (84,000 acre-feet per year) is just 8 % of the total annual average runoff of the watershed.

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Tributaries downstream of Matthews Dam contribute significantly to, and are a major influence on, resulting flow rates in the Mad River. A former USGS gage station near Forest Glen was located nine miles below the dam prior to the confluence of any major tributaries. Annual mean flow at the Forest Glen gage station increased by an average of 22 percent compared to the mean flows just below Ruth Lake. The more significant tributaries on the Mad River are located downstream of this former gage station. These tributaries contribute significantly to Mad River discharge, and also provide a "buffering effect" during the few times the HBMWD is releasing from Ruth Lake less than the natural flow (e.g. during the first winter storms).

There is no out-of-basin transfer in the upper watershed, as occurs on some river systems. The water which HBMWD releases flows down the mainstem Mad River channel, and augments flows compared to what otherwise occurred naturally during the summer and fall. Flow augmentation has many beneficial effects, including expanding river habitat for the benefit of aquatic species and improving water quality in the summer and fall (Humboldt Bay Municipal Water District 2012).

Iron Gate Dam and Klamath River

Iron Gate Dam is operated within the constraints of the Klamath Basin Operations Plan. The Operations Plan for the Bureau of Reclamation's Klamath Project, which is located within the upper Klamath River Basin in southern Oregon and northern California, describes Project operations on an annual basis from April 1 of one year through March 31 of the next, based upon current and expected hydrologic conditions.

Reclamation develops this plan to serve as a planning aid for agricultural water users, Klamath Basin Tribes, national wildlife refuges, and other interested parties. The plan provides an estimated Project water supply to the following areas:

West Side delivery area: This area includes lands in southern Oregon and northern California that receive Project water primarily from Upper Klamath Lake (UKL) and/or the Klamath River. This area also includes the Tule Lake and Lower Klamath National Wildlife Refuges.

East Side delivery area: This area includes lands within Langell Valley Irrigation District and Horsefly Irrigation District (both in Oregon) on the east side of the Project area. This area receives water from Clear Lake Reservoir (California), Gerber Reservoir (Oregon), and the Lost River (California and Oregon).

In response to both the 2010 National Marine Fisheries Service (NMFS) biological opinion (BO) and the 2008 U.S. Fish and Wildlife Service (USFWS) BO, Reclamation developed a "Variable Base Flow" (VBF) procedure to be used for operations. The VBF procedure was developed based on the following objectives: (1) provide certainty in compliance with the UKL minimum elevations, as outlined in Table 2-1 of the 2008 USFWS BO and (2) provide a procedure that tracks the flows outlined in Table 18 of the 2010 NMFS BO and Reasonable and Prudent Alternatives. These objectives were designed to help meet the needs of Coho salmon during critical periods of the year. The general elements of the VBF procedure are described below.

Variable Base Flow (VBF) Procedure for Klamath Project

For the April through September time period, a base flow for the Klamath River below Iron Gate Dam will be determined for each period using the most current 50% exceedance (chance of exceeding) Natural

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Resources Conservation Service (NRCS) UKL inflow forecast through September. The 50% exceedance inflow forecast value for 2012 is identified in Table NC-6 for the given time period. The corresponding flow is the base flow requirement for downstream of Iron Gate Dam. Table NC-7 relates inflow forecasts from percent of average inflow to a "base flow" past Iron Gate. Linear interpolation is used for percent of average inflow values that fall in between the values listed in Table NC-7.

PLACEHOLDER Table NC-6 UKL Exceedance

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

PLACEHOLDER Table NC-7 Base Flow Past Iron Gate Dam

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

The 2012 operations year will be use as an example. The April 1st NRCS 50% exceedance UKL inflow forecast for April through September is 400,000 Acre-Feet (AF), or 78% of the NRCS average inflow for this time period (515,000 AF). Using Table NC-8, the Iron Gate base flow for April 1st through April 15th is 1,500 Cubic Feet per Second (cfs).

PLACEHOLDER Table NC-8 Iron Gate Base Flow Requirement, April 1–15, 2012

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

As the elevation of UKL fluctuates, additional releases will be made to the Klamath River above VBF "threshold elevations". If the VBF threshold elevation is exceeded, the water above that threshold is to be released in support of the 2010 NMFS BO. The threshold elevations for UKL were developed through a trial and error process in order to better track the 2010 NMFS RPA Table 18 flows while maintaining the 2008 USFWS BO minimums for UKL. The threshold elevations are shown below in Table NC-9. Flows will be released to mimic the natural inflow pattern into UKL as best as possible above these elevations.

PLACEHOLDER Table NC-9 Threshold Elevations for Upper Klamath Lake (UKL)

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

In periods when threshold releases are being made during the months of March, April and May, a maximum controlled flow release will be determined. Threshold releases will not be increased above the maximum unless required for flood control purposes. Therefore, the elevation of UKL will increase above the threshold elevations shown above if the flows at Iron Gate Dam are at the maximum flow shown in Table NC-10. Maximum flows will be determined based on the current percent of average forecast shown in Table NC-11. Once the flood control limit is reached, flows will be released in order to maintain a full lake until the flows decrease back to the maximum flow (National Marine Fisheries Service 2010; United States Bureau of Reclamation 2012; United States Department of Interior 2008).

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PLACEHOLDER Table NC-10 Maximum Flows at Iron Gate Dam

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

PLACEHOLDER Table NC-11 Percent of Average Forecast

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Iron Gate, Copco and Dwinnell Reservoirs

Iron Gate and Copco Reservoirs are operated for hydropower, water supply and recreation. Copco reservoir is important as there are lakefront homes around it. Dwinnell reservoir (Lake Shastina) is for municipal water for city of Montague, irrigation supply for the Montague Irrigation District and recreation.

Trinity Dam and Exports from Trinity River to Central Valley

Trinity Dam stores water from the Trinity River in Trinity Lake (formerly, Clair Engle Lake). Water that is released from Trinity Dam is regulated by Lewiston Dam which provides a forebay for diversion flows to the Clear Creek Tunnel. Water then enters Whiskeytown Lake through Judge Francis Carr Powerhouse. Some of the water diverted from the Whiskeytown Lake flows into the Clear Creek Unit South Main Aqueduct to irrigate lands in the Clear Creek Unit. The rest flows through the Spring Creek Power Conduit and Power Plant into Keswick Reservoir. From there, water goes through Keswick Power Plant to the Sacramento River.

Exports from the Trinity River Diversion (TRD) contribute to meeting minimum flow requirements in the Trinity and Sacramento Rivers, help to maintain reservoir storage levels, and facilitate other Central Valley Project (CVP) operating requirements such as compliance with the Winter-run Biological Opinion which requires that certain temperature requirements be met in the Sacramento River below Keswick Dam.

Prior to construction of TRD, average annual discharge at Lewiston was approximately 1.2 maf. Peak flows in excess of 100,000 cfs were recorded at Lewiston and daily average flows greater than 70,000 cfs occurred three times between 1912 and 1963. Following construction, instream flow releases were set at 120,500 af/yr (10 percent of the average unimpaired inflow). From 1964-96, TRD exports accounted for 14 percent of Keswick releases. In the period of 1986 through 1996, TRD exports accounted for 12 percent of Keswick releases.

An outcome of TRD operations and the reduced instream Trinity River flows was degraded fish habitat and drastic reductions in anadromous fish populations. By 1980 it was estimated that fish populations had been reduced by 60 to 80 percent due to inadequately regulated harvest, excessive streambed sedimentation, and insufficient streamflows. The lost of fishery habitat was estimated to be 80 to 90 percent. To help address these problems, Congress passed the Trinity River Stream Rectification Act in 1980 (addressing sedimentation issues) and passed the Trinity River Basin Fish and Wildlife Management Act in 1984. The 1984 act directed efforts to restore fish and wildlife populations to levels that existed prior to TRD construction.

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One of the provisions of the 1992 CVPIA was the establishment of a minimum flow volume of 340,000 af for the Trinity River. The CVPIA also directed the completion of the 12-year study (Trinity River Flow Evaluation Study (TRFES)) to establish permanent instream fishery flow requirements, TRD operating criteria, and procedures for restoration and maintenance of the fishery. The TRFES report recommended specific annual flow released, sediment management, and channel rehabilitation to provide necessary habitat.

Since 2003 restoration efforts have included improvements to floodplain infrastructure, channel rehabilitation, and peak flow releases. Since 2004 peak flow releases have ranged from 4,419 cfs to 10,100 cfs.

As part of the Trinity River Restoration Program, there are three basic types of flow releases to the Trinity River: 1) Releases for River Restoration; 2) Safety of Dams; 3) Other. The flow scheduling process varies for each type of flow release as described below.

1. The best scientific information available recommends more natural and variable flow releases based on snow-melt driven hydrographs. Variable flows of sufficient size clean spawning gravels, build gravel/cobble bars, scour sand out of pools, provide adequate temperature and habitat conditions for fish and wildlife at different life stages, control riparian vegetation, and perform many other ecological functions. In order to recreate inter-annual, or "between-year" flow variability, the Record of Decision (http://www.trrp.net/?page_id=72) defined five water year types with a minimum volume of water to be released into the Trinity River for each of the five types, see Table NC-12. The water volumes are measured in acre-feet (af), which is the volume of water one foot deep in the area of one acre. Each year, the water not allocated to the river is available for export to the Central Valley Project for water supply and power generation. The Record of Decision also recommended typical flow releases for each of the five water year types as shown below. These typical release schedules may be adapted to meet specific restoration needs for the current year, See Figure NC-7.

PLACEHOLDER Table NC-12 Water Year Types from Trinity River Record of Decision

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

PLACEHOLDER Figure NC-7 Typical Flow Releases to Trinity River, Trinity River Record of Decision

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

2. During the winter, the Bureau of Reclamation maintains lower levels in Trinity Lake to provide a buffer in the event of an extremely large winter storm. The quantity of that buffer is based on several factors and primarily references many years of hydrologic record for the basin. Maintaining storage space is a very important aspect of flood control operations, and is fundamental in protecting areas downstream of Trinity Dam, as well as the dam itself. As winter storms fill Trinity Lake, the Bureau of Reclamation may need to increase releases to maintain the lower lake levels. Because these elevated winter releases help protect the dam, they are commonly called "Safety of Dams releases" and may or may not occur in conjunction with actual winter

storms. These releases are made independently from the ROD releases for river restoration. Safety of Dams releases are scheduled by the Bureau of Reclamation in response to current conditions and typically have no more advance warning than a few days. The Bureau of Reclamation uses a combination of increased releases to the Trinity River through Lewiston Dam and trans-basin diversions to the Sacramento River through the Clear Creek Tunnel to lower the water level in Trinity Lake (see: http://www.trrp.net/?page_id=39) . Consequently, releases from Trinity Dam to Lewiston Reservoir may be higher than releases from Lewiston Dam to the Trinity River. Safety of Dams releases from Lewiston Dam to the Trinity River are typically no greater than 6,000 cfs, but may go higher if conditions warrant.

3. The Bureau of Reclamation occasionally makes flow releases from Lewiston Dam to the Trinity River for other purposes such as tribal releases or to mitigate late summer conditions in the Lower Klamath River for fish health purposes. The Bureau of Reclamation coordinates these releases with the Trinity River Restoration Program and usually provides several weeks' public notice. Such releases are independent from the ROD releases for river restoration (Trinity River Restoration Program c2012; United States Department of Interior 2000).

In 2011, xxx produced high flows to study sediment transport and streambed improvement…
[Note: additional content to be provided.]

Surface Water Quality

[NCIRWM]

[NC RWQCB]

[Clean Water Act?]

[Near Coastal REGs]

[Description of surface water quality conditions and issues in the region]

Large portion of the North Coast is listed for TMDL's. Unfortunately, rural regions have difficulties maintaining State and Federal drinking water standards due to financial and technical issues.

The surface water quality issues of most concern in the North Coast Region are excess sediment, elevated water temperatures, and excess nutrients. These water quality conditions are the result of point and non-point sources of pollution and other controllable factors (e.g., landscape alteration, road building, etc.) and are exacerbated by hydrologic modification, water withdrawal, and the loss of competent riparian zones and floodplains to development, agriculture, and logging. Many north coast aquatic ecosystems are impacted by these constituents and controllable factors, resulting in a loss of streamside property to erosion, destruction of water intakes, loss of aquatic habitat and risk to threatened and endangered aquatic species, increased winter flood potential, and increased risk of summer nuisance algal blooms (including microcystis and other cyanobacteria).

There are more localized issues, as well. For example, surface water monitoring indicates a problem with pathogens in Bodega Bay Hydrologic Area, Hare Creek Beach and Pudding Creek Beach on the Mendocino Coast, several coastal beaches in the Trinidad Hydrologic Unit, and riverfront beaches on the

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Russian River and its tributaries, as well as the Laguna de Santa Rosa and its tributaries. In addition, several of the region's water bodies are impaired by mercury, including: Lake Pillsbury, the Laguna de Santa Rosa, Lake Sonoma, Trinity Lake, and the East Fork Trinity River from gold mining in the past. Exotic species are listed as a water quality problem in Bodega Bay and dioxin and PCBs are listed as impairing Humboldt Bay.

Groundwater Quality

[Placeholder – Additional groundwater content expected from the Groundwater Enhancement Team.]

Groundwater quality problems in the North Coast region include contamination from seawater intrusion and nitrates in shallow coastal groundwater aquifers; high total dissolved solids and alkalinity in groundwater associated with the lake sediments of the Modoc Plateau basins; and iron, boron, and manganese in the inland groundwater basins of Mendocino, Sonoma, and Siskiyou counties. Past and potential septic tank failures in western Sonoma County at Monte Rio and Camp Meeker, along the Trinity River below Lewiston Dam, and along the shore of Arcata Bay/Humboldt Bay, and other areas throughout the region, are a concern due to potential impacts to groundwater wells and recreational water quality.

In 2009, the USGS, in conjunction with the State Water Resources Control Board, collected untreated groundwater data from 58 wells selected from the California Department of Public Health database within 34 groundwater basins located in the North Coast Region. Wells were randomly selected from Napa, Lake, Mendocino, Glenn, Humboldt, and Del Norte Counties. The results of the study are published in Methany et al. (2011). All detected concentrations of organic constituents, nutrients, major and minor ions, and radioactive constituents were less than health-based benchmarks for the 30 wells sampled in the Northern Coast Ranges. There were a few detections of arsenic, boron, and barium in the 28 wells of the interior basins which exceeded MCLs or notification levels; but, these are likely related to the area's geology. The results of this study indicate that community drinking water systems drawing from primary aquifer systems in the North Coast Region generally provide safe drinking water, with the exceptions noted.

Shallow groundwater, however, has been pervasively contaminated by a long history of activities and operations, primarily: wood treatment facilities, unlined landfills, leaking underground storage tanks, and dry cleaning facilities. In many regions, shallow groundwater is neither used nor useable. But, because the North Coast Region is predominantly rural, many people rely on shallow (sometimes hand dug) wells for their drinking water. Thus, shallow groundwater cleanup remains a high priority in the region.

There may be contributions of nutrients and pesticides to shallow groundwater resulting from the continued conversion of land to vineyards in Sonoma and Mendocino counties and other widespread farming activities in the Upper Klamath River basin and the Smith River plain, among other disperse locations of the region. Aging wastewater treatment ponds and leaking septic tanks may play a part in shallow groundwater contamination in these areas as well (Mathany TM, et al 2009).

Drinking Water Quality

In general, drinking water systems in the region deliver water to their customers that meet federal and state drinking water standards. Recently the Water Boards completed a draft statewide assessment of

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community water systems that rely on contaminated groundwater. This draft report identified 15 community drinking water systems in the region that rely on at least one contaminated groundwater well as a source of supply (See Table NC-13). Arsenic is the most prevalent groundwater contaminant affecting community drinking water wells in the region (see Table NC-14). The majority of the affected systems are small water systems which often need financial assistance to construct a water treatment plant or alternate solution to meet drinking water standards.

PLACEHOLDER Table NC-13 Summary of Community Drinking Water Systems in the North Coast Hydrologic Region that Rely on One or More Contaminated Groundwater Well that Exceeds a Primary Drinking Water Standard

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

PLACEHOLDER Table NC-14 Summary of Contaminants affecting Community Drinking Water Systems in the North Coast Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Nonpoint Source Pollution (NPS)

Nonpoint source pollution is the leading cause of water quality impairment in California. Problems in the region include contamination of surface water due to NPS pollution from storm water runoff, erosion and sedimentation (roads, agriculture, and timber harvest), failing septic tanks, channel modification, gravel mining, dairies, MTBE and dioxin contamination (from lumber mills) and urban runoff. In areas where people can come into contact with contaminated waters, the State Water Board, North Coast Regional Water Board, and California Coastal Commission have the responsibility to protect the people. Among other priorities, one of highest priorities of the Regional Water Board's Basin Plan is to develop a freshwater beach program in cooperation with the Sonoma County Health Department for the Russian River. Sediment, temperature, and nutrients are the items of primary focus in the Regional Water Board's 303(d) list of impaired water bodies. Along the coast, NPS pollution can cause microbial contamination of shellfish (and in particular, oyster) growing areas. In rivers, lakes, and reservoirs in the Klamath Basin, extreme growths of blue green algae and accompanying microcystin neurotoxins have been found in high concentrations, leading to issuance of a health advisory by the State.

Mercury

Mercury in fish tissue is a water quality concern in Lake Pillsbury (Eel River), Lakes Mendocino and Sonoma (Russian River), and Trinity Lake (Trinity River); health advisories for mercury have been issued for Lake Pillsbury and Trinity Lake.

Erosion and Sedimentation

The Regional Water Board has prepared a Work Plan to Control Excess Sediment in Sediment-Impaired Watersheds (04-08-2008). The plan describes actions and tasks that staff is doing or intends to do over the next 10 years (as resources allow) to control human-caused excess sediment transport in the sediment-impaired water bodies of the region. Besides harming aquatic life, excess sediment can limit the use of water for municipal and domestic consumption, agriculture, industry, wildlife, fishing, and recreation, and it can cause or contribute to flooding. When sediment transport and increased runoff do occur, they cause

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changes in the downstream channels. These changes include gravel and sand deposition creating gravel bars, degrading spawning habitat and scouring of stream channels due to higher flows.

Recommendations to Improve Water Quality

The "Water Quality Control Plan for the North Coast Region" (Basin Plan) was originally adopted by the North Coast Regional Water Quality Control Board (Regional Board) in 1975 and, as a fundamental cornerstone, is designed around the prohibition against point source discharge of waste to all surface waters of the region, except the Mad River, Eel River, and Russian River. Point source discharges to these surface waters are only allowed during the winter season and when the discharge can be limited to 1% or less of the receiving waters' flow.

Two of the consequences of this water quality protection strategy are: 1) the general limitation of surface water quality issues in the North Coast to those resulting from nonpoint source discharges (e.g. sediment, temperature, and nutrients) and 2) the prevalence of land disposal as a method for waste treatment and discharge for individual, community, and industrial systems.

The prevalence of land disposal, in turn, has resulted in a risk to groundwater quality, particularly shallow groundwater. In addition, predicted population increases in the Region and anticipated erratic future precipitation trends due to climate change are likely to increase reliance on groundwater resources to support future water needs in the Region. Increased demand on groundwater supplies is already occurring in many areas of the Region. Protection of groundwater resources is an important component in the protection of a number of beneficial uses associated with surface waters, such as providing base flow and cold freshwater habitat from inflow of cold groundwater to streams during warm summer months.

Yet, federal and state funding for water quality protection work is generally biased towards the protection of surface water quality. Funding for the protection of groundwater quality is focused on 1) the protection of deep groundwater aquifers serving community drinking water systems and 2) the cleanup of individual spills, leaking underground storage tanks, and hazardous waste sites, including municipal landfills.

Surface Water Recommendations

In addition to the ongoing work associated with permitting, inspecting and taking enforcement action, as necessary, on waste treatment facilities in the North Coast Region, the Regional Board has given considerable attention over the past 15 years to the development of Total Maximum Daily Loads (TMDLs) for individual watersheds to address identified water quality and beneficial use impairments of surface water. The primary contaminants of concern in North Coast TMDLs are sediment, temperature, and nutrients, but also include pathogens, mercury, dioxin/PCBs, and exotic species in some locations. The actions necessary to achieve TMDLs have proven to be similar from watershed to watershed, leading the Regional Board to develop region-wide policies for the control of waste discharge from: timber operations, dairies and other concentrated animal feeding operations (CAFO), county roads, and irrigated agriculture. These policies generally use one or more of the following tools: waste discharge prohibitions, waste discharge requirements (i.e., individual, ownership, and watershed wide), and waivers of waste discharge requirements.

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To achieve the goal of full attainment of water quality objectives in North Coast surface waters, Regional Board staff makes the following recommendations:

1. Complete and implement region-wide policies to address sediment, temperature, and nutrient impairments. These policies should not only address watersheds currently identified as impaired, but protect high quality waters from degradation, as well.
2. Complete and implement the TMDLs necessary to address the specific locations where mercury, pathogens, dioxin/PCBs, and exotic species impairments exist.
3. Build greater interagency coordination around the need to address legacy sources of pollution in the North Coast Region, most notably:
    A. deposited instream sediment loads resulting from historic timber harvesting, road building and other major landscape altering activities;
    B. increased erosion potential associated with those landscape areas still not recovered from historic land altering activities; and,
    C. reduction in assimilative capacity for both legacy and contemporary pollutants resulting from hydrologic modifications, including: seasonal and permanent instream impoundments or barriers; excessive instream water withdrawals (e.g., over allocation of water rights or insufficient dedication of instream flows for environmental/public trust purposes); and unregulated or under regulated groundwater extraction.
4. Build greater interagency coordination around the need to support and encourage restoration activities, including: floodplain and riparian zone rehabilitation, wetland restoration, and instream/habitat restoration, as a mechanism for accelerating the recovery of damaged aquatic ecosystems, restoring beneficial uses, and increasing assimilative capacity.
5. Build greater interagency coordination around the need to address the controllable factors impacting water quality arising from illegal activities in the North Coast region, most notably illegal marijuana farms.

Groundwater Recommendations

As above, groundwater quality, particularly shallow groundwater, is substantially impacted by the prevalence in the North Coast region of land disposal as a mechanism for the disposal of individual, community, and industrial wastes. With respect to the North Coast region, the statewide groundwater quality framework adequately addresses the protection of community drinking water systems that rely on deep groundwater aquifers. Similarly, it adequately addresses the investigation and cleanup of individual underground storage tank and hazardous waste sites. Further, there are valuable statewide programs to address: 1) the potential for salt and nutrient contamination of shallow groundwater from the increased use of recycled water and 2) the potential for pathogen and nutrient contamination of shallow groundwater from the use of individual onsite disposal systems (i.e., septic systems).

To achieve the goal of full attainment of water quality objectives in North Coast groundwater, Regional Board staff makes the following recommendations:

1. Build greater interagency coordination around the need to assess shallow groundwater quality in the North Coast Region and develop a strategy to ensure its adequate protection.
    A. Initiate a region-wide shallow groundwater quality assessment, evaluating existing groundwater data and identifying the data gaps worth filling so as to determine i) the extent of shallow groundwater contamination in the region, ii) the extent of shallow groundwater use in the region (i.e., municipal use, domestic use, agricultural use, industrial use, and environmental use, where groundwater is the predominant source of surface water for peren-

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nial streams, lakes, and wetlands during a seasonal or extended drought), and iii) those areas in the region where shallow groundwater contamination and shallow groundwater use overlap.

B. Develop and implement a comprehensive shallow groundwater protection strategy for the North Coast region, including 1) an assessment of the resources that could be made available for its implementation and 2) land use specific action plans relating to discharge of waste to land.

2. Build greater interagency coordination around the need to manage groundwater extractions, particularly in areas identified as important to perennial streams, lakes, and wetlands and including those areas where significant drawdown will have a detrimental impact on the movement of existing contaminant plumes.

Recent Initiatives or Actions to Improve Water Quality

Since 2009, the Regional Water Board has been engaged in the following activities. Many of these activities support one or more of the 10 resource strategies developed by DWR with the primary objective of improving water quality. These activities also represent the North Coast Regional Board's accomplishments for the period of 2009-2013.

1. Cleaning up and closing groundwater contamination sites at an accelerated rate.
2. Updating NPDES permits and Waste Discharge Requirements (WDRs). New permits incorporate toxics rules and Low Impact Development techniques, where appropriate. Permits are also written to accommodate an increase in water recycling and water reuse, where possible. Non-municipal waste discharges typically regulated by NPDES permits in the North Coast include: canneries, fish hatcheries, wineries and other food processing plants, groundwater cleanup projects, hardboard manufacturing plants, pulp mills, sawmills, and gravel operations.
3. Implementing the statewide stormwater prevention regulations. Efforts include: enrolling cities and other entities under the general stormwater permits and adopting individual stormwater permits. A very large effort was made in the adoption of an MS4 permit* for the City of Santa Rosa.

*MS4 permit; Small Municipal Separate Storm Sewer System, The regulatory definition of an MS4 (40 CFR 122.26(b)(8)) is "a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains): (i) Owned or operated by a state, city, town, borough, county, parish, district, association, or other public body (created to or pursuant to state law) including special districts under state law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act that discharges into waters of the United States. (ii) Designed or used for collecting or conveying storm water; (iii) Which is not a combined sewer; and (iv) Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2."

In practical terms, operators of MS4s can include municipalities and local sewer districts, state and federal departments of transportation, public universities, public hospitals, military bases, and correctional facilities. The Storm water Phase II Rule added federal systems, such as military bases and correctional facilities by including them in the definition of small MS4s.

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4. Continued monitoring of surface water quality trends at select locations around the region, as well as intensive watershed monitoring on a rotating schedule.
5. Evaluating available surface water data to identify impaired waters and schedule the development of a Total Maximum Daily Load (TMDL) assessments and/or establish implementation measures to control known sources. A very large and complex TMDL was adopted for the Klamath River in 2010. Action Plans have been adopted for the Klamath River and the Lost River. An MOU was signed with the U.S. Forest Service for TMDL implementation efforts in the Scott and Salmon River watersheds. TMDL development efforts are underway in the Elk River, Freshwater Creek, Laguna de Santa Rosa, and Russian River. A Region-wide Temperature Implementation Policy is under development and will address identified temperature impairments in the Eel River, Mattole River, and Navarro River.
6. Developing a program for controlling waste discharge from timber operations and other operations on forested lands. Ownership-wide Waste Discharge Requirements (WDRs) have been adopted for Mendocino Redwood Company and Green Diamond Resource Company. A waiver of WDRs has been developed for various activities on U.S. Forest Service lands. A general WDR for timber operation was adopted in 2004 and a categorical waiver in 2009. Timber operators not otherwise covered by an ownership wide permit or waiver must apply for coverage under either of the general programs—or apply for an individual permit or waiver. Prior to this period, the Regional Water Board primarily addressed timber harvest related discharges on a THP-by-THP (Timber Harvest Plan) basis; thus, the new permit structure serves to more efficiently and effectively identify those operations requiring more or less oversight to insure the protection of water quality.
7. Protection of water quality from waste discharges associated with roads. Efforts include:
   A. Coordination with CDF (Cal Fire) on road-related Timber Harvest Rules;
   B. Development of a waiver of Waste Discharge Requirements for county road activities consistent with the fish-friendly guidelines established by the 5 counties of Del Norte, Humboldt, Mendocino, Trinity, and Siskiyou;
   C. Support of rural road closure, maintenance, and/or upgrade, i.e., through the Mendocino County Permit Coordination Program. This program supports a wide range of best management practices related to erosion control and restoration, beyond road-related activities.
   D. Settlement agreement with Caltrans over discharges associated with the Confusion Hill bypass project.
8. Developing a program for the control of waste discharge from agricultural activities. A Dairy Program was recently adopted by the Board (2012) in which the discharge of waste to surface water will be controlled and shallow groundwater will be monitored to protect against impacts from land application of dairy waste. A compliance program for irrigated agricultural lands is also under development.
9. Ongoing enforcement activities to control water quality violations.

Major Water Quality Challenges and Addressing these Challenges

Many of the activities as listed above for the period of 2009-2013 represent actions which have been taken to address water quality challenges. The discussion here highlights challenges not represented by the list above, and efforts proposed by the Regional Water Board in its triennial review process to address these additional challenges.

1. The Water Quality Control Plan for the North Coast Region (Basin Plan) was first developed in 1975. It has been updated numerous times since then. However, many aspects of the Basin Plan

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require further updating to ensure adequate protection of water quality in an ever more stressed ecological setting. The Regional Water Board in its 2011 Triennial Review proposed revisions of toxic-related objectives for groundwater and surface water, as well as dissolved oxygen for surface water. The Regional Water Board has committed staff resources to these activities. There are numerous other objectives also in need of updating. But, the budget does not currently provide for the commitment of staff resources to those efforts.

2. Most of the region's watersheds have historically supported aquatic species which are now threatened with extinction, most notably salmonids. Many of the activities the Regional Water Board engages in are designed to control water quality impacts in a manner sufficient to support ailing populations. But, watershed impairments persist, many of them a legacy of land use activities (e.g., logging, mining) prior to 1975 when the Basin Plan was first adopted. The Basin Plan prohibits the contemporary discharge of sediment and organic material to waters of the region in amounts deleterious to beneficial uses. The prohibition applies to timber activities, construction activities, and other related activities. The Regional Water Board has committed staff resources to the development of an exemption from this discharge prohibition for large-scale restoration projects which have the potential to provide important environmental benefits. Restoration is critical to supporting the return of aquatic ecosystem functioning.
3. In addition to restoration, the return of aquatic ecosystem functioning of the Region's watersheds requires the protection of stream-side riparian structure and wetlands. The Regional Water Board committed staff resources to the development of a Stream and Wetlands Protection Policy in conjunction with staff in Region 2 (San Francisco Regional Water Quality Control Board). But, budget cuts have prevented Region 1's (North Coast Regional Water Quality Control Board's) continued involvement.
4. One of the consistent findings in TMDL's of the last several years is the importance of water quantity to water quality. Excessive surface water or groundwater withdrawals reduce stream flows and increase a system's vulnerability to other perturbations. Similarly, instream impoundments can alter the natural pattern and range of flows in a manner detrimental to the ecological functioning of a water body. In specific locations, the Regional Water Board has determined that certain sources of cold water (e.g., springs or seeps) are critical to ensuring adequate instream temperatures for cold water species; and require protection. The Regional Water Board has identified the development of an instream flow objective as an important step towards addressing this issue. But, budget cuts have prevented it from committing staff resources at this time.
5. Other issues of importance on the Triennial Review (but for which regional funds do not currently exist) include: the development of a Mixing Zone Policy for human health-related constituents, the development of a Hatchery Policy, updating the beneficial uses of water in the region, identifying Outstanding Natural Resource Waters in the region, and addressing recycled water reservoirs.

Aquifer Conditions and Issues

[Placeholder – Additional content expected from the Groundwater Enhancement Team]

Near-Coastal Issues

There are a number of documents relating to near coastal issues focused on the protection and enhancement of fisheries and the control of sediment in streams and rivers. Northern California coastal habitats include grasslands, terrace prairies, dunes, marshes, eelgrass mudflats, and diverse forest types.

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Critical Coastal Area Protection

Protection of Critical Coastal Areas (CCAs) was identified in the State Water Board Watershed Management Initiative, Appendix C. The Critical Coastal Program was established to coordinate actions within identified CCAs through an interagency committee (CCA Committee) led by the California Coastal Commission, the State Water Board, six coastal Regional Water Boards, and the public to identify CCAs and develop additional management measures necessary to protect these areas. The intent of CCA designation is to direct attention to coastal areas of special biological, social, and environmental significance, and to provide an impetus for these areas to receive special support and resources. These areas include Environmentally Sensitive Habitat Areas currently designated in the California's Coastal Zone Management program, areas adjacent to Areas of Special Biological Significance, California's National Estuarine Research Reserves, National Estuary Program, and National Marine Sanctuaries. Goals of the CCA Program include ensuring that the management measures and management practices of the NPS plan are fully implemented; provide a mechanism to develop and apply additional management measures as needed to achieve or maintain high quality water in CCAs; and to develop action plans for each CCA to improve degraded water quality and to protect exceptional water quality (California Department of Water Resources, Bulletin-160, 2009).

[Placeholder - Examples of CCA projects-Additional Content to be Developed.]

Desalination

Currently the North Coast Region does not possess any desalination plants or have any plans for development of desalination facilities, although this option may be explored by the NCRWMG in the future.

Flood Management

Traditionally, the approach to flood management was to develop narrowly focused flood infrastructure projects. This infrastructure altered or confined natural water courses, which reduced the chance of flooding thereby minimizing damage to lives and property. This traditional approach looked at floodwaters primarily as a potential risk to be mitigated, instead of as a natural resource that could provide multiple societal benefits. Activities under traditional flood management include physical modification of stream channels, dam and surface impoundments, levees, and other structures.

Today, water resources and flood planning involves additional demands and challenges, such as multiple regulatory processes and permits, coordination with multiple agencies and stakeholders, and increased environmental awareness. These additional complexities call for an Integrated Water Management approach, that incorporates natural hydrologic, geomorphic, and ecological processes to reduce flood risk by influencing the cause of the harm, including the probability, extent, or depth of flooding (flood hazard). Some agencies are transitioning to an IWM approach. IWM changes the implementation approach based on the understanding that water resources are an integral component for sustainable ecosystems, economic growth, water supply reliability, public health and safety, and other interrelated elements. Additionally, IWM acknowledges that a broad range of stakeholders might have interests and perspectives that could positively influence planning outcomes.

Projects that combine flood and ecosystem restoration also can provide areas of active- and passive-use recreation, increase open space, and provide scenic value, all of which result in economic and societal benefits. For example, in Humboldt County, the Rohner Creek Flood Control and Riparian Habitat

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Improvement project is a watershed-based, channel corridor-scale project with multiple objectives. The project is intended to provide immediate and substantial improvements to channel corridor function that will benefit aquatic organisms and reduce flood frequency within the City of Fortuna. Rohner Creek, at its confluence with Strongs Creek (located approximately 1,000-feet upstream from the Eel River), has a 4.5 square mile watershed ranging in elevation from 25- to 1,600-feet. The upper portion of the watershed is predominately comprised of second and third-growth redwood forest, whereas the mid-portion consists of rural residential areas. The lower portion of the watershed is comprised of residential, commercial, and industrial land uses and within the City limits of Fortuna. Through historic channelization and encroachments, Rohner Creek through the urbanized reach of Fortuna experiences overbank flows on a 1.5-year recurrence. Historic attempts to reduce flooding throughout the corridor have resulted in the absence of complex and diverse instream habitats suitable to support native stocks of Salmonids including Chinook salmon, Steelhead Trout, and the State and Federally listed Coho Salmon. The proposed project is taking a channel corridor approach in identifying opportunities to integrate habitat enhancement elements with flood reduction improvements through the 1-mile project corridor within the City of Fortuna. Conceptual design-level hydrologic, hydraulic and geomorphic analyses are currently evaluating a suite of improvement opportunities throughout the project corridor. These improvements will address localized streambank mass wasting, channelization, and the absence of Salmonid habitat elements throughout the corridor. These improvements will benefit ecological and hydraulic function of the corridor focusing on instream features and riparian plantings that will improve corridor habitats while reducing flood frequency. Once the improvements are identified and associated opinion of probable costs are developed, the City will prioritize the projects and commence final design, CEQA documentation, and permitting to support the priority projects as available funding allows.

Risk Characterization

Floods can be caused by heavy rainfall; by dams, levees, or other engineered structures failing; by extreme wet-weather patterns; or by coastal storms and tsunamis. Historically, in the North Coast Hydrologic Region, flooding originates principally from melting of the coastal range snowpack and from rainfall. Flooding from snowmelt typically occurs in the spring and has a lengthy runoff period. Flooding from rainfall occurs in the winter and early spring, particularly when storms arriving from the Gulf of Alaska draw moisture-laden air from the tropics. This pattern is known as an Atmospheric River. This pattern also creates coastal storms that drive waves resulting in coastal flooding and erosion. Offshore earthquakes have caused tsunamis along the coast in the hydrologic region.

Historic Floods

Communities in the North Coast Hydrologic Region have suffered frequent flood damage that has been observed since at least 1861. Devastating floods were recorded in the winter of 1861-62. Torrential rains caused flooding throughout the region in 1937. Winter floods between 1935 and 1945 in Sonoma County spurred the USACE to develop a flood management plan and construct Coyote Valley Dam, which impounded Lake Mendocino upon completion in 1957 (Russian River Project).

Major flood events in the region include the December 1964 floods, the largest ever recorded in California in terms of cubic feet per second (cfs), that were caused by heavy rainfall and were estimated to be equal to or greater than the devastating floods of winter 1861-62. For example, the peak discharge of the Eel River near Scotia in 1964 was greater than the Mississippi River discharge north of St. Louis during the floods of 1993. Whole towns were wiped out; Orick, Hoopa, Weitchpec, and Orleans suffered major damage from floodwaters, sediment deposits, and timber washed off upstream lumber yards.

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Floodwaters from the Russian River inundated large swaths of Santa Rosa, rendered 500 people homeless in Guerneville, and flooded large acreages of agricultural land near Sebastopol when high flows backed up into Mark West Creek.

The region was struck by a tsunami in March 1964 as a result of an earthquake in Prince William Sound, off the south coast of Alaska. The earthquake generated a tsunami that towered more than 20 feet when it made landfall on the North Coast. The huge wave smashed into Crescent City in the early morning of March 28 and devastated the community. Parts of Citizens Dock, a major distribution hub for the city's bustling natural resources industry, were completely wrecked, and several fishing vessels were capsized. The massive wave damaged 289 homes and businesses; 11 people were killed and 3 were never found. Damages were estimated at $16 million in 1964 dollars.

For a complete record of floods, refer to the California Flood Future Report Attachment C: Flood History of California Technical Memorandum.

Damage Reduction Measures

Flood exposure in the North Coast Hydrologic Region occurs along the coastline, Eel River, Scott River, around Crescent City Harbor and, Humboldt Bay. Flood exposure identifies who and what is impacted by flooding. Two flood event levels are commonly used to characterize flooding:

- 100-Year Flood is a shorthand expression for a flood that has a 1-in-100 probability of occurring in any given year. This can also be expressed as the 1 percent annual chance of, or "1 percent annual chance flood" for short.
- 500-Year Flood has a 1-in-500 (or 0.2 percent) probability of occurring in any given year.

In the North Coast Hydrologic Region, more than 43,000 people and over $4.2 billion in assets are exposed to the 500-year flood event. Table NC-15 provides a snapshot of people, structures, crops, infrastructure, and sensitive species exposed to flooding in the region. 320 State and Federal threatened, endangered, listed, or rare plant and animal species exposed to flood hazards are distributed throughout the North Coast Hydrologic Region. Table NC-15 lists the number of sensitive species exposed to flood hazards in 100-year and 500-year flood events.

PLACEHOLDER Table NC-15 North Coast Hydrologic Region Exposures within the 100- and 500-Year Floodplains

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

Levee Performance and Risk Studies

Flood Hazard mitigation planning is an important part of emergency management planning for floods and other disasters. Hazard Mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to human life and property from hazards. Hazard Mitigation Planning is the process through which natural hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set, and appropriate strategies that would lessen the impacts are determined, prioritized, and implemented. Hazard Mitigation Planning is required for state and local governments to maintain their eligibility for certain Federal disaster assistance and hazard mitigation funding programs.

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Multi-Hazard Mitigation Plans (MHMPs) are required by FEMA as a condition of pre- and post-disaster assistance. The Stafford Act, as amended by the Disaster Mitigation Act of 2000, provides for states, tribes, and local governments to undertake a risk-based approach to reducing risks to natural hazards, such as flooding, through mitigation planning. The National Flood Insurance Act reinforced the need and requirement for mitigation plans linking flood mitigation assistance programs to state, tribal and local mitigation plans. FEMA-approved MHMPs were identified or collected for Sonoma, Humboldt, and Mendocino counties. Other risk assessment studies were prepared by various entities including USACE, FEMA, and the State Reclamation Board of California. For a list of risk studies, refer to California's Flood Future Report Attachment G: Risk Information Inventory Technical Memorandum.

In the North Coast Hydrologic Region, twenty-six local flood management projects or planned improvements were identified. Fourteen of these projects have costs totaling more than $108 million while the remaining projects do not have costs associated with them at this time. Fifteen local planned projects use an Integrated Water Management (IWM) approach with a flood component. Examples of local IWM projects include the Mattole Integrated Watershed Management Initiative and the Big River Main Haul Road Phase I Restoration Project. For a complete list of these projects refer to California's Flood Future Report Attachment F: Information Gathering Technical Memorandum.

Redwood Coast Tsunami Work Group

The Redwood Coast Tsunami Work Group (RCTWG) is an organization of local, state and federal agencies, tribes, relief and service groups, land managers, and businesses from Del Norte, Humboldt and Mendocino Counties. The group was formed in July 1996 to define the needs of local jurisdictions to mitigate the North Coast earthquake and tsunami hazard and to promote a coordinated, consistent mitigation program for all coastal areas. The RCTWG received recognition by the Coastal Region, Governor's Office of Emergency Services in May 1997, as a part of on-going state hazard reduction efforts. In April 2002, the Humboldt County Board of Supervisors declared their support of "…the Redwood Coast Tsunami Work Group and its member organizations to mitigate the effects of future great earthquakes." The Western States Seismic Policy Council recognized the RCTWG in 2009 with an Award in Excellence for Innovation for its mitigation efforts (Humboldt State University c2012a).

In 2007, RCTWG helped the community of Samoa prepare for and conduct the first full-scale tsunami evacuation drill in California. Additional drills have been conducted in schools and other North Coast communities. In 2008, RCTWG members working with the State Office of Emergency Services planned and coordinated the first test of the tsunami warning communications system using actual (live) codes outside of Alaska. All three RCTWG counties will be included in 2009 testing. In 2006, Humboldt County participated in FEMA's first ever tsunami response training exercise. For more information contact: Lori Dengler, Professor of Geology, Humboldt State University, Phone: 707.826.3115, Email: lad1@humboldt.edu (Humboldt State University c2012b).

[DWR, etc. Emergency Response Exercises…]

Current Relationships with Other Regions and States

Klamath Basin

As shown on the region map (see Figure NC-1) the Klamath River Basin straddles the border with Oregon, such that water from the upper basin flows into Oregon and eventually returns to California

above Iron Gate Reservoir. On the Oregon side of this interstate basin, two surface water diversions export an average of 29,600 acre-feet per year from Klamath River tributaries into the Rogue River system in Oregon. The Klamath River Basin also receives a small amount of imported water (about 2,000 acre-feet per year) from the upper reaches of the Sacramento River Hydrologic Region through a canal called the North Fork Ditch within Shasta Valley in Siskiyou County.

The Klamath Basin Restoration Agreement (KBRA) and the Klamath Hydroelectric Settlement Agreement (KHSA) are companion agreements between Klamath Basin Tribes, irrigators, fishermen, conservations, counties, States of Oregon and California, federal agencies, and dam owners which aim to restore Klamath Basin fisheries and sustain local economies. The Agreements include removal of 4 dams in the upper Klamath River; increased flows for fish; greater reliability of irrigation water deliveries; reintroduction of salmon above the dams and into and above Upper Klamath Lake; investment in comprehensive and coordinated habitat restoration; an electrical power program for Basin farmers and ranchers; mitigation to counties for the effects of dam removal; and investment in tribal economic revitalization. The first dam is scheduled to be removed in 2020, pending CEQA and NEPA (California Department of Water Resources, Statewide Agreements 2010).

Trinity River

The North Coast region exports a large volume of water from the upper reaches of the Trinity River into the Sacramento River region through the US Bureau of Reclamation's Central Valley Project at Lewiston Dam and the Clear Creek Tunnel. In 1998, a wet year, Trinity River exports (by water year) were 851,610 acre-feet; in 2000, an above normal water year, 1.110 million acre-feet; and in 2001, a dry year, 670,530 acre-feet showing the variability of flows related to changing hydrology. In contrast, when looking at flows for years since the ROD was implemented (see section on Trinity River in Settings section of this document), in 2006, a wet year, exports were 1.353 million acre-feet, in 2008, a critical dry year, exports were 555,929 acre-feet and in 2010, a below normal water year, 275,202 acre-feet. These examples show how hydrology plays an important part in the decision of how much water to export. However, current year hydrology is only part of the decision. Instream requirements for fisheries downstream on the Trinity River, past year hydrology, current year estimated hydrology, water quality concerns in the Delta and Trinity River, reservoir levels and operational needs are all considered when setting export quantities (United States Geological Survey c2012).

Trinity River Restoration Program was founded in 2000, based on three comprehensive foundational documents: the landmark Trinity River Flow Evaluation Final Report (TRFES) prepared by the U.S. Fish and Wildlife Service and the Hoopa Valley Tribe; the Trinity River Environmental Impact Statement (TREIS) prepared by USFWS; and the US-DOI Record of Decision (United States Fish and Wildlife Service and Hoopa Valley Tribe 1999; U.S. Fish and Wildlife Service, et al 2000; United States Department of the Interior Record of Decision 2000).

The Program is administered by the Bureau of Reclamation (Reclamation) and the U.S. Fish and Wildlife Service (USFWS), both bureaus of the U.S. Department of the Interior, as co-leads. Other partner agencies make up and share in the decision making process of the Trinity Management Council: the Hoopa Valley Tribe (HVT), the Yurok Tribe (YT), Trinity County, the California Resources Agency (consisting of California's Department of Water Resources (CDWR) and the Department of Fish and Game (Fish and Wildlife, CDFW), the U.S. Forest Service (USFS), and the National Marine Fisheries Service (NMFS).

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The river was dammed and most of the flow was diverted to the Sacramento Valley beginning in 1963, as part of the Trinity River Division of the Central Valley Project, a Federal water development program for California, managed by Reclamation. The diverted water enters the Sacramento River near Redding, California, and provides for a variety of uses such as agriculture, industry, drinking water, recreation, electrical power generation, and habitat. According to the Trinity River Restoration Program Annual Report (2011), in 1970, it was believed that this diversion of water to the CVP was causing a population decline in the Trinity River Fishery. Federal legislation at that time and in subsequent years has called for a variety of protections to the river, including protection of pre-dam levels of fisheries and of Native American tribal rights for access to Trinity River fish. For more information on the Trinity River Watershed and Trinity River Diversion, see section on Setting; sub-section, Trinity River Watershed, in this document (Trinity River Restoration Program 2012).

Potter Valley Project

The Russian River Basin began receiving Eel River water through the Potter Valley Project (PVP) in 1908 (http://www.pottervalleywater.org/history.html) and with several modifications was diverting 154 TAF/yr into the basin. Communities grew up based upon the available supply in the augmented river system. However, with the FERC relicensing and some lawsuits, the diversion has been cut 15 percent to 130.9 TAF/yr.

Communities like Redwood Valley CWD (RVCWD), are in an almost annual summertime water shortage condition. On top of the PVP change in diversion came the low water years of 2007 through 2010. RVCWD gathered most of the attention, but several small CSDs and CWDs began having severe water supply problems. The loss of supply also affected the reliability of the Sonoma County Water Agency to meet its demands, which affected supplies into the San Francisco Bay Region.

Sonoma-Petaluma Aqueduct

In the most southern part of the Region, a smaller export of roughly 33,000 acre-feet per year is transported from the lower Russian River into the northern portion of the San Francisco Bay Region through the Sonoma-Petaluma Aqueduct, to supply communities in northern Marin County and southern Sonoma County. For more information on the Petaluma Aqueduct, see section on Project Operations; Petaluma Aqueduct, within this document.

Implementation Activities

[This subsection contains a discussion of the actions that have been taken since the last California Water Plan update to meet the water challenges in the region.

Considerations for this subsection:

- The efforts we will be doing for the progress report format should provide some content for this section. We should not, however, be limited to the progress report if significant activities have occurred in the region since the last update.
- Under the Integrated Regional Water management grant program, stakeholders in the region are working together to implement projects that meet regional resource management activities that promote improvements to water supply, water quality, and environmental stewardship.]

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Resource Management Strategies

[This information was furnished by RMS group.]

The following are the resource strategies identified by DWR with great potential to benefit water quality in the North Coast Region.

- Agricultural Water Use Efficiency
- Urban Water Use Efficiency
- Conjunctive Management and Groundwater Storage, with the caveat that shallow groundwater use is of critical human and ecological importance in the North Coast Region.
- Recycled Municipal Water
- Groundwater and Aquifer Remediation, with the caveat that shallow groundwater use is of critical human and ecological importance in the North Coast Region.
- Pollution Prevention
- Urban Runoff Management
- Agricultural Lands Stewardship
- Ecosystem Restoration
- Forest Management
- Land Use Planning and Management
- Recharge Areas Protection, with the caveat that shallow groundwater use is of crucial human and ecological importance in the North Coast Region.
- Water-dependent Recreation
- Watershed Management

The following are resource strategies identified by DWR which address issues of importance in the North Coast Region; but may not accurately capture the issues as they express themselves on the North Coast.

- Surface Storage—Regional/Local. Instream impoundments in the North Coast Region often alter the natural pattern and range of flows in a river, reduce a water body's assimilative capacity for other perturbations, and sometimes result in unintended water quality consequences (e.g., nuisance algal blooms, including the production of toxic algae; elevated temperatures; alteration of downstream sediment delivery and sorting, etc.). The Regional Water Board is supportive of efforts to provide off-channel storage for summer agricultural use as an alternative to summer instream withdrawals. But, the construction of instream impoundments is not viewed, in most cases, as supportive of water quality goals.
- Flood Risk Management. The North Coast Region has experienced increased flooding as a result of several interacting factors. These include: historic land uses which have resulted in massive deliveries of sediment to water bodies; alterations to channel form and hydrology via roads, dams, armoring, and loss of riparian and floodplain habitat; reduction in base flows due to surface and groundwater withdrawals; and increase in runoff rate and volume from landscape alterations. The Regional Water Board is supportive of efforts to address these causes of increased flood potential. The further reduction in natural hydrologic functioning via the construction of hardened flood control channels is not viewed, in most cases, as supportive of water quality goals.

Drinking Water Treatment & Distribution

[Note: Drinking water content under development for this section.]

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Water Governance

[Describe any changes made to the water governance in the region since the last California Water Plan update. This would include any joint powers agreements and IRWM groups formed.]

In 2009, state lawmakers passed four policy bills and an $11.4 billion bond, the Safe, Clean, and Reliable Drinking Water Supply Act of 2010, as a comprehensive water package (Water Conservation Act of 2009). The purpose of this package was to set a water conservation policy, ensure better groundwater monitoring and provide the State Water Resources Control Board with increased enforcement powers for illegal water diversions. The bond also funded drought relief, water supply reliability, Delta sustainability, statewide water system operational improvements, conservation and watershed protection, groundwater protection, and water recycling and water conservation programs (California Department of Water Resources, Comprehensive Water Package 2009).

Of the four policy bills contained in the Water Conservation Act of 2009, three will affect water governance in the North Coast (SB x7-x).

SB x7-6 Groundwater Monitoring

SB x7-6 requires that local agencies monitor the elevation of their groundwater basins to help better manage the resource during both normal water years and during drought conditions.

On November 4, 2009 the State Legislature amended the Water Code with SBx7-6, which mandates a statewide groundwater elevation monitoring program to track seasonal and long-term trends in groundwater elevations in California's groundwater basins. To achieve that goal, the amendment requires collaboration between local monitoring entities and Department of Water Resources (DWR) to collect groundwater elevation data. Collection and evaluation of such data on a statewide scale is an important fundamental step toward improving management of California's groundwater resources. On or before January 1, 2011, parties seeking to assume groundwater elevation monitoring functions must notify DWR (CWC section 10928). In addition, on or before January 1, 2012, monitoring entities shall begin reporting seasonal groundwater elevation measurements (California Department of Water Resources 2012b).

AB 1152 (Chesbro and Cook) 2011 (Groundwater), This bill would add to the list of entities that may assume responsibility for monitoring and reporting groundwater elevations, a local agency that has been collecting and reporting groundwater elevations and that does not have a groundwater management plan, if the local agency adopts a groundwater management plan in accordance with specified provisions of existing law by January 1, 2014.

SB x7-7 Statewide Water Conservation

SB x7-7 (Water Conservation Act of 2009) creates a framework for future planning and actions by urban and agricultural water suppliers to reduce California’s water use. This bill requires the development of agricultural water management plans and requires urban water suppliers to reduce statewide per capita use consumption 20 % by 2020. The purpose of the bill is to increase water use efficiency and is divided into 2 sections; Urban Water Conservation and Agricultural Water conservation. For more information on this topic, please refer to DWR’s Water Use Efficiency web page located at: http://www.water.ca.gov/wateruseefficiency/sb7/.

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AB 2409 (Nestande, 2010)

AB 2409 amends section 10632 of the California Water Code (Urban Water Management Planning Act) to require urban water suppliers to prepare and adopt water shortage contingency plans including the identification and treatment of artificially supplied water features, i.e., ponds, lakes, waterfalls and fountains; separately from swimming pools and spas (California Legislature 2009-2010).

SB x7-8 Water Diversion and Use/Funding

SB x7-8 improves accounting of the location and amounts of water being diverted by recasting and revising exemptions for in Delta water diversion reporting requirements under current law. Its significance to the region is that this bill appropriates existing bond funds from various activities from Prop 1E and 84 for integrated regional water management grants, stormwater management grants, and expenditures and grants to local agencies for Natural Community Conservation Plans. This bill directly affects water diverters in the Sacramento-San Joaquin Delta and water exports from the Trinity River for Delta water quality.

California Water Code Sec 1259.4 AB 2121

Water Code Sec 1259.4 AB 2121 requires the State Water Board to adopt principles and guidelines for maintaining instream flows in Northern California Coastal Streams for the purposes of water right administration. The geographic scope of the policy includes all coastal streams from the Mattole River to San Francisco and coastal streams entering San Pablo Bay, and extends to five counties: Marin, Sonoma, and portions of Napa, Mendocino, and Humboldt counties.

Fish and Game Code Section 5653

Because in stream dredging is a popular activity in this region, it should be noted that there have been changes to rules that affect these activities. On April 27, 2012 the Office of Administrative Law approved updated regulations governing suction dredge mining under Fish and Game Code section 5653 et seq., the California Environmental Quality Act (CEQA) and the Administrative Procedures Act (APA). DFG (DFW) has closed suction dredging for the next several years. However, the closures are moot, as a statewide moratorium has been in place since 2008 and is planned to expire in 2016 after a planned court decision on the issue. For more information on Suction Dredging, see Department of Fish and Game web page located at: http://www.dfg.ca.gov/suctiondredge/ and section on Water Governance in this document.

Water Code Division 5, Sections 8,000 - 9,651

Water Code Division 5, Sections 8,000 - 9,651, has special significance to flood management activities and is summarized in California's Flood Future Report Pages Attachment E: Information Gathering Technical Memorandum.

AB 70 (2007) Flood Liability

AB 70 (2007) provides that a city or county might be responsible for its reasonable share of property damage caused by a flood, if the State liability for property damage has increased due to approval of new development after January 1, 2008.

AB 162 (2007) General Plans

AB 162 (2007) requires annual review of the land use element of general plans for areas subject to flooding, as identified by FEMA or DWR floodplain mapping. The bill also requires that the safety

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element of general plans provide information on flood hazards. Additionally, AB 162 requires the conservation element of general plans to identify rivers, creeks, streams, flood corridors, riparian habitat, and land that might accommodate floodwater for purposes of groundwater recharge and stormwater management.

State Funding Received

PLACEHOLDER Table NC-16 State Funding Received

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.] Note: Need context for following numbers

[IRWM Prop 50 planning grant (before 2007 – outside your five years?) - $500,000

Prop 50 Rnd 1 Implementation (state water board) - $24,831,579

Prop 50 Supplemental - $2,075,000

Prop 50 (Scott River) - $160,000

Prop 84 Planning - $1,000,000

Prop 50 LGA (Ukiah) - $50,000

Prop 84 DAC Pilot Project - $500,000

Prop 84 Rnd 1 Implementation - $8,221,061

Prop 1E City of Fortuna - $3,394,652]

Local Investment

[Describe the local investment made to implement water-related infrastructure, coordination, or planning in the region.

Look for statistics]

Water Conservation Act of 2009 (SB x7-7) Implementation Status and Issues

[Provide a discussion of the status and major issues with implementation of the Water Conservation Act of 2009 for both urban and agricultural water conservation.]

The Water Conservation Act of 2009 requires urban and agricultural water suppliers to submit an agricultural water management plan to DWR by December 31, 2012. Agricultural water suppliers must adopt and implement a plan or become ineligible for State of California grants and/or loans by 2013 (see section on Water Governance in this document).

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Interregional and Interstate Activities

[Describe those interregional and interstate activities that have occurred since the last California Water Plan update. KBRA, federal mandated water-mandated info]

Looking to the Future

[Notes: (1) Although the regional forums may seek consensus on objectives for the entire hydrologic region, this section will likely be a compilation of the IRWM and other local plan objectives. (2) Reference statewide priorities or IRWM guidelines to ensure consistency. (3) Because no single resource management strategy can meet the broad set of resource management objectives, this section is meant to shift planning approach/discussions from focusing on specific types of resource management strategies (e.g., desalination vs. conservation vs. storage, etc.) to an objectives-based planning approach.]

Future Conditions

[IRWM Plan objectives?]

[Data/information provided by CWP work teams]

Future Scenarios

[This subsection contains a discussion of the following topic. (Primary authors would be from the analytical data and tools work team.)

- Water demand by sector for future scenarios.]

[Considerations for this subsection:

- How do the three future scenarios relate to regionally derived future plans/visions? This might be the best place to examine compatibilities and contrasts of local and state objectives.
- Regional estimates regarding future agricultural, urban, and environmental water demands; economic development; flood management; land use; etc.]

Climate Change Note: updated material to be provided April 2013

For over two decades, the Federal Government and State of California have been preparing for climate change effects on natural and built systems with a strong emphasis on water supply. Currently, enough data exists to warrant the importance of contingency plans, mitigation (reduction) of greenhouse gas (GHG) emissions, and incorporating strategies (methodologies and infrastructure improvements) that benefit the region at present and into the future regardless of climate change status.

Climate change is already impacting many resource sectors in California, including public health, biodiversity, agriculture, and vital State infrastructure such as water, transportation, and energy (CNRA, 2009). Model simulations using the Intergovernmental Panel on Climate Change's 21st century climate scenarios project increasing temperatures in California, with greater increases in the summer (Cayan, 2008). Changes in annual precipitation patterns across California will result in changes to volume, type, and surface runoff timing. While the State of California is taking aggressive action to mitigate climate change through GHG reduction and other measures (CARB, 2008), global impacts from carbon dioxide and other GHGs that are already in the atmosphere will continue to impact climate through the rest of the century (IPCC, 2007).

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The region's temperature and precipitation vary greatly due to complex topography and relation to the Pacific Ocean. Over the last 100 years, mean annual air temperatures in the region have remained relatively stable, but minimum nighttime air temperatures have increased by 0.5 to 1.0 F (WRCC, 2012). A rise in minimum nighttime air temperatures is consistent with the expectations of climate change (IPCC, 2007). Mean annual precipitation in Northern California has increased slightly in the 20th century, and precipitation patterns in the region have considerable geographic and annual variation (DWR, 2006). The Klamath River Basin has responded to these climate trends with a decline in spring snowpack, less precipitation falling as snow, and earlier snowmelt runoff (Knowles et al., 2007).Water year runoff trends over the past century have increased in the Klamath, Salmon, Eel, and Russian River Basins, the largest increase was in the Eel River Basin with an additional 12 taf/yr from 1911 to 2005 (DWR, 2006).

Globally, sea level is expected to rise as a result of warmer temperatures; however, historic sea level trends in the region are conflicting. A tide gage at North Spit, California operated since 1977 shows mean sea level (MSL) to be increasing at a rate equivalent to 1.5 feet over 100 years, another tide gage at Crescent City, California operated since 1933 shows MSL to be decreasing at a rate equivalent to 0.2 feet over 100 years (NOAA, 2012). Although we expect MSL to rise with climate change, MSL at Crescent City is trending lower due to the Cascadia Subduction Zone, where the buildup of interseismic strain is causing coastal uplift north of Cape Mendocino. Most gages south of Cape Mendocino show relative sea-level rise, consistent with land subsidence. When adjusted for vertical land motions and for atmospheric pressure effects, the rates of relative sea-level rise along the U.S. west coast are lower than the rate of global mean sea-level rise (NRC, 2012).

While historic data is a measured indicator of how the climate is changing, it can't project what future conditions may be like under different GHG emissions scenarios. Current climate science uses modeling methods to simulate and develop future climate projections. Anticipated impacts from climate change in the region under a high GHG emissions scenario include a continued warming trend with air temperature increases from 4°F to 5°F in the winter and 5°F to 10°F in the summer by 2100. Warmer temperatures will result in more precipitation falling as rain instead of snow, decreased snowpack, and increased wildfire risk (CRNA, 2012).

Changes in annual precipitation across California, either in timing or total amount, will result in changes to type of precipitation (rain or snow) in a given area, and to surface runoff timing and volume. Climate model precipitation projections for the State are not all in agreement, but most anticipate drier conditions in the southern part of California, with heavier and warmer winter precipitation in the North (citation needed). Since there is less scientific detail on localized precipitation changes, there exists a need to adapt to this uncertainty at the regional level (Leung, 2012). Rainfall and snowmelt dominated watersheds in the region will each have a unique climate response and corresponding runoff, depending on the amount of warming that occurs. With warmer temperatures and changes in precipitation patterns, the Klamath River Basin may experience December-March runoff increases in streamflow and decreased April-June streamflow by 2100 (Markstrom et al., 2011).

While future precipitation and runoff is somewhat uncertain, greater flood magnitudes are anticipated as more frequent atmospheric river storm events (water vapor transported toward the poles across the mid-latitudes that is transported within narrow, intense filamentary bands of moist air) encounter the region (Dettinger, 2011). A higher proportion of precipitation falling as rain instead of snow and increased storm frequency will impact the system's ability to provide effective flood protection. Additionally, sea level is

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projected to continue to rise along California's coast. For the California coast south of Cape Mendocino, the National Research Council (2012) projected that sea level will rise 1.5 to 12 inches by 2030, 4.5 to 24 inches by 2050, and 16.5 to 66 inches by 2100. For the Washington, Oregon, and California coast north of Cape Mendocino, sea level is projected to change between falling 1.5 inches to rising 9 inches by 2030, falling 1 inch to rising 19 inches by 2050, and rising between 4 to 56 inches by 2100.

Projected climate changes are likely to upset the ecosystem balance, impacting sensitive fish and wildlife species (Janetos et al., 2008). Warmer water temperatures will result in stress to fisheries, reducing coldwater habitat for native species such as Coho salmon, while potentially benefitting invasive species such as quagga and zebra mussels. Increased water temperatures and nutrient loading will potentially exacerbate toxic algae problems in the Klamath River with increases in extent, duration, toxicity, and concentration of blue-green algal blooms (BOR, 2011b).

Shifts in coastal fog patterns have been making conditions less favorable for coastal ecosystems. The north coast redwoods are currently experiencing drought stress under changing climate conditions (Johnstone et al., 2010). A shift in coastal fog patterns along with temperature and precipitation changes may lead to range shifts in vegetation. While a shift in vegetation patterns along the coast may actually decrease wildfire risk (Lenihen et al., 2006), with warmer temperatures the non-coastal areas in the region will be at higher risk of wildfire (CNRA, 2012).

Climate change has the potential to impact the region, which the State depends upon for its economic and environmental benefits. These changes will increase the vulnerability of natural and built systems in the region. Impacts to natural systems will challenge aquatic and terrestrial species with diminished water quantity and quality, and shifting eco-regions. Built systems will be impacted by changing hydrology and runoff timing, loss of natural snowpack storage, and making the region more dependent on surface storage in reservoirs and groundwater sources. Increased future water demand for both natural and built systems may be particularly challenging with less natural storage and less overall supply.

Adaptation

Local agencies, as well as federal and state agencies, face the challenge of interpreting new climate change data and information and determining which adaptation methods and approaches are appropriate for their planning needs. The Climate Change Handbook for Regional Water Planning (EPA/DWR, 2011) provides an analytical framework for incorporating climate change impacts into the regional and watershed planning process and considers adaptation to climate change. This handbook provides guidance for assessing the vulnerabilities of California's watersheds and hydrologic regions to climate change impacts, and prioritizing these vulnerabilities.

The primary water supply in the region is the Klamath, Eel and Russian River systems. With diminished spring snowpack storage and very few significant aquifers, the potential for water supply shortages increase. Agricultural Water Use Efficiency and Urban Water Use Efficiency are Resource Management Strategies outlined in the Water Plan to adapt to water scarcity. These strategies would benefit the region that has already developed most of its potential surface and groundwater supplies. Urban water use focuses on conservation to lower municipal demand and agriculture water use efficiency helps the grower to use water in a way that is most effective to the crop, while minimizing yield losses.

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Additional resource management strategies found in the Water Plan not only assist in meeting water management objectives, but also provide benefits for adapting to climate change in the region. These include:

- Regional and local Conveyance
- Conjunctive Management and Groundwater storage
- Precipitation Enhancement
- Regional and Local Surface Storage; Pollution Prevention
- Ag Land Stewardship
- Ecosystem Restoration
- Forest Management
- Land Use Planning and Management
- Recharge Area Protection
- Watershed Management
- Integrated Flood Management

The region contains a diverse landscape with different climate zones, making it difficult to find one-size-fits-all adaptation strategies. Water managers and local agencies must work together to determine the appropriate planning approach for their operations and communities. While climate change adds another layer of uncertainty to water planning, it does not fundamentally alter the way water managers already address uncertainty (USEPA and DWR, 2011). However, stationarity (the idea that natural systems fluctuate within an *unchanging* envelope of variability) can no longer be assumed, so new approaches will likely be required (Milly et al., 2008).

Integrated Regional Water Management (IRWM) planning is a framework that allows water managers to address climate change on a smaller, more regional scale. Climate change is now a required component of all IRWM plans (DWR 2010). IRWM regions must identify and prioritize their specific vulnerabilities, and identify adaptation strategies that are most appropriate for their sub-regions. Planning strategies to address vulnerabilities and adaptation to climate change should be both proactive and adaptive, starting with strategies that benefit the region in the present-day while adding future flexibility and resilience under uncertainty.

Mitigation

Mitigation will include methods to reduce greenhouse gas (GHG) emissions. Moving away from the use of coal fired power plants to lower carbon emitting power sources such as natural gas and hydro-power will help to lower anthropogenic sources of GHG's. However, this effort will require much cooperation between policy makers, planners, water agencies and the public.

This is the first Water Plan to include specific energy intensity information within the regional reports. A conceptual graphic (see Figure NC-8) and notes will indicate relative energy intensity of raw water extraction and conveyance for the primary water supply sources for this region.

PLACEHOLDER Figure NC-8 Energy Intensity of Water in the North Coast Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the report.]

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Interregional and Interstate Planning Activities

North Coast Integrated Regional Water Management Plan

Since 2005, stakeholders in the North Coast Region have been participating in the North Coast Integrated Regional Water Management Plan (NCIRWMP). Stakeholders include local government, watershed groups, tribes from seven North Coast counties, Sonoma County Water Agency and Mendocino County Water Agency. The NCIRWM integrates long-term planning, project development and implementation that fosters communication and coordination between signatories to the NCIRWM's governing document that includes a MOU. Goals and Objectives of the North Coast IRWM Region include restoring salmon populations, enhancing the beneficial uses of water, encouraging local autonomy and interregional cooperation and enhancing public health and economic vitality in disadvantaged communities (North Coast Integrated Regional Water Management Plan 2012).

There are many benefits associated with synchronized, regional planning at the North Coast Region scale as opposed to establishment of myriad county-based or watershed-based efforts for the region. County or watershed-based efforts in the region would be limited and complicated due to boundary issues and planning approaches. Many watersheds are in multiple counties, and the approaches that have historically been applied to watershed-based planning are profoundly different than the planning approaches typical of county-based general plans. With a regional approach to integrated water management planning, the NCIRWMP can provide a framework for melding different spatial scales, jurisdictional and physical boundaries, and planning methodologies into a cohesive mechanism for efficient attainment of water management goals, both statewide and locally. While the NCIRWMP is being developed at the North Coast Region scale, the NCIRWMP framework has a strong inherent emphasis on local planning, data gathering, issues analysis, project identification, prioritization, and implementation. The NCIRWMP approach to planning acknowledges and incorporates the unique issues, information and planning approaches of local areas (both watersheds and counties) within a framework that integrates statewide planning priorities. This flexible and adaptive approach allows the NCIRWMP to accomplish effective planning at a large scale, while retaining and enhancing high-resolution data and planning at the local scale. We expect that this approach will assist the State in efficiently interacting with the North Coast Region, avoiding the need to interact individually with hundreds of entities throughout the region on issues related to integrated regional water management planning. Conversely, the NCIRWMP approach to planning at multiple scales enhances the ability of individual counties and watershed groups to understand and implement Statewide Priorities without needing to "reinvent the wheel". According to the Water Quality Control Plan for the North Coast Region, "The protection and orderly development of the Region's water resources make it essential that all planning efforts be coordinated" (North Coast Regional Water Quality Control Board 1993). We believe that the NCIRWMP planning approach accomplishes that goal. From a geographic perspective, the NCIRWMP planning framework is based on watershed designations – ranging from large systems such as the Eel River watershed down to sub-watersheds within the larger watersheds. Using watershed boundaries as the geographic planning framework allows the North Coast to integrate with other regional, state and federal planning, implementation and funding efforts – including those already in place with California Department of Fish and Game (Fish and Wildlife), California State Coastal Conservancy, State Water Resources Control Board, Regional Boards and Department of Water Resources.

NCIRWMP Planning Approach

The NCIRWMP relies upon an adaptive management approach providing for ongoing data gathering, planning, design, implementation and evaluation at a variety of scales in a long-term, iterative,

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community-based process. The NCIRWMP acts as a nexus between statewide planning efforts and local planning, helping to synchronize the large, complex planning processes, regulations and priorities at the state level with the locally specific issues, data, concerns, planning and implementation needs at the local level. The NCIRWMP provides for the following: Data gathering and sharing among local, regional and state agency collaborators; Organized efficient framework for identifying local and regional issues, evaluating water; Management planning objectives and strategies, identifying opportunities for integration of water management strategies and evaluating implementation projects; Educating local planning efforts regarding integrated regional water management planning; Considerations and conveying Statewide Priorities to local planning efforts; Organized, efficient framework for regional project prioritization and reduction in competition within the region; and Enhancement of funding opportunities due to demonstrated integrated planning approach.

Local Planning and Priorities

Local planning efforts in the North Coast Region have historically been segregated into jurisdictional planning and watershed planning. Most jurisdictional planning has been focused on county-based general plans and city-based planning. Although general plans often have a natural resources element, many do not fully integrate the natural resource-based water management issues in a given area. Watershed planning in the North Coast Region has predominantly focused on natural resources including specific species, habitats and ecosystem processes, and has largely been directed by the state natural resources agencies. In general, watershed planning does not tend to incorporate municipal considerations to the degree that is necessary for effective integrated water management planning and implementation. There is a historic lack of a framework for integration of state priorities with local planning efforts. While cumulative impacts are felt at the regional (or even statewide) scale, many of these impacts tend to be caused at the local level and are most affected by local planning. It is therefore critical that the transfer of data and priorities between state and local planning efforts take place in an organized fashion. Scale issues may also be problematic, as state agencies are addressing broad statewide issues and priorities, while local planning is high resolution and focused at the county, city or watershed scale. As many local planning entities do not have the staff or resources to evaluate statewide planning goals and objectives, the NCIRWMP acts as an information resource for counties, cities, and watershed groups to learn about, understand and implement statewide objectives within the context of local planning. NCIRWMP, by operating as a planning and implementation “hub” at the regional scale, synchronizes local planning with statewide planning efforts, making both stronger and more robust.

Integrated Coastal Watershed Management Planning

The NCIRWMP works with and incorporates the Integrated Coastal Watershed Management Plans (ICWMPs) in the North Coast region, including ICWMPs underway in the City of Trinidad, the watersheds of the Noyo and Big Rivers, the Mattole River, the Russian River, and Salmon Creek. These watershed planning processes place an emphasis on all of the objectives and themes of the NCIRWMP, with a special focus on Critical Coastal Areas (CCAs) and Areas of Special Biological Significance (ASBS).

Statewide Priorities

In addition to the IRWM PSP’s (proposal solicitation package) and Guidelines, The State of California has developed several guidance documents that are applicable to integrated water management planning in the North Coast Region. These include the State Water Resources Control Board’s Watershed Management Initiative (WMI) and the associated RWQCB Basin Plan, the Department of Water

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Resource's California Water Plan, and the Department of Fish and Game (Fish and Wildlife) Recovery Strategy for Coho Salmon. The California State Coastal Conservancy is in the process of completing an enhancement plan for the North Coast. Significant research, planning and staff expertise has been invested in these guidance documents, and they provide technical and jurisdictional direction to the Region in terms of integrated planning to attain water quality objectives and the recovery of endangered salmonids.

The plan development process for NCIRWMP Phase I and II meets statewide process goals as follows:

1. NCIRWMP has an inclusive and transparent development process that incorporates stakeholders and community members in the plan development process and in the project prioritization and implementation process.
2. NCIRWMP places an emphasis on engagement, planning and project implementation for disadvantaged communities throughout the Region.

Following is a list of Statewide Priorities that the NCIRWMP will meet or contribute to:

- TMDL implementation
- Implementation of NCRWQCB WMI Chapter
- Implementation of SWRCB's NPS Pollution Plan
- Implementation of state species recovery plans
- Address environmental justice concerns
- Integrated projects with multiple benefits
- Support and improve local and regional water supply reliability
- Contribute expeditiously and measurably to the long-term attainment and maintenance of water quality standards
- Eliminate or significantly reduce pollution in impaired waters and sensitive habitat areas including areas of special biological significance;
- Include safe drinking water and water quality projects that serve disadvantaged communities.

Federal Priorities

The NCIRWMP process identifies and incorporates appropriate federal priorities. These may include species recovery plans as outlined by NOAA Fisheries, components of the US Environmental Protection Agency's NPS program and other planning information from agencies such as Natural Resources Conservation Service, U.S. Geological Survey or U.S. Fish and Wildlife Service (California Department of Fish and Game 2004; North Coast Regional Water Quality Control Board 1993; North Coast Integrated Regional Water Management Plan, Phase I 2007).

Future Vision

Regional Future Vision

[This subsection would describe the desired future condition that the local stakeholders have for this region. Concepts such as regional water self-sufficiency, flood protection from a 100-year flood, conservation goals, and land use goals could be described here.]

Tribal Objectives/Vision

[Objectives and vision of the tribal interests in the region would be described here.]

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Relevant Statewide Interests and Objectives

[Describe statewide interests and objectives and how they might influence or affect the region. State government initiatives would be discussed in relation to the region.]

Regional Water Planning and Management

The North Coast Region has been participating in the IRWM since 2005. The region has a complete IRWM plan and has applied for and received funding under the IRWM program for a number of years. They recently received Proposition 84 funding to update their NCIRWMP and numerous implementation funding awards. The City of Fortuna, a signatory to the North Coast IRWMP obtained a $3.4 million dollar grant under the Prop IE Storm Water program.

The focus of regional planning activities varies significantly from north to south across the North Coast region because of the diversity of water issues and involved water agencies. In the far north interstate Klamath River watershed, much of the planning is being done by federal agencies such as the U.S. Bureau of Reclamation, the Natural Resources Conservation Service, and the U.S. Fish and Wildlife Service, among others. These federal agencies are working to balance the needs of the federal Klamath Project with water for fish, tribal interests, and interests of communities affected by the federal project. Planning and issue resolution for the Trinity River also have a significant federal lead role because of the federal Central Valley Project at Trinity and Lewiston lakes. In general, many of the Northern California counties lack funding at the level available to federal agencies to conduct regional planning.

In the central portion of the region, the communities and water issues in Humboldt, Trinity, and Mendocino counties tend to be organized at the local or county levels, partly because these areas are geographically separated from other developed regions. Planning activities of Humboldt Bay Municipal Water District and the Humboldt County general plan update are one of the primary forums for regional planning for the Arcata and Eureka areas. The Mendocino Council of Governments and the Mendocino Community Services District are among the lead water planning agencies for the county, which includes Ukiah and portions of the upper Russian River wine country.

Sonoma County is the southernmost county in the North Coast Hydrologic Region, and water planning is closely associated with those of the adjoining San Francisco Bay region. Water planning is strongly focused on meeting the urban needs of Santa Rosa and the surrounding communities served by Sonoma County Water Agency. The agency coordinates with and is a member of several San Francisco Bay area regional planning groups, such as the Bay Area Water Agencies Coalition that provides significant direction and guidance for regional planning. Much of Sonoma County regional planning also focuses on the competing uses of the Russian River, which is the largest river in this part of the North Coast region. The Russian River Action Plan has been updated by Sonoma County Water Agency, as a coordinated effort among federal, State, and local agencies to protect and restore salmonid fishery populations and habitat.

The State agency with the most significant influence on regional water planning activities in the North Coast region is the North Coast RWQCB. Although headquartered in Santa Rosa, this agency has key responsibilities for surface water quality and regulations for all of the rivers in the region. The board oversees several water quality programs and issues related to timber operations, vineyard runoff, nonpoint

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source pollution, the development of total maximum daily load limits, and the development of water quality objectives for individual basin plans.

Integrated Regional Water Management Coordination and Planning

Development Process for the North Coast Integrated Regional Water Management Plan

Phase I of the North Coast Integrated Regional Water Management Plan represents the combined effort of many individuals and groups within the North Coast Region. Oversight for plan development and project selection has been provided by the North Coast Regional Water Management Group (represented by the NCIRWMP Policy Review Panel), while project identification and plan review have been provided by the Region's stakeholders, with project and plan technical review performed by the NCIRWMP Technical Peer Review Committee. All phases of plan development and project selection have been completely transparent to the public, and public involvement has been actively solicited and encouraged.

North Coast Regional Water Management Group Description

Phase I of the North Coast Integrated Regional Water Management Plan was developed under the oversight of the North Coast Regional Water Management Group. The North Coast Regional Water Management Group (NCRWMG) is a consortium of counties working together on water management planning and project prioritization and implementation for the North Coast region. The NCRWMG has authorized Humboldt County to act on their behalf as the regional applicant for the NCIRWMP implementation grant and Phase II planning grant. Currently the member counties of the NCRWMG are responsible for implementation of the NCIRWMP, with individual project proponents responsible for project implementation. More information about the authorizing resolutions for the existing institutional structure can be found at: http://www.northcoastirwmp.net/docManager/1000006298/NCIRWMP_Phase_I_2007.pdf "Authorizing Documentation and Eligible Applicant Documentation".

The Regional Water Management Group consists of the following entities, each with a unique local relationship to water management:

Del Norte County

Del Norte County does not directly manage water; however Del Norte County has a number of areas throughout the unincorporated area that rely on Districts to provide potable water and water for fire suppression. The City of Crescent City manages a municipal water system that provides potable water and fire suppression to the incorporated area as well as to unincorporated areas of the County that are in the proximity of the City limits and the transmission line serving the City system.

Siskiyou County

The Siskiyou County Board of Supervisors is also the County's Flood Control District Board. In addition, groundwater Ordinances are in effect in the county (Siskiyou County Code of Ordinances 2012).

Siskiyou County Board of Supervisors and the Flood Control and Water Conservation District retain their local sovereignty over General Planning. The Board will not participate in anything approaching a regional Joint Powers Agreement, nor will they synchronize general planning. Most of the "water managers" in the mid-Klamath area are individuals, informal ditch groups or very small irrigation districts. Most have long vested pre-1914 water rights which are private property. Most are governed under either the Shasta or Scott River Adjudications which are, for the most part, implemented by a local water master service.

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It is questionable whether Siskiyou County will continue to sign the MOU with all the conditions in it that undermine local authority given to them by the State and Congress and their local sovereignty. Siskiyou County intends to participate in the NCIRWMP only on a voluntary basis.

Trinity County

The County of Trinity has authority over water quality and floodplain management per its General Plan and various ordinances. Through its membership in the Trinity Management Council, as determined by the Trinity River Record of Decision, Trinity County also has one vote out of 8 in determining annual flow releases into the Trinity River from Lewiston Dam. Trinity County is also the lead agency for implementation of the Five Counties Salmonid Conservation Program per mutual agreement among the counties of Siskiyou, Trinity, Humboldt, Del Norte and Mendocino.

Humboldt County

Local MOU signed by all service districts and cities in the county engages all service districts and cities in collaborative water management. Land Use policies and ordinances also provide statutory control in areas not preempted by State and Federal authority.

Mendocino County

The Mendocino County Water Agency's (MCWA) statutory authority is derived from the enabling legislation - the "Mendocino County Water Agency Act" - that created the MCWA. Pursuant to the Mendocino County Water Agency Act, the MCWA has the authority to provide for the control and disposition of storm and flood waters, make water available for any beneficial use, and secure title to real property, water rights and water distribution facilities.

Sonoma County

County of Sonoma has statutory authority over water supply, water quality, flood control and storm water management as per the County's general plan and ordinances.

In addition to the above-listed counties, the Mendocino County Water Agency and Sonoma County Water Agency each have statutory authority over water in their own right.

Each of the counties listed are fully or partially included in a community designated as disadvantaged.

For additional information on the collaborative partnership and methodologies used to develop the North Coast Integrated Regional Water Management Plan, please refer to The NCIRWMP website at, http://www.northcoastIRWMP.net.

Accomplishments

[Placeholder - Drinking water content under development for this section.]

Flood Management

In the North Coast Hydrologic Region, a number of flood risk management actions were accomplished which were recommended in the 2009 California Water Plan including the following:

- DWR has created a climate change handbook to help local agencies incorporate climate change into planning activities. In addition, the State of California has developed a statewide climate

change adaptation strategy, requested that the National Academy of Science establish an expert panel to report on impacts of sea level rise, and issued interim guidance to agencies on planning for sea level rise in designated coastal and floodplain areas.

- DWR has collaborated with the USACE to produce California's Flood Future: Recommendations for Managing the State's Flood Risk, which will help guide local, State, and Federal decisions about policies and financial investments related to improved public safety and flood management throughout California. Information for the California's Flood Future Report was provided by 142 public agencies located in all 58 counties, as well as by State and Federal agencies.
- IRWM planning guidelines were revised to incorporate flood management into the process giving credit for including these flood benefits in Integrated Water Management projects.
- Comments and recommendations from the Flood Risk Management Strategy in the 2009 California Water Plan were used to inform:
    - SFMP California's Flood Future Report (Statewide Flood Management Planning)
    - IRWM planning (Integrated Regional Water Management)
- Water Code Section 8307 links flood liability with local planning decisions. Cities and counties now share flood litigation liability with the State over unreasonably approved new development on previously undeveloped areas.

In early 1998, the city of Santa Rosa selected an alternative plan to recharge depleted geothermal fields in the Geysers area with treated wastewater as part of its long-term wastewater-recycling program. Under this alternative, the Santa Rosa Sub-regional Sewage System will pump about 11-million gallons per day of treated wastewater to the Geysers for injection into the steam fields. This amount is a little less than half the flow the treatment system is expected to produce when finished. The project is intended to eliminate weather-related problems of the city's disposal system and minimize treated wastewater discharges into the Russian River.

The communities around Humboldt Bay support programs intended to achieve the dual goals of flood control and habitat enhancement. The region is committed to restoring the natural functioning of urban streams and wetlands. The city of Arcata has many programs to acquire conservation easements and deeds to wetlands, for the re-establishment of a natural floodplain for storm water management, and for the restoration of fish and wildlife habitat. In the past 15 years, Arcata has collaborated with government agencies, nonprofit organizations, community groups, and schools for development of these restoration activities, and has spent millions of dollars on programs. Additional financial support has been obtained through grants from the California Department of Water Resources, Department of Fish and Game (Fish and Wildlife), the Wildlife Conservation Board, and the U.S. Fish and Wildlife Service.

The Russian River Action Plan, first prepared in 1997, was updated by Sonoma County Water Agency in 2003 and provides a regional assessment of ongoing efforts to restore the salmonid fishery and improve the riparian habitat in the Russian River watershed. The plan describes 17 current and pending restoration activities, followed by an extensive list of additional habitat restoration projects that are in need of funding. In 1997, the National Marine Fisheries Service listed steelhead trout as threatened and in 2002 listed Coho salmon as endangered along part of the Central California coast that includes the Russian River Basin. The Sonoma County Water Agency, the U.S. Army Corps of Engineers, and the National Marine Fisheries Service signed an agreement to establish a framework for consultation under Section 7 of the Endangered Species Act. Under that agreement, the Army Corps and the Sonoma County agency

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jointly review and coordinate information on their respective Russian River activities to determine effects to critical salmonid habitat. The Eel-Russian River Commission, composed of county supervisors from Humboldt, Mendocino, and Sonoma counties, also provides a regional forum for agencies and groups to stay informed about projects and issues affecting the Eel and Russian rivers.

Challenges

Flood Management Challenges Note: additional content to come.

Typically, flood management agencies in large urban areas tend to be highly organized. Agencies in more rural counties or with low exposure to flooding are often handled by emergency responders or a single contact at the county. This can present a unique set of challenges when developing a project. Flood management in the North Coast Hydrologic Region has a unique set of challenges that were identified during meetings with 29 local agencies. These challenges include:

- Impacts of sea level rise
- Operations and maintenance costs
- Clearly defined roles between agencies involved in flood management activities
- Working with outdated or missing flood related data, especially aerial photography
- Environmental regulations that restrict the ability of agencies to utilize options for flood management
- Inconsistent and unreliable funding

Also, climate change will have a significant impact on the timing and magnitude of precipitation and runoff and will contribute to a rise in sea levels. Increased air temperatures could reduce the extent of snow pack in mountainous areas, thereby adding to the portion of watersheds that are available to contribute to direct winter runoff. Decreased snow pack would also reduce spring runoff volumes. Although future precipitation is somewhat uncertain, greater flood magnitudes are anticipated due to more frequent atmospheric river storm events (Dettinger M 2011). These changes could alter the magnitude and frequency of flood events, although specific effects might be difficult to reliably predict. However, the potential for increased frequency and magnitude of floods and a rise in sea level suggest that the enhancement of both structural and nonstructural measures for flood management is needed.

[Note: Drinking water content under development for this section.]

The region faces many water quality and water supply challenges. The North Coast Regional Water Quality Control Board's water quality priorities highlight the need for control of nonpoint source runoff from logging, rural roads, agriculture, and urban areas. In fact, sediment, temperature, and nutrients are the primary focus of the RWQCB's 303(d) list of impaired water bodies. Along the coast, nonpoint-source pollution can cause microbial contamination of shellfish growing areas, especially oysters. Much of the region is characterized by rugged, steep, forested lands, with highly erodible, loosely consolidated soils; taken together with wildfires, extensive timber harvesting, and heavy precipitation primarily in the form of rain, the watershed is highly susceptible to erosion and landslides. Such heavy runoff in turn causes stream sedimentation that impacts habitat for spawning and rearing of anadromous fish. Channel modifications and water diversions have radically changed water-quality conditions in many water bodies in the region, reducing natural flows that dilute contaminant concentrations and lessen their impacts. In the southern portion of the region, the development of new hillside vineyards is an increasing source of erosion and pesticides.

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Fisheries can be adversely affected by a number of factors related to both water quality and water quantity. The Eel, Mad, Trinity, Klamath and Russian rivers, as well as many other streams, suffer from sedimentation, which can smother salmonid spawning areas. The North Coast region's basin plan sets turbidity restrictions to control erosion impacts from logging and related activities, such as road building. The basin plan also specifically establishes temperature objectives for the Trinity River, in which reduced flows have disrupted temperature and physical cues for anadromous fish runs. Because of water diversions, summer temperatures in the Trinity as well as the Klamath can be lethal to salmonids. Fisheries can be further affected by the lack of woody debris for pool habitat and sediment metering.

The North Coast RWQCB's basin plan requires tertiary treatment of wastewater discharges to the Russian River, a major source of domestic water, and establishes limits on bacteriological contamination of shellfish-growing areas along the coast. The plan also prohibits or strictly limits waste discharges to the Klamath, Trinity, Smith, Mad, and Eel Rivers, as well as estuaries and other coastal waters. Nonpoint source runoff, especially after heavy precipitation, has resulted in contamination and closure of shellfish harvesting beds in Humboldt Bay. In the lower Russian River watershed storm water runoff also might be contributing to high ammonia and low dissolved oxygen levels in Laguna de Santa Rosa, which is threatening aquatic life. Mercury in fish tissue is a water quality concern in Lakes Pillsbury, Mendocino, and Sonoma; a health advisory for mercury has been issued for Lake Pillsbury.

Groundwater quality problems in the North Coast region include contamination from seawater intrusion and nitrates in shallow coastal groundwater aquifers; high total dissolved solids and alkalinity in groundwater associated with the lake sediments of the Modoc Plateau basins; and iron, boron, and manganese in the inland groundwater basins of Mendocino and Sonoma counties. Septic tank failures in western Sonoma County, at Monte Rio and Camp Meeker, and along the Trinity below Lewiston Dam, are a concern because of potential impacts to groundwater wells and recreational water quality.

Other water quality concerns include the impacts of boating fuel constituents such as MTBE to recreational water use at Trinity, Lewiston, and Ruth lakes. Abandoned mines, forest herbicide application, and historical discharge of wood treatment chemicals at lumber mills, including Sierra Pacific Industries near Arcata and Trinity River Lumber Company in Weaverville, are also regional issues of concern. Of note, according to the 305(b) report, only the Russian River Basin has a long-term water quality data set in this region, which is necessary to evaluate water quality changes over time.

Even though the North Coast region produces a substantial share of California's surface water runoff, only about 10 percent of this runoff occurs in the summer and water supplies are limited throughout much of the area. Small surface-water supply projects generally have limited carryover capacity that cannot supply adequate water during extended months of low rainfall. The drinking water for many of the communities on the North Coast, such as Klamath, Smith River, Crescent City, and most of the Humboldt Bay area, is supplied by Ranney collectors (horizontal wells adjacent to or under the bed of a stream). Erosion is undercutting some of these collectors, such as those in the Mad River supplying the Humboldt Bay Municipal Water District (which serves Eureka, Arcata, and McKinleyville). As such, these "wells" may actually be under the direct influence of surface water, which would then require filtration. The city of Willits has had chronic problems with turbidity, taste, and odor with water from Morris Reservoir, and high arsenic, iron, and manganese levels in its well supply. Organic chemical contamination has closed municipal wells in the cities of Sebastopol and Santa Rosa. The town of Mendocino typifies the problems

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related to groundwater development in the shallow marine terrace aquifers; surveys in the mid-1980s indicate about 10 percent of wells go dry every year and up to 40 percent go dry during droughts.

The Klamath River Basin is an interstate watershed with surface storage facilities in both California and Oregon, with competing water needs for agriculture, Indian tribal rights, waterfowl refuges, and endangered fish. The primary water storage facilities belong to the federal Klamath Project, which is operated by the U.S. Bureau of Reclamation, in conjunction with other dams and diversion structures operated by local irrigation districts, wildlife management agencies, and electric power companies. In 2001, the lack of rainfall generated a severe drought, which aggravated water disputes and caused harsh effects to agriculture, waterfowl refuges and the downstream fisheries. The endangered fish populations include listed species such as the Lost River and shortnose suckers, Coho salmon, and steelhead trout. During 2001, the U.S. Bureau of Reclamation was able to deliver only about 75,000 acre-feet of water to agriculture in California, which is about 25 percent of normal. In the Tule Lake and Lower Klamath Lake subbasins, this translated to a drought disaster for both agriculture and the wildlife refuges. In 2002, about 33,000 adult salmon died due to water quality and quantity problems while trying to swim up the Klamath.

Federal agencies have taken a lead role in conducting studies and developing proposals to resolve the competing water needs in the Klamath Basin, with assistance from state agencies in Oregon and California, and several local governments and interest groups. The U.S. Bureau of Reclamation develops an annual Klamath Project Operations Plan intended to establish specific allocation procedures to best meet the needs of agriculture, fishery restoration per the Endangered Species Act, waterfowl refuges, and tribal water rights. The U.S. Geological Survey has initiated a four-phase Klamath Basin groundwater study to document water levels, water quality, and groundwater flow patterns; and to identify potential opportunities for future groundwater conjunctive use. For more information on the USGS groundwater study, see: http://or.water.usgs.gov/projs_dir/or180/phaseI.html. The U.S. Natural Resources Conservation Service has developed an adaptive management program that allocates federal funds for agricultural conservation programs, fish and wildlife habitat, water quality improvements, and water storage improvements, which are intended to increase water use efficiencies and achieve long-term reductions in total water use. Other federal agencies in the Klamath Basin Working Group include the U.S. Forest Service, the Fish and Wildlife Service, the Bureau of Land Management, and the National Marine Fisheries Service. Many of these programs and studies will take several years to develop and implement, so the overall ability to successfully meet all competing water needs will not be known for several years. In the meantime, below-normal water supply conditions (when present) will continue to aggravate water management issues, disputes, and negative effects to basin resources.

As part of the efforts to restore the Trinity River fishery, the Secretary of the Interior in December 2000 approved a significant change in use of Trinity River Basin water. As part of an effort to restore Trinity River fish habitat, the river's instream flows were increased from 340,000 acre-feet per year (roughly 25 percent of average annual flow at the Central Valley Project diversion point on the Trinity River) to an average of 595,000 acre-feet per year. This decision, which would reduce the amount of water available for export from the Trinity River to the Central Valley, was challenged by water and power interests in U.S. District Court in 2001. On July 13, 2004, the 9th U.S. Circuit Court of Appeals overturned the injunction imposed by the district court, and ruled that the original year 2000 Record of Decision was adequate. The water allocated to downstream fish flows is now being increased to the new flow schedule,

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which ranges from a minimum of 368,600 acre-feet in a critically dry year up to 815,000 acre-feet in an extremely wet year.

The Eel River and its tributaries are the largest river system draining to the coast of Humboldt County, and it is characterized by significant water quality problems during winter storm events due to massive sediment loads from unstable soils. The Eel River is also host to Humboldt County's largest fisheries of salmon and steelhead, which depend on access to upstream tributaries for spawning. The only major water storage in the upper reaches of the Eel River is the Potter Valley Project, which consists of Lake Pillsbury and a downstream diversion dam and tunnel to the Russian River (Mendocino County). The project was originally built in 1908 by Snow Mountain Water and Power Company. Lake Pillsbury was constructed in 1922 for hydropower production, and the project was acquired by Pacific Gas and Electric Company in 1930.

In recent years, fishery interest groups have argued that the amount of water diverted to the Russian River has adversely affected salmon and steelhead in the Eel River. The water needs of the Eel River fishery have been evaluated and disputed during the recent Federal Energy Regulatory Commission hydropower license amendment proceeding of the Potter Valley Project. In June 2004, FERC approved PG&E's relicense amendment of the Potter Valley Project and its associated water diversions to the Russian River. However, fishery groups are litigating the FERC decision, so the future distribution of project water between the Eel and Russian rivers is not yet resolved.

Drought and Flood Planning

[Content for this section still to come.]

Drought Contingency Plans

State Wide Drought Plan 2010 Department of Water Resources

In 2007, Governor Schwarzenegger issued Drought Proclamations and Executive Orders directing State Agencies to manage the crisis. DWR, with help from other state agencies, developed the California Drought Contingency Plan (2010). The Plan identifies an integrated, regional approach to addressing drought, describes drought action levels, and the appropriate agency responses as conditions change. Coordination and responsibilities of federal, state, and local agencies are defined and instructions for the timely dissemination of information to decision makers are also contained in this plan (California Department of Water Resources 2010).

Klamath Basin Restoration Agreement Drought Plan 2011

In 2011, representatives from the State of California and Oregon, the Bureau of Reclamation, tribal organizations, and other stakeholders (Klamath Basin Coordinating Council) under Section 19.2 of the Klamath Basin Restoration Agreement developed a Drought Plan for the Upper Klamath Region. The Drought Plan identifies a number of strategies that would be used to counteract the effects of drought and extreme drought in the region. Measures that could be implemented include voluntary water conservations, additional stored water, the use of ground water and the reduction of diversions (Klamath Basin Coordinating Council 2011).

Resource Management Strategies

[Placeholder - Content not ready as of 10-2012. Will be input later.]

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[Note: (1) Align with resource management strategy impacts and benefits of IRWM standards. (2) Information for this section will be regionally derived. The "statewide" strategies (i.e., the updated text from Volume 2 of Update 2009) will be published in a separate volume, not in these regional reports.]

Strategy Availability

[This subsection contains a discussion of the following topics.

- Subset of 27 strategies that are potentially applicable within each region.
- Estimate of benefits that could be achieved considering all constraints (e.g., institutional regulatory, finance, local opposition, technology, conveyance, local land use, etc.).]

[Considerations for this subsection:

- Estimation of resource management strategy potential of the 27 strategies detailed in Volume 2 of Update 2009.
- Water Evaluation and Planning (WEAP) results for the Sacramento, San Joaquin, and Tulare Lake Hydrologic Regions.]

Regional Strategies

Flood Management

Flood management in the future will require unprecedented integration among traditionally varying agencies that have overlapping and sometimes conflicting goals and objectives. More reliable funding and improved agency alignment are required at all levels. Updated technical and risk management approaches will be needed to protect the public from flooding by assessing risk, as well as by improving flood readiness, making prudent land use decisions, and promoting flood awareness. Project implementation methods could benefit from IWM-based approaches to leverage the limited funding and other flood management resources. In short, future solutions should be aligned with broader watershed-wide goals and objectives and must be crafted in the context of IWM

Integrated Regional Water Management (IRWM) promotes the coordinated development and management of water, land, and related resources to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. Flood management is a key component of an integrated water management strategy.

[This subsection contains a discussion of the following topics.

- Regional response packages for managing future water supply, managing flood risk, managing water quality, adapting to climate change, and achieving sustainability.]

[Considerations for this subsection:

- Highlight response strategies important to the region.
- This section will inform the strategy and policy recommendations in Volume 1 of the Update 2013 as themes become evident.
- Number of accepted plans.]

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