NORTH COAST RESOURCE PARTNERSHIP PLAN

Healthy Communities, Functional Ecosystems, & Vibrant Economies

PHASE IV
July 2019

PUBLIC REVIEW DRAFT

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LIST OF APPENDICES

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ACRONYMS

5C	Five Counties Salmonid Conservation Program
AF	acre-feet
ASBS	Area of Special Biological Significance
BLM	US Bureau of Land Management
BMPs	Best Management Practices
CARCD	California Association of Resource Conservation Districts
CCA	Critical Coastal Area
CCC	California Coastal Commission
CDF	California Department of Forestry
CDFG	California Department of Fish and Wildlife
CEPA	California Environmental Protection Agency
CSD	Community Services District
DWR	California Department of Water Resources
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FS	USDA Forest Service
GSA	Groundwater Sustainability Agency
JPA	Joint Powers Authority
KRBFTF	Klamath River Basin Fisheries Task Force
LAFCO	Local Agency Formation Commission
MG	million gallons
MGD	million gallons per day
MMs	management measures
MMA	Marine Managed Area
MOMU	Memorandum of Mutual Understanding
NCRP	North Coast Resource Partnership
NCIRWMP	North Coast Integrated Regional Water Management Plan
NCRWMG	North Coast Regional Water Management Group
NCWAP	North Coast Watershed Assessment Program
NOAA	National Oceanic and Atmospheric Administration
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NPS	nonpoint sources
NSO	northern spotted owl
NWFP	Northwest Forest Plan
PNAMP	Pacific Northwest Aquatic Monitoring Partnership
POTWs	Publicly Owned Treatment Works
PRP	Policy Review Panel
RNSP	Redwood National and State Parks
RWQCB	Regional Water Quality Control Board
RCD	Resource Conservation District
RWQMP	Rangeland Water Quality Management Plan
SCWA	Sonoma County Water Agency
SGMA	Sustainable Groundwater Management Act
SONCC	Southern Oregon/Northern California Coast
SWAMP	Surface Water Ambient Monitoring Program
SWQPA	Stormwater Quality Protection Area
SWRCB	State Water Resources Control Board
SWRP	Storm Water Resource Plan
THP	Timber Harvest Plan
TMDL	Total Maximum Daily Load
TPRC	Technical Peer Review Committee
TPZ	Timber Production Zone
UCCE	University of California Cooperative Extension
USDA	U.S. Department of Agriculture
USGS	U.S. Geologic Survey
USDI	U.S. Department of the Interior
UWMP	Urban Water Management Plan
WDR	Waste Discharge Requirement

ACKNOWLEDGMENTS

Special thanks to the Reviewers for all their time and dedication to this project:

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MEMORANDUM OF MUTUAL UNDERSTANDINGS SIGNATORIES

Del Norte County:
County of Del Norte
Big Rock Community Service District
City of Crescent City
Del Norte Resource Conservation District
Gasquet Community Service District

Humboldt County:
County of Humboldt
Briceland Community Service District
City of Arcata
City of Blue Lake
City of Eureka
City of Fortuna
City of Rio Dell
City of Trinidad
Fieldbrook Community Service District
Garberville Sanitary District
Humboldt Bay Harbor, Recreation and Conservation District
Humboldt Municipal Water District
Humboldt Community Service District
Humboldt County Resource Conservation District
Hydesville Community Water District
Loleta Community Service District
Mattole Restoration Council
McKinleyville Community Service District
Myers Flat Mutual Water System
Orick Community Service District
Redway Community Service District
Sanctuary Forest Inc.
Weott Community Services District
Westport County Water District
Westhaven Community Service District

Lake County:
County of Lake

Lake County Watershed Protection District
Mendocino County:
Brooktrails Township Community Service District
County of Mendocino
City of Willits
City of Ukiah
City of Fort Bragg
Covelo Community Service District
Gualala River Watershed Council
Mendocino County Resource Conservation District
Mendocino County Water Agency
Mendocino Woodlands Camp Association
Noyo Watershed Alliance
Pacific Reef Water District
Redwood Forest Foundation Inc.
Redwood Valley County Water District
Resort Improvement District No. 1
Modoc County:
County of Modoc
Siskiyou County:
County of Siskiyou
City of Etna
City of Weed
Happy Camp Community Service District
Happy Camp Sanitary District
Montague Water Conservation District
Shasta Valley Resource Conservation District
Sonoma County:
County of Sonoma
Circuit Rider Productions, Inc.
City of Cloverdale
City of Rohnert Park
City of Santa Rosa
City of Healdsburg
City of Sebastopol
City of Cotati
Dutch Bill Creek Watershed Group
Gold Ridge Resource Conservation District
Graton Community Service District
Gualala River Watershed Council
Laguna de Santa Rosa Foundation
LandPaths
Occidental Arts and Ecology Center
Sonoma Ecology Center
Sonoma County Water Agency
Sebastopol Water Information Group
Sonoma Resource Conservation District
Town of Windsor
Westminster Woods Environmental Education Program
Trinity County:
County of Trinity
Lewiston Park Mutual Water Company
Northwest CA Resource Conservation
& Development Council
Salyer Mutual Water District
Trinity County Resource Conservation District
Trinity County Water Works District #1
Weaverville Sanitary District
Weaverville Community Service District
The Watershed Research and Training Institute
Willow Creek Community Services District
Tribal Nations:
Bear River Band of Rohnerville Rancheria
Blue Lake Rancheria
Hopland Band of Pomo Indians
Hoopa Valley Tribe
Karuk Tribe
Kashia Band of Pomo Indians
Pinoleville Pomo Nation
Pit River Tribe
Redwood Valley Little River Band of Pomo Indians
Sherwood Valley Band of Pomo Indians
Tolowa Dee-ni' Nation, (previously Smith River Rancheria)
Trinidad Rancheria
Wiyot Tribe
Yurok Tribe
Other Entities:
North Coast Regional Water Quality Control Board
Trout Unlimited
Community Clean Water Institute
Russian River Watershed Association
North Coast Resource Conservation
and Development Council
Pacific Coast Fish, Wildlife and Wetlands
Restoration Association
California State Parks
Stewards of the Coast and Redwoods
Institute for Fisheries Resources
California Department of Forestry and Fire Protection
California Land Stewardship Institute
E Center
Botanical Dimensions
North Coast Regional Land Trust
The Conservation Fund
Redwood Community Action Agency
Redwood Forest Foundation, Inc.

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West Coast Watershed
Reza Environmental
Tukman Geospatial
Woods Biological Research & Services
DowHouse

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PREAMBLE

"The North Coast Resource Partnership Plan is by design a voluntary, non-regulatory, stakeholder-driven planning framework meant to emphasize shared priorities and local autonomy, authority, knowledge, and approaches to achieving Tribal, state, regional, and local priorities related to North Coast water infrastructure, watersheds, public health, and economic vitality. The NCRP focuses on areas of common interest and concern to North Coast stakeholders and on attracting funding to the North Coast Region, and recognizes unique local solutions in different parts of the Region."

[NCRP Section 1.2.1 "Statement of Purpose"]

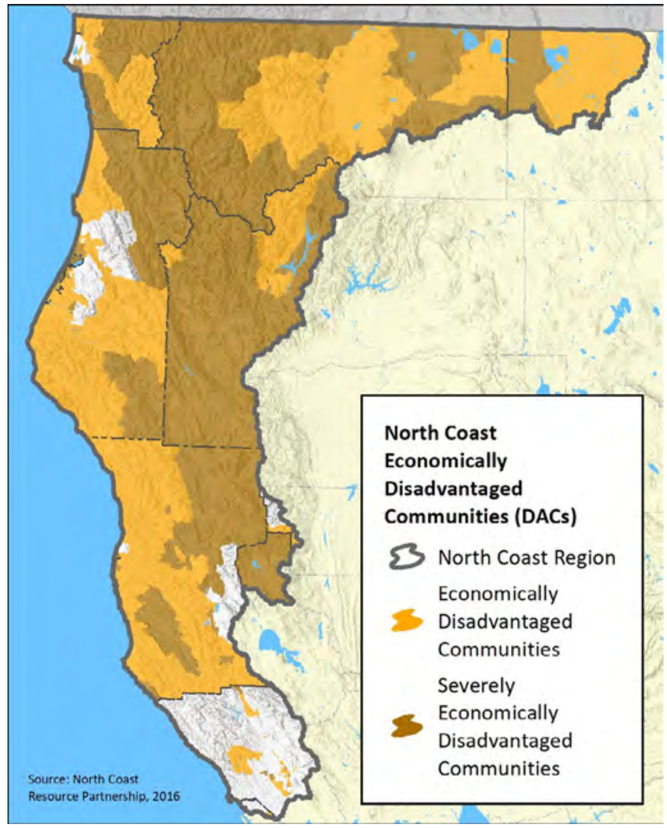
MAP 1 THE NORTH COAST REGION

1 GOVERNANCE AND PLANNING APPROACH

The North Coast Resource Partnership (NCRP) is an innovative, stakeholder-driven collaboration among local governments, Tribes, watershed groups, and other interested partners focused on integrated resource planning and local project implementation in California's North Coast region. The NCRP is led by locally elected county and Tribal officials from the following North Coast counties: Del Norte, Humboldt, Mendocino, Modoc, Siskiyou, Sonoma and Trinity. Initiated in 2005, the NCRP has worked collaboratively on water and energy management challenges to: reduce conflicts; integrate federal, state, regional and local priorities; and utilize a multi-benefit approach to funding for the highest priority project needs throughout the region. The overarching themes of the NCRP include salmonid recovery, enhancing beneficial uses of water, intra-regional cooperation, energy independence and climate change mitigation & adaptation, and enhancing public health and economic vitality in disadvantaged communities.

The North Coast Resource Partnership emphasizes the following:

- Creation of a sustainable environmental and socio-economic framework for the North Coast, by engaging in integrated planning for water infrastructure and natural resources. Planning and project focus areas include the recovery of salmonid populations, enhancement of the beneficial uses of water, support for energy independence, local autonomy and intra-regional cooperation.
  - » Outreach, education and inclusion for all interested stakeholders in the North Coast region via the website, workshops, conferences, meetings and printed materials.
  - » Transparent and inclusive communication and decision making.
  - » Enhancement of water infrastructure and natural resources values in socio-economically disadvantaged communities.



MAP 2 ECONOMICALLY DISADVANTAGED COMMUNITIES

1.1 NCRP GOALS AND OBJECTIVES

The establishment of NCRP goals and objectives was accomplished with input from the Policy Review Panel (PRP), Technical Peer Review Committee (TPRC), resource agencies, and stakeholders in the North Coast Region during focused strategic planning meetings, as well as ongoing stakeholder input to staff and PRP members at public meetings, workshops and correspondence. Input was considered by the PRP and a final set of regional goals and objectives were selected. Per the adaptive management approach of the NCRP, the PRP reevaluates the objectives during periodic Plan updates to ensure that they continue to accurately reflect those priorities that address water and energy management issues of greatest importance to those living in North Coast communities (*see Appendix A, Table 1,Matrix of NCRP Objectives & Statewide IRWM Priorities and Table 2,Matrix of NCRP Objectives & Local Project Priorities*).

The NCRP places an emphasis on local autonomy, allowing each county, Tribe or sub-region to address and implement NCRP goals and objectives in a way that works best locally. This approach has served the Region well in finding common ground within areas of potential conflict and respects local control, knowledge, and approaches to achieving regional objectives. The NCRP framework provides a means for local entities to address state and regional goals and objectives when implementing projects to meet local water, climate, and energy-related needs and provides the structure and flexibility necessary to promote cohesion and accommodate unique planning and implementation approaches region-wide. As part of this framework, strategies adopted by the California Air Resources Board in its AB 32 Scoping Plan (*see Appendix A, Table 3, ARB Scoping Plan Strategies Considered in NCRP Strategy & Goal Development*) were evaluated for their applicability in meeting NCRP Plan objectives and goals related to protection and improvement of water quality. The Strategic Growth Council in 2012 provided funding to the NCRP to develop a Regional Climate Mitigation and Energy Independence Plan, Regional Climate Adaptation Plan, and a Regional Greenprint that voluntarily complied with SB 375 (Transportation planning) and implemented the intent of SB 732 (Regional Planning for Transportation, Housing and the Environment). Through the process of Greenprint development (Healthy Watersheds, Vital Communities, Thriving Economies: Actionable Strategies for the North Coast Region), the NCRP synchronized state priorities such as SB 375, AB 32, and SB 732 with local priorities and operating methods. Additionally, specific instances where AB 32 has been incorporated into planning strategies or implementation actions are documented throughout this plan.

For the 2014 and 2019 updates, the original NCRP objectives were subject to a process of revision and refinement under the direction of the PRP and with input from the Region's stakeholders. Thirteen NCRP objectives are now subsumed under six Plan goals. All the objectives are interrelated, and are relevant at both the local and regional scale. Objectives are organized thematically, by goals, and are not ranked or listed in order of priority. Although NCRP objectives are not prioritized (they all are "priority"), NCRP project proposals that ultimately implement the goals are. Prior to each funding proposal, the PRP gives direction and sets criteria in terms of selecting projects. Due to the nature of the funding opportunities, certain objectives are emphasized with each funding cycle. For example, the 2014 DWR Proposition 84 RFP focused on drought adaptation and projects that implemented NCRP objectives 8 and 10 were prioritized. Thus, through project prioritization, specific objectives are prioritized based on the critical needs of the region at that time, but the NCRP has the flexibility of prioritizing other objectives as needed. The project prioritization process is described in *Section 4.1 Project Application, Review & Selection Process*. The process to measure progress toward meeting the NCRP Goals and Objectives are discussed in the Project and Program Monitoring and Evaluation portion of the website and in *Section 4.4 Project & Program Monitoring & Evaluation*.

Goal 1: Intraregional Cooperation & Adaptive Management

- Objective 1 — Respect local autonomy and local knowledge in Plan and project development and implementation
- Objective 2 — Provide an ongoing framework for inclusive, efficient intraregional cooperation and effective, accountable NCRP project implementation
- Objective 3 — Integrate Traditional Ecological Knowledge in collaboration with Tribes to incorporate these practices into North Coast Projects and Plans

Goal 2: Economic Vitality

- Objective 4 — Ensure that economically disadvantaged communities are supported and that project implementation enhances the economic vitality of disadvantaged communities by improving built and natural infrastructure systems and promoting adequate housing
- Objective 5 — Conserve and improve the economic benefits of North Coast Region working landscapes and natural areas

Goal 3: Ecosystem Conservation and Enhancement

- Objective 6 — Conserve, enhance, and restore watersheds and aquatic ecosystems, including functions, habitats, and elements that support biological diversity
- Objective 7 — Enhance salmonid populations by conserving, enhancing, and restoring required habitats and watershed processes

Goal 4: Beneficial Uses of Water

- Objective 8 — Ensure water supply reliability and quality for municipal, domestic, agricultural, Tribal and recreational uses while minimizing impacts to sensitive resources
- Objective 9 — Improve drinking water quality and water related infrastructure to protect public health, with a focus on economically disadvantaged communities
- Objective 10 — Protect groundwater resources from over-drafting and contamination

Goal 5: Climate Adaptation & Energy Independence

- Objective 11 — Address climate change effects, impacts, and vulnerabilities, including droughts, fires, floods, and sea level rise. Develop adaptation strategies for local and regional sectors to improve air and water quality and promote public health and safety

- Objective 12 — Promote local energy independence, water/ energy use efficiency, GHG emission reduction, carbon sequestration, and jobs creation

Goal 6: Public Safety

- Objective 13 — Improve flood protection, forest and community resiliency to reduce the public safety impacts associated with floods and wildfires

1.1.1 INTEGRATION OF NCRP GOALS & OBJECTIVES

NCRP goals and objectives form the foundation for development, implementation, evaluation, and adaptive management of the Plan and its projects. The goals and objectives were conceived and developed explicitly to address North Coast issues and provide some resolution to conflicts inherent in considering and addressing multiple resource and water-related priorities across such a diverse Region.

1.2 NCRP PLANNING APPROACH

Leadership, governance, policy and decision making is provided by the NCRP Policy Review Panel (PRP). The PRP consists of two representatives appointed by each County's Board of Supervisors and three Tribal Representatives appointed by North Coast Tribes. Scientific and technical review is provided by the Technical Peer Review Committee (TPRC), project staff, consultants, and the stakeholders within the North Coast Region. The TPRC is comprised of technical experts appointed by each County's Board of Supervisors and Tribal representatives. The TPRC reviews and evaluates the development of NCRP Plans and proposed projects based on technical and selection criteria approved by the PRP.

The NCRP approach to planning acknowledges and incorporates the unique issues, information and planning approaches of local areas (watersheds, Tribal lands and counties) within a framework that integrates local, regional and statewide priorities. This flexible and adaptive approach allows the NCRP to accomplish effective planning at a large scale while retaining and enhancing high-resolution data and planning at the local scale. The NCRP acts as a nexus between statewide and local planning efforts.

The NCRP is committed to the ongoing refinement of its associated plans, which are intended to be "living documents" that incorporate new information and monitoring feedback to reprioritize project needs, reanalyze policy, and make other changes to the NCRP structure and function as necessary.

Further, the NCRP is committed to communication outside of the region and practices this by participating in statewide efforts. The NCRP participates in statewide planning processes including review of and comments on draft state regulatory and grant documents, participation in the Roundtable of Regions, and one-on-one meetings and multi-agency meetings with state and federal agencies. NCRP conferences include speakers from state and federal agencies and the state government, and outreach is conducted to these entities to encourage attendance. Through pursuing open dialogue at multiple levels of governance, the NCRP is able to serve as an information, networking, and coordination hub amongst the region, other regional efforts, and federal and state agencies.

1.2.1 STATEMENT OF PURPOSE

The NCRP is by design a voluntary, non-regulatory, stakeholder-driven planning framework meant to emphasize shared priorities and local autonomy, authority, knowledge, and approaches to achieving Tribal, state, regional, and local priorities related to North Coast water infrastructure, watersheds, public health, and economic vitality. The NCRP focuses on areas of common interest and concern to North Coast stakeholders and on attracting funding to the North Coast Region, and recognizes unique local solutions in different parts of the Region.

1.2.2 LOCAL AUTONOMY & JURISDICTIONAL AUTHORITY

While the NCRP engages at the North Coast Region scale, the framework has a strong inherent emphasis on local planning, data gathering, issues analysis, project identification/ prioritization, and portfolio implementation. The NCRP recognizes that the approaches and priorities of local counties, Tribal lands, municipalities, and

watersheds vary throughout the Region: indeed, "one size does not fit all." For example, policy and project priorities for integrated water and energy management in Rohnert Park (Sonoma County in the south) may be very different from those in Etna (Siskiyou County in the north), yet both counties' local communities value functioning watersheds, healthy communities, energy independence, and viable local economies. Additionally, the NCRP recognizes that Tribes are sovereign nations, and as such, coordination with Tribes is on a government-to-government basis.

To support local autonomy, specific planning processes have been developed to allow local entities and/ or jurisdictions to "opt-out" of a specific Plan element they find unacceptable, but in a way that respects funding requirements and does not jeopardize NCRP eligibility or project funding opportunities. If a county or Tribe chooses to opt-out of a particular Plan element, this fact will be documented in the NCRP plans, relevant funding applications and communications. Additionally, the NCRP attempts to use language in its plans that respects local autonomy and preferences while meeting shared objectives and funding eligibility requirements. Examples might include the use of the term "energy independence" to document strategies and projects that reduce GHG emissions and reliance on foreign oil, while still meeting state goals and eligibility requirements related to "climate change adaptation and mitigation."

Issues related to the jurisdictional authority of Tribal, local, regional, state, and federal governments often are beyond the scope of this voluntary, non-binding collaboration represented by the NCRP. The focus of the NCRP is on resolving shared challenges facing the economically disadvantaged North Coast Region, including failing infrastructure, public health, energy independence, watershed function, and economic vitality. The NCRP is strongly focused on planning towards project implementation. Decision-making authority for the NCRP project-selection process is exercised by the NCRP Policy Review Panel (PRP) as the governing body for the regional NCRP process: individual county and Tribal appointees to the PRP do not determine the projects that move forward from their particular county or Tribal area. However, all projects are subject to relevant local, regional, state, Tribal, and federal laws and policies; may not be in conflict with these laws and policies; and must meet minimum thresholds establishing their adherence to these policies. Additionally, the project selection process includes mechanisms requiring notification of relevant local entities (including counties and Tribes). The NCRP explicitly recognizes the jurisdictional authority of private property rights: all projects submitted to the NCRP must have the documented permission of the landowner on whose property the work will take place.

The NCRP intends that:

- The NCRP framework supports regional planning while recognizing that "one size does not fit all"
- The NCRP framework respects local autonomy, jurisdictions, and planning processes
- The NCRP incorporates the existing studies/ reports in the Region that have been produced and are being planned by local and state entities, some of whom are working to consolidate their reports to identify local needs and data gaps
- The NCRP helps, rather than hinders, local planning entities with local priority-planning activities that are in alignment with NCRP Plan objectives
- NCRP participants *voluntarily* comply with AB 32[1] and SB 375[2] and implement the *intent* of SB 732[3] for the planning, selection, and implementation of NCRP projects to improve air quality and reduce conventional energy use
- The NCRP framework has a strong inherent emphasis on local planning, data gathering, issues analysis, project identification, prioritization, and implementation
- Land use planning should be developed by counties (i.e. not stipulated in the NCRP or by the state),

1 California Assembly Bill No. 32 http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf

2 California Senate Bill No. 375 (2008) at http://www.leginfo.ca.gov/pub/07-08/bill/sen/sb_0351-0400/sb_375_bill_20080930_chaptered.pdf

3 Californai Senate Bill No. 732 (2007) at http://www.leginfo.ca.gov/pub/07-08/bill/sen/sb_0701-0750/sb_732_bill_20080930_chaptered.html

all of which have developed their own land use plans, planning processes, and planning priorities

To this end, the Siskiyou County Board of Supervisors would like to strictly limit their participation to regional opportunities to fund specific projects related to energy independence, water and wastewater infrastructure and broadband infrastructure. The Siskiyou County Board of Supervisors wishes to retain its independent sovereignty and jurisdiction over land use policies and General Planning and does not want to participate in regional planning or harmonization regarding climate change, habitat assessment and "protection of priority conservation areas, "model ordinances or modular planning elements, "Regional Greenprints," or the valuation of "ecosystem services."

Resolve Jurisdictional Issues with Watershed-Based Planning

The NCRP framework facilitates the utilization of a watershed-based planning approach to address multiple stakeholder concerns. The use of local *physical boundaries* alleviates pressure on local *jurisdictional boundaries* in order to address sometimes-conflicting interests. Watershed-based planning recognizes the fundamental links between upland and aquatic resources, and the functional links between land and water management strategies. This approach, as demonstrated since the NCRP inception, is a proven alternative to relying on traditional jurisdictional boundaries. Rather than by county, municipality, or special district, boundaries of watershed management areas (WMAs), watersheds, IRWM planning areas, and local project implementation areas, for example, may be applied as the physical units for local land and water management.

1.2.3 TRANSPARENCY & INCLUSION

Since its inception, the NCRP has maintained a strong commitment to process transparency and stakeholder inclusion. This has been achieved by ensuring that all NCRP meetings are open and welcoming to the public; have been properly noticed; have meeting agendas and summaries on the NCRP website; and that at each meeting there is sufficient time allotted for public comment. Meetings are spatially and temporally rotated throughout the Region to increase opportunities for stakeholder attendance and to provide for equitable local representation across the Region. Meeting agendas, summaries and materials can be found on the NCRP Resources web page.

NCRP Quarterly Meetings are held on the third Friday of the months of January, April, July and October in the following general locations unless otherwise approved by PRP decision.

- January – Ukiah area
- April – Yreka area
- July — Eureka area
- October — Weaverville area

In November 2011, the NCRP and its partners adopted a revised Memorandum of Mutual Understanding (MoMU) agreeing that all NCRP meetings are subject to and carried out in accordance with the Ralph M. Brown Act. The Brown Act embodies the philosophy that public entities exist for the purpose of conducting public business and as such, the public has the right to know how its decisions are being made. By formalizing this provision in the governing documents, the NCRP formally declared its intent to continue to conduct its actions openly and to facilitate continued public participation in its deliberations. The NCRP Leadership Guidance Handbook, which is reviewed and approved on an annual basis, describes the governance structure, goals/objectives, and policies and documents PRP decisions made during the quarterly meetings.

1.2.4 STAKEHOLDER INVOLVEMENT

Since its inception, the NCRP process has been inclusive of all of the Region's stakeholders and has provided opportunities for a diversity of stakeholders to participate in all stages of the planning process and project implementation. Stakeholder support and participation is vital to implement projects that support NCRP Goals and Objectives and identify local needs and the projects to address them. The NCRP uses a variety of strategies to identify individuals and groups with a potential stake in regional planning and project implementation. The NCRP outreach mechanisms address the range of water management and stakeholder issues within the Region and provide for a balanced geographical representation. These efforts also promote access to, and collaboration with, people or entities with diverse viewpoints (*see Appendix B, Stakeholder Engagement & Integration*).

1.2.4.1 PUBLIC MEETINGS & WORKSHOPS

The primary interface for stakeholder involvement in the NCRP is through regular meetings and topic-based local workshops, which are announced to interested parties via the NCRP website and email listserve. Since 2005, the PRP and TPRC have met on an ongoing and regular basis to review the Plan and NCRP process; discuss water, energy, climate change, environmental, and economic issues related to the North Coast; evaluate funding opportunities; review legislative and policy issues; and discuss and review North Coast projects. In 2011, the PRP adopted a regular quarterly meeting schedule (third Friday of January, April, July, October) that alternates between Mendocino, Siskiyou Humboldt, and Trinity county locations in an effort to make it easier for those with limited mobility to attend at least one quarterly meeting.

All PRP and TPRC meetings are open to the public and public participation is encouraged. Prior to the TPRC and PRP meetings, the meeting date, location, time, and a preliminary agenda are posted on the NCRP website and, in accordance with the Brown Act, meeting agendas are publicly noticed at each meeting location. Each meeting agenda designates time for the public to comment on any items included on the agenda or any other items of interest and that time period often extends well beyond the time allotted on the agenda. Meeting agendas, materials, summaries, and a list of attendees are archived on the NCRP website.

Barriers to participation are related to the region's dispersed geography and mostly economically disadvantaged status. To alleviate these issues, meetings are rotated geographically and agendas and meeting notes are provided on the NCRP website.

In addition to regular NCRP meetings, dozens of facilitated workshops on priority topics have been organized for stakeholders. Workshops are coordinated by NCRP staff and have provided information pertinent to regional water management planning to groups of 10-70 individuals. Topics have included local, regional and statewide goals and objectives; information on the North Coast regional planning framework; opportunities for input on NCRP Plan documents and assessments; and opportunities for funding.

Finally, these regular and publicly-noticed meetings and workshops have been supplemented by a number of direct meetings and coordination with local Tribes, watershed groups, cities, and others to encourage representative participation by all potential stakeholder groups. These meetings are scheduled as warranted and may be held at the request of NCRP, or of the interested stakeholder(s).

1.2.4.2 NCRP WEBSITE

The NCRP website provides for information sharing among a diverse audience across a large, rural, decentralized region. The website was developed to extend outreach capabilities while reducing or eliminating travel-related restrictions that could limit participation. The website provides background information about the North Coast region and NCRP process; links users to NCRP programs and projects; and offers a library of relevant planning documents and resources. An on-line mapping feature allows users to view various watershed, natural resources, socio-economic, and jurisdictional data as well as proposed project locations. Website users also are alerted to public meetings, process decisions, funding opportunities, and NCRP events.

1.2.4.3 EMAIL LISTSERVE

Email, e-blasts and e-newsletters have all proved to be an effective mechanism for communication between North Coast stakeholders and the NCRP. The website email listserve (approximately 1,500 members), which interested stakeholders may choose to join via the NCRP website, is used to inform stakeholders of upcoming NCRP events (meetings, conferences, workshops), share critical news items, access Plan drafts, and distribute information about potential funding opportunities. All correspondence to stakeholders contains contact information for NCRP staff so that questions or concerns can be addressed quickly and directly. The website and e-mail listserve have been very successful at conveying large amounts of complex information to a wide variety of stakeholders dispersed across the North Coast.

1.2.4.4 INTERVIEWS

Over the years, the NCRP has conducted periodic interviews of NCRP leadership, project sponsors, technical experts, and North Coast stakeholders to solicit specific information to identify and evaluate ongoing planning efforts, documents, and processes; highlight data gaps and data needs; and foster incorporation of local land and water planning priorities. Interview results are summarized and posted on the NCRP website. Interview topics include:

- Local and regional vision, conflicts, goals, constraints, and opportunities
- Priorities for economically disadvantaged communities
- Priorities for local Tribes and Tribal lands
- Strategies for addressing climate change vulnerability
- Priorities for energy efficiency/ independence/ security
- Priorities for integrated water management
- Storm and flood water management opportunities
- Identification of key water infrastructure and watershed projects
- North Coast financing needs and solutions
- Forest health, wildfire risks, and innovative management
- Access to drinking water, water quality and infrastructure, and innovative responses to water issues
- Flooding impacts and flood risk

1.2.4.5 NCRP CONFERENCES AND EVENTS

Multi-day regional conferences on NCRP-related topics have been held in the North Coast in 2007 and 2013. Nearly 250 stakeholders from the Region attended each conference including, local and state elected officials, Tribal representatives and leaders, local governments, water/wastewater entities, advocacy groups, non-governmental organizations, Resource Conservation Districts, and business groups. During both conferences, NCRP member agencies provided scholarships to more than 40 entities to ensure that no one who wished to attend would be excluded from participating due to inability to pay the conference fee.

Throughout the conferences, state and federal agency representatives played key roles in information dissemination, participating in Plenary Sessions, panel sessions, as individual speakers, and as workshop leaders. The conferences offered half-day technical workshops including a grant-writing workshop which provided practical, hands-on information for those interested in submitting a grant application through the NCRP process and other funding agencies.

In April, 2016, the NCRP held a Ten-Year Celebration of Collaboration & Positive Impact in Yreka. The event included project tours and an interactive session on strategies to enhance the land and communities in the North Coast region. Over a hundred individuals representing state and local government and agencies as well as water suppliers, wastewater treatment operators, and other stakeholders attended the event.

Continuing the celebratory theme, in October 2016, the NCRP held a Celebration Workshop in Sonoma County for funders, elected officials, and project partners and project proponents. This event was noticed on the NCRP website with targeted individuals receiving invitations; over a hundred stakeholders attended. Goals of the workshop were to enhance and expand understanding of the NCRP among elected officials and funders, to positively influence perceptions of NCRP impact and the need for regional investment, and to expand the circle of supporters of the NCRP.

The April 2017 conference was entitled *Integrated Strategies for the North Coast* and focused on the North Coast as a source region for water, carbon, biodiversity and rural innovation. The conference consisted of morning speakers and three panel sessions with facilitated audience discussion.

Increasingly, the NCRP quarterly meetings have become venues for synchronizing state, federal and local priorities. In October 2018, a NCRP quarterly meeting was held that included a panel discussions featuring representatives from state and federal legislatures and agencies including the Tribal Policy Advisor and Assistant Deputy Director from the Department of Water Resources (DWR), the Executive Director from the Strategic Growth Council (SGC), Director of the California Department of Conservation (DOC), Resilience Program Manager of the Governor's Office of Planning and Research (OPR), and Undersecretary of the Department of Food and Agriculture. Another panel comprised of Assemblymember Jim Wood and staff from the offices of Congressman Huffman, Assemblymember Dahle and Senator McGuire provided an update on recent legislation affecting forest resource improvements, agriculture, and forest practice rules and lead a discussion on State priorities related to forest health, climate resiliency and rural community benefits. During a subsequent session, when future priorities for the NCRP were being discussed, the idea of continuing to work in the "radical middle," integration of Tribal communities, and renewed commitment to the partnerships formed during the IRWM process. Seventy-six stakeholders participated in this meeting.

In conjunction with the University of California, Berkeley, OPR and Governor's Office of Emergency Services, the NCRP co-sponsored the Climate Science Symposium for the North Coast Region, held in Eureka in mid-December, 2018. The two-day conference consisted of presentations and panel discussions sharing information and outcomes from the State's Fourth Climate Assessment, panel discussions identifying state funding strategies to build local climate resilience, interactive break-out sessions on technical, financial, and capacity-related barriers and strategies to overcome them, and technical tools and resources for climate adaptation planning.

1.2.4.6 TECHNICAL ASSISTANCE

Early in the NCRP development process, the TPRC became aware that many of the NCRP project funding applications from disadvantaged communities and rural areas were lacking the technical expertise evident in applications from entities with greater human and financial resources. The PRP considered this information when prioritizing projects and revised the weight given to projects benefitting DACs, specifically those projects identified by the applicants and TPRC as addressing threats to public health. This process also brought awareness to the regional nature of these issues: that these projects and communities weren't isolated, but spanned the entire North Coast Region, and that the water supply, quality, and ecosystem benefits from solving these individual problems would yield results at local, regional, and statewide levels.

Since then, the PRP has consistently committed NCRP staff and subcontractors to provide technical assistance to project proponents (or potential proponents) in need of it. Assistance has included project feasibility studies development, grant-writing technical assistance, engineering support, GIS mapping, eligibility, economic analysis, and budgetary advice to project proponents in need. Technical-assistance workshops were held at different locations in the Region prior to NCRP proposal solicitation rounds, in order to ensure accessibility to a broad number of participants. Additional technical assistance was provided during the project submittal process, including budgets, economics, project evaluation, work plans, documentation, and troubleshooting upload tool problems.

The NCRP Water and Wastewater Service Provider Outreach and Support Program (WSWW) identified and provided technical assistance for underserved rural communities who faced daunting water supply and wastewater challenges. In 2011, DWR awarded funding for this pilot program to improve local capacity and quality of services of small water supply and wastewater providers in the North Coast Region. The funding enabled development of the NCRP Small Community Toolbox, which provides resources to help with system maintenance, replacement and upgrades as well as to assist in the project development process. The Toolbox is intended to help small utilities develop a "first order" understanding of what their options are, how they should begin to budget, where to find funding opportunities, and how to get help. This resource is organized around the steps associated with the "Utility Management Cycle". Tools contained in the Toolbox may be provided as documents, maps, charts, or links to web resources.

The NCRP Economically Disadvantaged Community and Tribal Involvement (DACTI) Program provides technical assistance to disadvantaged and Tribal communities using a "circuit rider" element to facilitate Peer to Peer technical service. This model is offering the following types of technical assistance services:

- Preliminary planning and engineering to upgrade and enhance deteriorating infrastructure
- Assessments of pollution, public health, and water supply threats
- Preliminary project design and feasibility analysis
- Development of funding strategies through grants, loans, and/or rate recovery
- Circuit-rider programs to provide on-site assessments
- Provision of templates and procedures to improve system operations and/or funding requests
- Preparation of applications for funding
- Permitting and environmental review

These services are meant to supplement existing efforts and coordination with the State Water Resource Control Board (SWRCB) Proposition 1 Technical Assistance program is built into the evaluation process.

The NCRP DACTI also includes administration of needs assessment surveys and in-person interviews developed to specifically address the unique challenges faced by disadvantaged and Tribal communities. Survey responses are being used to develop topical workshops and trainings tailored to geographic region, community type, and needs identified through the survey and interview process. Approximately 6 – 10 workshops will be conducted and provide sessions on technologies and activities relevant to the North Coast, current challenges associated with permitting and environmental compliance, disadvantaged community strategies, funding opportunities, integration of NCRP objectives and interactive sessions to determine project priorities of North Coast economically disadvantaged communities.

The DACTI Program is also updating the existing Toolbox Utility Management Cycle elements and adding additional elements to respond to water-related environmental resource management. The Program provided Proposition 1 IRWM funding by assisting Tribes and disadvantaged communities to identify projects that are competitive and responsive to state criteria and requirements and assist with the development of project proposals including solicitation of additional support for engineering and other technical elements.

Finally, during the DACTI outreach and assistance process, the NCRP has identified appropriate demonstration projects and innovative programs that reflect the diversity of the region and provide an opportunity to "beta test" the improved Small Community Toolbox, provide substantive technical and engineering support to providers, and allow for the development of case studies to serve as examples for the North Coast Region.

1.2.5 LONG-TERM PLANNING

1.2.5.1 NCRP PLAN UPDATES & READOPTION

With respect to long-term planning, the NCRP is using an adaptive management approach for goal and objective and policy evaluation, project selection, and plan implementation. As part of its adaptive management framework, the NCRP updates Plans and reports as new information is brought forward, regional assessments are completed, project impacts and benefits are realized and documented, and statewide guidelines and priorities shift. As part of the update process, the PRP reviews any new requirements or proposed changes to the existing Plan and decides what elements need to be included in updated drafts (e.g. draft outlines, annotated outlines, full drafts). NCRP staff works with the PRP and TPRC to develop new draft language and/ or to revise existing language. Draft elements are presented at NCRP meetings and posted on the NCRP website. Public comment periods/opportunities are made available to stakeholders who wish to provide input on these elements. The Plan is presented to respective Tribal Councils and county Boards of Supervisors for consideration and adoption/ re-adoption.

The NCRP demonstrates a commitment to an adaptive management approach and flexible decision-support structure as seen, for example, in its ongoing improvement to governance structures and project selection process, refinement of Plan objectives, addition of key initiatives that meet North Coast objectives, and exploration of financing alternatives. The NCRP framework and planning process have served as a vehicle for the identification of common goals and a forum for discussion of contentious issues as they emerge. With each successful negotiation and milestone achieved, bonds between NCRP participants, and individual commitments to the process are strengthened. This forges the way for more complex and inter-related future endeavors and increasing the likelihood of their successful negotiation.

The NCRP Leadership Guidance Handbook, which is reviewed and approved on an annual basis, describes the governance structure, goals/objectives, and policies and documents PRP decisions made during the quarterly meetings as well as providing rules and guidance for project prioritization in response to funding opportunities. The handbook is the dynamic part of the NCRP Plan which is updated yearly as part of the NCRP's adaptive management process. This allows the NCRP leadership flexibility in adapting to changing environmental, climatic, social, or political conditions without needing to allocate limited resources to completely revamping more static sections of the Plan. During the yearly update, the following sections of the Plan are reviewed:

- NCRP PRP, TPRC, Executive Committee and Ad Hoc Committee membership
- Goals and Objectives
- NCRP Policies
- Project Review Criteria and Guidelines
- NCRP Projects

- Signatories to the Memorandum of Mutual Understandings
- Integration of External Plans

As part of its long-term planning efforts, the NCRP periodically examines funding and financing options. The most recent, *A Review and Assessment of Potential Funding Sources for the North Coast Resource Partnership*, was completed in July 2017 and is available on the NCRP website. For a more detailed discussion of how the NCRP is ensuring long-term financial viability, please see *Section 3.6 Long-Term Economic & Financing Plan.*

1.2.6 INTEGRATION

NCRP processes and plans integrate a combination of physical, environmental, societal, economic, legal, and jurisdictional aspects of water and resource management into a single flexible program allowing it to function as a unified effort. Three pertinent types of integration exhibited by the NCRP are stakeholder/ institutional integration (e.g. engaging diverse stakeholders to participate at all levels of the planning process), resource integration (e.g. combining or sharing multiple participant funds, data, protocols, and expertise; considering both built and natural water resources), and project implementation integration (e.g. identifying opportunities to benefit from economies of scale; considering the needs of both specific local and overarching regional interests, encouraging multi-benefit integrated projects).

The NCRP integrates long-term planning and high-quality project implementation in a flexible, adaptive management framework that fosters coordination and communication among all the diverse water and watershed managers and users in the Region. The Partnership acts as a nexus regionally – for example the Small Community Toolbox was created after extensive outreach to small community water providers and wastewater treatment operators to help with system maintenance, replacement, and upgrades as well as to assist in project development. It also serves as a nexus between statewide and local planning efforts, helping to synchronize the large, complex planning processes, regulations and priorities at the state or regional level with the specific issues, data, concerns, and needs at the local level.

In addition, the NCRP integrates local plans into the regional process planning process. The NCRP shall use standard processes during Policy Review Panel meetings to incorporate Storm Water Resource Plans and other relevant and state-required plans into the NCRP Plan.

1.2.7 NCRP PLANS AND DOCUMENTS

Throughout the NCRP Plan, there is reference to policy and guidance documents (e.g., Project Review and Selection Process Guidelines) available on the NCRP website (http:// northcoastresourcepartnership.org). Because the NCRP uses an Adaptive Management approach to governance, these policies and planning processes are updated and approved by the NCRP PRP on a regular basis that occurs more frequently than NCRP Plan updates. The planning documents available online are considered formal NCRP planning documents and are referenced where applicable within this document.

As a "living document," the NCRP Plan is intentionally dynamic. Although the main body of the Plan is revised every few years, Plan Goals and Objectives and important policy and guidance documents are revisited annually and evaluated for continued relevance. In the case of Project Review Guidelines, these are updated to reflect current Goals and Objectives as well as criteria specified by the Guidelines of the solicitation to which the NCRP is responding.

The process for reviewing and potentially revising Goals, Objectives, policies, and guidance documents are transparent and inclusive. During a Policy Review Panel meeting, a motion regarding review, revisions, or additions is made and if seconded, a vote is taken. In most cases, if unanimity is not reached, the PRP will discuss modifications that would result in unanimous approval. Since the group's inception in early 2005 through July 2019, the PRP have moved to pass 258 motions during meetings and 95% have been unanimous.

Plan elements contained in the NCRP Leadership Guidance Handbook that are reviewed for possible revision yearly include:

- Goals and Objectives
- NCRP Policies
- Project Review Criteria and Guidelines
- NCRP Projects
- Integration of External Plans

1.2.7.1 NORTH COAST RESOURCE PARTNERSHIP PLAN

(formerly known as the North Coast Integrated Regional Water Management Plan, North Coast IRWM Plan or NCIRWMP)

The NCRP Plan has been revised four times since its initial publication in July 2005. The current iteration (Phase IV) reflects local and regional priorities as well as the 2016 IRWMP Guidelines and IRWM Plan Standards. NCRP PRP members and Counties adopt each iteration of the NCRP Plan at public meetings that have been publicly noticed through various media outlets, such as email, websites, and newspaper notifications. Tribal partners adopt the NCRP Plan at Tribal Council meetings which are noticed to their constituents. All counties notice their Board of Supervisors meetings at least 72 hours in advance to comply with Brown Act requirements. Each member County, Tribal Council, and project sponsor is expected to formally and publicly adopt the Phase IV Plan by December, 2019.

The NCRP has a history of synchronizing statewide planning priorities with local planning efforts to guide local project implementation, including Integrated Coastal Watershed Management Plans and Storm Water Resource Management Plans. These planning documents are informed by the best available technical information and local knowledge, and include input from interested stakeholders. Local plans that are integrated into the NCRP planning process can be found on the NCRP Integrated Local Plans webpage and a list of local plans incorporated by reference into the NCRP Plan can be found on the NCRP Resources webpage.

1.2.7.2 NCRP STRATEGIC GROWTH COUNCIL PLAN ELEMENTS

The NCRP in 2013 received funding from the Strategic Growth Council to develop a strategic plan to guide the region's growth. The final plan consists of a series of documents that address strategies for continued success (*Healthy Watersheds, Vital Communities, Thriving Economies: Actionable Strategies for California's North Coast Region*), climate adaptation (*North Coast Regional Climate Adaptation Strategies*), climate mitigation (*Climate Mitigation Report for the North Coast Region of California*), economic prosperity (*North Coast Healthy Watersheds & Vital Communities Economic Analysis*), and multiple technical assessment reports:

- Climate Modeling, Projections and Vulnerabilities: *Climate and Natural Resources Analysis and Planning for the North Coast Resource Partnership*, USGS and Pepperwood Foundation
- Regional economic valuation of natural capital and regional economic analysis: *Technical Report for the North Coast of California Ecosystem Service Valuation,* Earth Economics
- Regional renewable energy analysis and GHG accounting framework: *North Coast Resource Partnership Integrated Strategic Plan: Climate Change Mitigation, GHG Emissions Reduction and Energy Independence*, Redwood Coast Energy Authority and *Greenhouse Gas Emissions Assessment Roadmap for the North Coast Regional Partnership*, Schatz Energy Lab
- Regional mapping of forest based carbon sequestration (>4 Billion Metric Tonnes CO2e/year): *Carbon Inventory Estimates for the North Coast Resource Partnership,* Dogwood Springs Forestry
- Opportunities and constraints for biomass energy in the region: *Biomass Energy in the North Coast Region: An Assessment and Strategy for Ecologically and Socially Compatible Development*, The Watershed Research and Training Center
- *Trinity County Forest Ecology, Watershed Hydrology and Economic Valuation of Natural Capital and Economic Analysis for Trinity River Water,* March 2017. Trinity County RC&D Five Counties Program
- ECONorthwest produced a detailed assessment of potential funding mechanisms that the NCRP can use to produce an actionable financing strategy. *A Review and Assessment of Potential Funding Sources for the North Coast Resource Partnership*, July 2017

1.2.7.3 INTEGRATED COASTAL WATERSHED MANAGEMENT PLANS

Four Integrated Coastal Watershed Management Plans (ICWMPs) have completed in the North Coast region, including planning processes in Trinidad, the Mattole River watershed, the Russian River watershed, and the Salmon Creek watershed. All of the ICWMPs in the North Coast region emphasize a programmatic approach and have specific objectives related to reducing pollution in impaired waters and sensitive habitats, including the Critical Coastal

Areas (CCAs), Marine Protected Areas (MPAs) and Areas of Special Biological Significance (ASBS).

- Russian River Integrated Coastal Watershed Management Plan
- Salmon Creek Integrated Coastal Watershed Management Plan
- Mattole Integrated Coastal Watershed Management Plan
- Trinidad-Westhaven Coastal Watershed Management Plan

1.2.7.4 NORTH COAST REGION STORM WATER RESOURCE PLANS

- Storm Water Resource Plans (SWRP) are a requirement for receiving grant funds for storm water and dry weather runoff capture projects from any bond approved by voters after January 2014, per Senate Bill 985, the Storm Water Management Planning Act. SWRP's encourage the use of storm water and dry weather runoff as a resource to maximize water supply, water quality, flood management, and other community benefits within the watershed. On January 20, 2018 the NCRP Plan & Storm Water Resource Plan Integration Process Policy was approved by the PRP and can be found in the NCRP Leadership Guidance Handbook, Policy Appendix and the NCRP Integrated Local Plans webpage. North Coast SWRPs incorporated into the NCRP Plan include:
- Final Russian River Storm Water Resource Plan
- Final Mendocino Coast Storm Water Resources Plan
- Final Eureka Area Watershed Storm Water Resources Plan

1.2.7.5 NCRP Model Guidelines & Policies

These documents represent a wealth of localized, specific information and tools for use by planners, policy makers, and stakeholders in the region about possible solutions to common issues and can be found in the Resources section of the NCRP website.

- Planning Guide for Tribal Energy Sovereignty
- Model Tribal Environmental Enforcement Response Plan
- Planning Guide for Development of Tribal Environmental Protection Ordinance
- Yurok Tribe Water Resource: Land Use and Residential Water Policies
- Trinity River Hoopa Valley LiDAR Technical Data Report
- Site Resilience and Energy Assessment Process for Key Assets
- North Coast Irrigation Water & Fertigation Management Plan User's Guide & Tool Version 1.0
- Decentralized Wastewater Treatment System Planning: Options Evaluation Methodology, Disposal Solutions Scenarios, Management Model Guidelines
- Humboldt County planning models: Environmental Impact Report, Energy Consumption and Conservation, Land Use Element, Community Infrastructure and Services Element, Water Resources Element, Energy Element, Safety Element, Implementation Action Plan
- Mendocino County Water Emergency Preparedness for Underserved Districts
- Mendocino County Integrated Planning and Outreach
- Siskiyou County – Assistance for Small Community Water and Wastewater Service Providers
- Trinity County Water Resources Planning

1.3 GOVERNANCE AND MANAGEMENT STRUCTURE

The NCRP consists of a collaborative partnership between the NCRP Policy Review Panel (PRP), the Technical Peer Review Committee (TPRC), project staff, consultants, and the stakeholders within the North Coast Region. With the exception of Modoc County, with one representative, the PRP consists of two representatives appointed by each County's Board of Supervisors and three Tribal Representatives appointed by North Coast Tribes as outlined in the 'Tribal Representation Process' described in the NCRP (formerly North Coast

IRWM) Memorandum of Mutual Understandings. The TPRC is comprised of technical experts also appointed by each County's Board of Supervisors and Tribal representatives. The TPRC reviews and evaluates the development of the NCRP Plan and proposed projects based on technical criteria and the PRP is the governing and decision-making body providing policy level direction and oversight for the NCRP planning process. Seven counties and North Coast Tribes comprise the leadership of the NCRP. Participating counties include:

- Del Norte County
- Humboldt County
- Mendocino County
- Modoc County
- Siskiyou County
- Sonoma County
- Trinity County

North Coast Tribes are represented by Tribal Representatives elected by the Tribes within the North, Central and Southern Districts through the NCRP Tribal Nomination and Voting Process. There are 34 Tribes in the region who are eligible to vote for the Tribal Representatives and are nominated by the Tribal Councils of North Coast Tribes to fill the three PRP and three TPRC positions, and their alternates. In total there are twelve Tribal Representatives, including primary and alternate representatives.

1.3.1 POLICY REVIEW PANEL

The oversight, governing, and decision-making group for the NCRP is the Policy Review Panel (PRP). The PRP consists of two Board of Supervisors' appointees and alternates from each of the seven participating North Coast counties and three Tribal representatives and their alternates selected by the North Coast Tribes according to the "Tribal Representation Process" developed by North Coast Tribes and defined in the NCIRWMP MoMU. In order to ensure that all North Coast member Tribes are kept informed and offered the opportunity to provide feedback at the policy level, the NCRP hired a Tribal Coordinator who is led by the Tribal Representatives, and is tasked with keeping lines of communication open and functioning between North Coast, NCRP member Tribes, the Tribal NCRP TPRC and PRP Representatives and the full NCRP. The PRP nominates and elects a Chair and Vice-Chair on an as-needed basis and each position is brought before the PRP for reconsideration and appointment every two years. All NCRP PRP and their member agencies are required to be signatories to the NCIRWMP MoMU and in accordance with the IRWM Program are required to formally adopt the North Coast IRWM Plan.

1.3.1.1 DECISION-MAKING

The PRP provides direction and ultimate oversight to the NCRP planning process. Decision-making is usually by consensus, with each member having one vote. When decisions cannot be reached by consensus, the majority opinion prevails as long as a quorum (one half or more) is present, and dissenting opinions are documented in the NCRP Leadership Guidance Handbook and reflected in NCRP documents and plans. The group works diligently to transact its business and arrive at decisions and often will continue to modify an option until it is acceptable to all NCRP members.

1.3.1.2 STAKEHOLDER PARTICIPATION

The PRP is committed to transparency and inclusion, supporting input from stakeholders from throughout the Region, as well as information sharing via the NCRP website, meetings and workshops. Because many NCRP members are representatives of economically disadvantaged communities (DAC), DAC participation is built into the NCRP planning process. All NCRP meetings and activities are in compliance with the Brown Act; therefore, meetings are noticed in advance, provide for substantial public input, and are summarized on the NCRP website for easy access. At PRP meetings, staff and consultants provide background, reports, analysis, and facilitator services as requested by the PRP. The PRP welcomes public input, and agendizes public comment prior to each decision at its meetings. There is no financial requirement for participation in the NCRP.

1.3.2 EXECUTIVE COMMITTEE

The NCRP Executive Committee (EC) is a Standing Committee whose actions are subject to the Brown Act. The EC is composed of the PRP Chair, PRP Vice-Chair, a third member nominated and approved by the PRP and a fourth member nominated by the Tribal representatives and approved by the PRP. The PRP reconsiders the third and fourth member's appointment every two years. The EC provides day-to-day leadership for the NCRP, including signing letters of support; represents the NCRP to legislators and key agency partners; and makes time-sensitive decisions. Any time sensitive decisions made by the EC on behalf of the NCRP reflect previous PRP direction and are consistent with PRP approved goals and objectives. Decisions are made by unanimous or majority vote. When majority vote cannot be reached, the decision is brought before the full Policy Review Panel for consideration. EC decisions are reported via email or are provided during updates to the full PRP at regular NCRP meetings.

1.3.3 TECHNICAL PEER REVIEW COMMITTEE

The Technical Peer Review Committee (TPRC) is composed of technical and scientific staff appointed from each county Board of Supervisors and North Coast Tribes. The TPRC has two primary areas of responsibility: (1) provide technical peer review of NCRP Plans and other technical documents and (2) review and recommend a prioritized slate of NCRP implementation projects, based on technical considerations and the criteria established by the PRP and funding agency. The TPRC also nominates and submits prospective Co-Chair nominees for PRP selection and approval every two years. Expertise on the TPRC includes, but is not limited to: agriculture, county planning, ecology, energy, engineering, fisheries, geology, forest management, traditional knowledge, and water infrastructure.

1.3.4 AD-HOC COMMITTEES

The NCRP PRP forms ad-hoc committees on an as needed basis to address short duration issues or topics. An ad-hoc committee is not subject to the Brown Act and is disbanded once the topic has been addressed and outcomes or recommendations have been reported to the PRP. NCRP ad-hoc committees consist solely of less than a quorum of the PRP and TPRC and may include members of the PRP, TPRC and staff.

1.3.5 REGIONAL ADMINISTRATOR

In 2005, the NCRP authorized Humboldt County to act on its behalf as the regional applicant and contract administrator of grant funds for the NCRP. Individual project proponents, under contract with the County of Humboldt, are responsible for project implementation. To date the County of Humboldt has successfully managed over $69 million in grant funding for over 90 North Coast implementation projects. The Regional Administrator team provides quality assurance and quality control (QA/QC) on all invoices and progress reports submitted by sub-grantees and compiles reports and invoices for the granting agency. The Regional Administrator tracks costs; maintains auditable files; and ensures accurate, current, and complete financial reporting and records. In addition, the Regional Administrator acts as the liaison between the project proponents (sub-grantees, sub-contractors) and the granting agency to streamline communications.

1.3.6 NCRP MOMU

In addition to the formal relationship of counties and Tribes as PRP and TPRC members, and the substantial, regular and intentional outreach to economically disadvantaged communities, the NCRP invites participation from all of the Region's stakeholders. In 2010, the NCRP's PRP revised the Memorandum of Mutual Understandings (MoMU) to expand representation on the PRP and TPRC to include Tribal representatives; require the PRP and TPRC's adherence to the Ralph M. Brown Act thereby formalizing an historic practice of open, transparent, and inclusive meetings and deliberations; meet new stormwater, flood management, groundwater, and climate change considerations required by DWR and of interest to stakeholders throughout the North Coast Region; and satisfy requirements for future grant funding applications. As of 2019, over 140 agencies, special districts, Tribes, non-governmental organizations, watershed groups, and other stakeholders have signed the MoMU signifying their support for and participation in the NCRP.

2 NORTH COAST REGION

The North Coast Region represents a large and diverse portion of the state, encompassing a suite of coastal and inland areas, floodplains and uplands, urban centers and rural communities, and numerous land cover, habitat, and land use types. This diversity is exemplified by the wide variety of human-built and natural attributes that comprise the Region. From north to south and east to west, the North Coast exhibits a range of geologic, hydrologic, climatic, ecological, resource, political, jurisdictional, socioeconomic, demographic, and cultural characteristics. Although consisting of diverse attributes, the Region as a whole may be characterized as relatively rural, economically disadvantaged, and rich in natural resources and intact landscapes, as compared to the state as a whole.

2.1 NORTH COAST REGION PLANNING BOUNDARY

Prior to development of the first iteration of the NCIRWM Plan (2005), extensive thought, discussion, and debate contributed to the determination of the North Coast regional boundary. The Policy Review Panel made a decision early on to focus on watershed boundaries and to align the NCRP planning boundary with the hydrologic boundary of the Regional Water Quality Control Board, Region 1. Although the Region contains all of Del Norte, Humboldt, Trinity, and Mendocino Counties, it contains only portions of the others that drain to the Sacramento River or San Francisco Bay. NCRP staff encouraged counties not fully within the northeastern boundary of the NCRP to connect with other IRWM efforts underway in the Northern Sacramento Valley and Lahontan funding areas and has, during discussions with DWR, encouraged the state to set monies aside for these developing IRWM efforts occurring in Tribal jurisdictions, rural and/or economically disadvantaged communities.

Under the direction of the PRP, NCRP staff has engaged in an ongoing dialogue with Lake County about their participation and gave a presentation to the County Board of Supervisors in 2007, inviting their participation. Since only a small portion of the county (23%) is within the North Coast Region and most of those lands are federal, Lake County has not chosen to actively participate in the NCRP. The county is currently pursuing IRWM planning and projects located outside of the North Coast. Lake County is a signatory to the NCRP's MoMU and is supportive of the NCRP. Marin County, which only has a small portion (7%) in the North Coast Region, also pursues planning and project implementation outside of the North Coast Region. Marin stakeholders participate in the San Francisco Bay Area IRWMP, as do the communities located in the southern portion of Sonoma County outside of the North Coast hydrologic region (18% of Sonoma County) (NCRWQCB 2018).

The following subsections describe, quantify, and illustrate these and other regional and local features, and summary inform summary information by Watershed Management Area, Tribal lands, and county (*see Appendix B, Regional Description, Table 6, Summary of North Coast Region Attributes*).

2.2 GEOGRAPHY

The NCRP planning boundary is equivalent to the hydrologic basin delineated by the North Coast Regional Water Quality Control Board (NCRWQCB) as "North Coast Region 1". The Region encompasses approximately 19,390 square miles (50,220 square km), including approximately 340 miles (547 kilometers) of coastline, abundant wilderness, agricultural areas and some urban centers. Coastal, upland, riparian, and aquatic habitats support diverse plant and wildlife populations, including some of the last viable salmon runs in the state. Several designated Stormwater Quality Protection Areas (formerly Areas of Special Biological Significance), Marine Protected Areas, and Critical Coastal Areas occur along the North Coast. The Mediterranean climate varies from moderate and foggy along coasts to hot and dry inland (i.e. regularly in excess of 100 degrees F).

The Region is divided into two natural drainage basins, the Klamath River Basin and the North Coastal Basin; six Watershed Management Areas (Eel River, Humboldt Bay, Klamath, North Coast Rivers, Russian River/Bodega Bay and Trinity River Watershed Management Areas); and numerous watersheds and groundwater basins.

Overlying the watershed, groundwater, and other physical boundaries are the jurisdictional boundaries of the various North Coast counties, Tribes, municipalities, and special districts. The Region includes all of the counties of Del Norte, Humboldt, Trinity, and Mendocino; major portions of Siskiyou (82%) and Sonoma (82%); and small portions of Glenn (6%), Lake (23%), Marin (7%), and Modoc (28%) counties (NCRWQCB 2018).

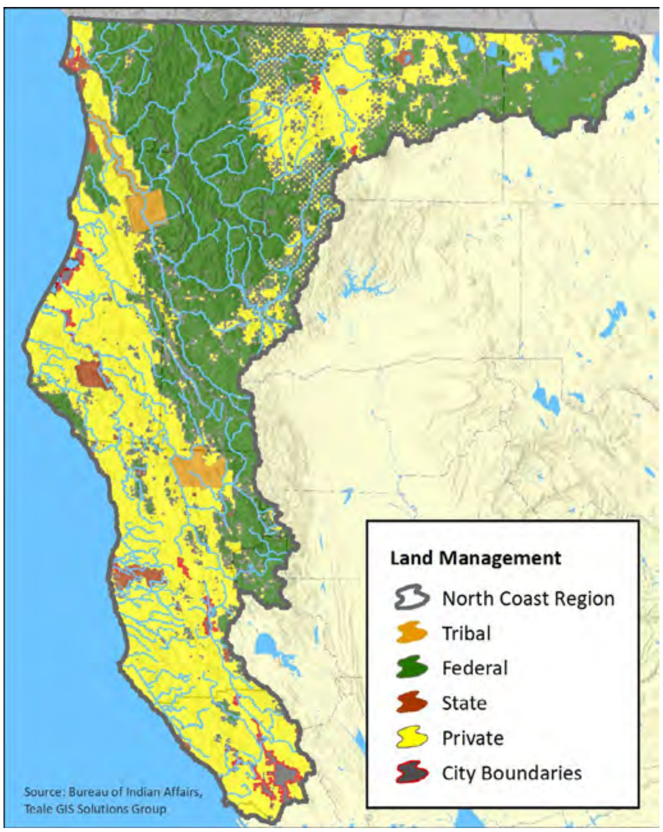
2.2.1 JURISDICTIONAL BOUNDARIES

The North Coast Region contains a number of jurisdictional, administrative, and ownership boundaries. These include federal, state, regional, county, municipal, Tribal, water district, special district, RCD, RC&D, and LAFCO boundaries. Each of these jurisdictions has a particular thematic and geographic scope and there is some degree of overlap or conflict between some boundaries. The NCRP planning approach includes a strong emphasis on local autonomy and jurisdictional authority and strives to achieve a balanced representation of relevant jurisdictional and administrative requirements and concerns at all scales, from local to federal.

2.2.1.1 LAND OWNERSHIP

The North Coast Region includes considerable privately-owned land and land within the federal, state, and local jurisdiction (*see Appendix B, Regional Description, Table 7, Land Owner Types of the North Coast Region*). Land ownership for the North Coast Region is as follows[4]:

- Private/ other entities — 51%
- Federal — 46%
- Tribal — 2%
- State — 2%
- Special districts — 0.07%
- Counties — 0.03%
- Cities — 0.02%
- Non-profit entities — 0.19%

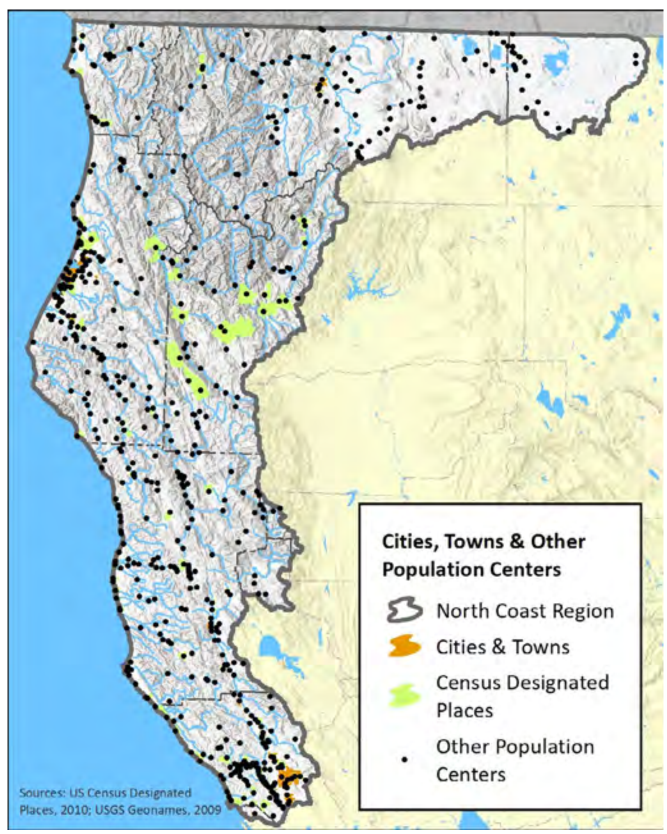


MAP 3 LAND MANAGEMENT

2.2.1.2 FEDERAL AND STATE JURISDICTIONS

On a federal level, the North Coast Region is contained within the US Environmental Protection Agency (US EPA) Region Nine, which covers the entire Pacific Southwest; the US Department of Agriculture Forest Service Pacific Southwest Region 5 (equivalent to the state of California); and NOAA National Marine Fisheries Service (NMFS) Southwest Region, which includes California coasts and portions of the eastern Pacific and Southern Oceans. The U.S. Fish & Wildlife Service (USFWS) Region 8 includes all of California, plus Nevada and the Klamath Basin. For the U.S. Bureau of Reclamations (USBR), the North Coast is part of the Mid-Pacific Region, which covers the northern two-thirds of California, most of western Nevada and part of southern Oregon. The Federal Emergency Management Area (FEMA) places California in Region IX, with Arizona, Nevada, Hawaii, and the Pacific Islands. The only federal water boundary in the Region is the Klamath Project, which is administered by the US Bureau of Reclamation.

On a state level, the North Coast Region has the same boundaries as SWRCB Region 1 "North Coast Region". According to the DWR, the North Coast Region is partially contained within its North Coast and Central Districts. According to California Department of Fish & Wildlife (CDFW) boundaries, the North Coast Region spans portions of three units: the North Coast, North Central, and Bay Delta Regions. According to the California Biodiversity Council bioregional boundaries (developed by the Inter-agency Natural Areas Coordinating Committee), the North Coast Region includes portions of the Klamath/North Coast, Bay Area/Delta, and Modoc bioregions.



MAP 4 CITIES, TOWNS & OTHER POPULATION CENTERS

4 Source: California Protected Areas Database is a GIS inventory of all Californian lands held in fee ownership by public agencies and non-profits, developed and maintained by GreenInfo Network. https://www.greeninfo.org/services/gis-services

2.2.1.3 TRIBAL JURISDICTIONS

North Coast Tribes are separate and independent sovereign nations within the territorial boundaries of the United States. The sovereignty of Tribes has been acknowledged in the U.S. Constitution. This sovereignty is inherent and flows from the pre-constitutional and extra-constitutional governance of each Tribe. Early federal policy and U.S. Supreme Court case law recognizes that Tribes retain the inherent right to govern within political boundaries (Worcester v. Georgia (1832) and that power to interact with Tribes is vested in the federal government (Cherokee Nation v. Georgia (1831). This established governmental structure recognizes the sovereign and political independence of Tribal nations and its members. This right is also recognized by the State of California. Pursuant to the Executive Order B-10-11, the State "recognizes and reaffirms the inherent right of these Tribes to exercise sovereign authority of their members and territory."

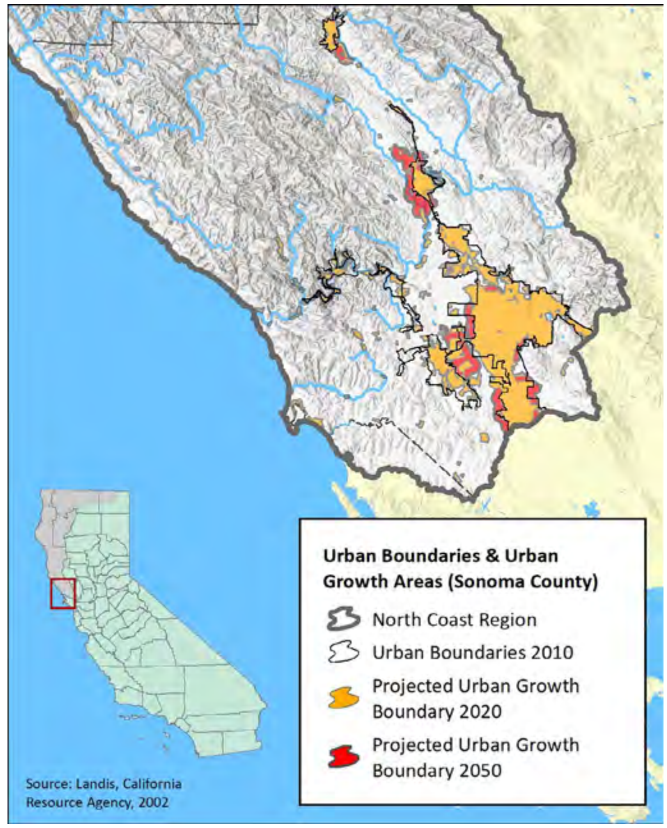
The North Coast is the ancestral territory of North Coast Tribes. The majority of North Coast Tribes acknowledge an inherent responsibility for managing their ancestral territories regardless of whether they currently have the capacity. Therefore, North Coast Tribes' jurisdiction goes beyond the gathering, fishing, and hunting rights, which each individual Tribal member retains. It is the intent of the NCRP Plan to document and support (Goal 1, Objective 1) the fact that each of the North Coast Tribes exerts their jurisdictional authority according to their own traditional policies, laws, mandates, and capacity (*see Appendix D, Tribal Profile*).

2.2.1.4 COUNTY JURISDICTIONS

The North Coast Region comprises four entire counties (Del Norte, Humboldt, Mendocino, and Trinity), major portions of two counties (Siskiyou and Sonoma), and smaller portions of four counties (Glenn, Lake, Marin, and Modoc). An elected Board of Supervisors governs each county (*see Appendix E, County Profile*).

2.2.1.5 MUNICIPAL JURISDICTIONS

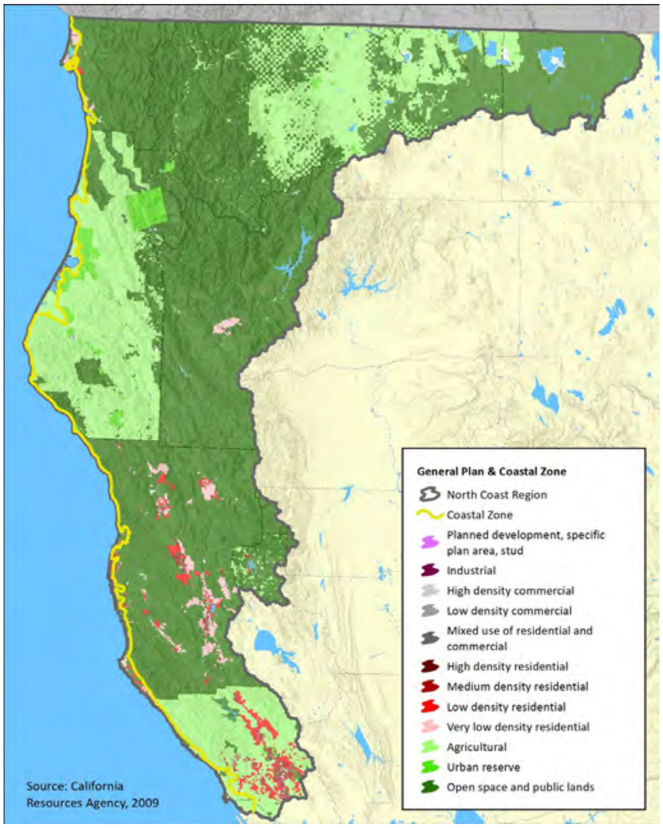
Being predominantly a rural region, the North Coast is home to relatively few large population centers (i.e. cities, towns; municipalities). The boundaries of 25 incorporated municipalities and 9 "census-designated places" fall within the North Coast Region boundary. Most of these entities are signatories to the NCRP MoMU. Urban boundaries and urban growth areas have been designated near select municipal areas in the Region (*see Appendix B, Table 8, Municipalities & Census Designated Places of the North Coast Region*).



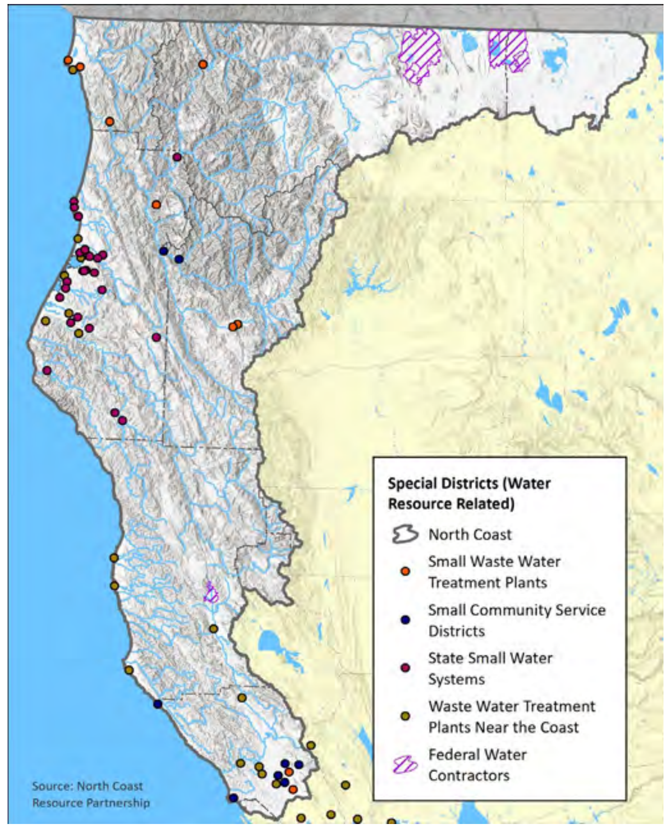
MAP 5 URBAN BOUNDARIES & URBAN GROWTH AREAS

2.2.1.6 GENERAL PLAN & COASTAL PLAN ZONE BOUNDARIES

The General Plans of all North Coast counties and many of its cities have designated specific local land use/development categories, ranging from industrial and commercial uses (relatively restricted to urban centers), to agricultural and open space (comprising the vast majority of the Region). General Plans are fundamental to local resource planning in the Region and contents vary for different counties and municipalities. The County General Plans that have been developed for each of the North Coast counties includes, where appropriate, a corresponding "County Coastal Plan."



MAP 6 GENERAL PLAN & COASTAL ZONE BOUNDARIES



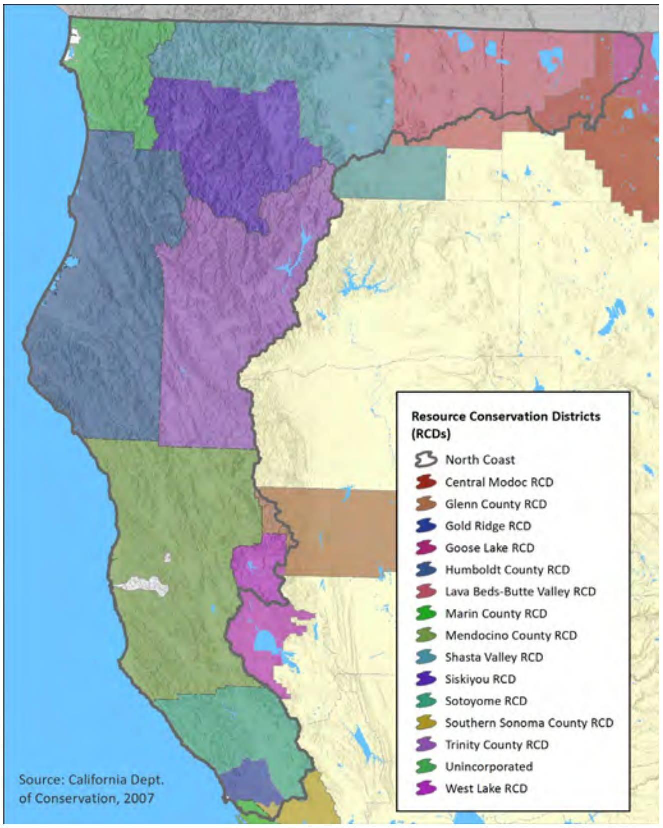
MAP 7 SPECIAL DISTRICTS (WATER RESOURCE RELATED)

2.2.1.7 SPECIAL DISTRICTS

Voters statewide have established various "special districts" in order to fund and perform many functions, from libraries to cemeteries. A number of special districts are natural-resource focused (e.g. fire, air, water), and a subset of these are intended to support attributes and functions that are priorities of the NCRP including Community Service Districts, flood/drainage, irrigation, reclamation, resource conservation, water supply, and wastewater treatment providers. Special districts are formed by local election and governed by elected (or sometimes, appointed) boards. With regard to "jurisdictional authority," special districts serve their constituency based on identified need, not based on political boundary. This allows special districts a level of flexibility not afforded to cities, counties, and other local jurisdictions. Coordination with these local water-related jurisdictions is essential to planning, implementing, and monitoring the projects that will realize the NCRP goals and objectives. Note that Resource Conservation Districts, a type of special district, are specifically addressed below.

2.2.1.8 RESOURCE CONSERVATION DISTRICTS

The Region has eleven Resource Conservation Districts (RCDs), special districts authorized under Division 9 of the Public Resources Code. RCDs work in local communities to implement water and habitat conservation and restoration projects, often on private and agricultural lands, and as such are an integral part of the NCRP stakeholder outreach and project identification and implementation processes. North Coast Region RCDs are Lava Beds/ Butte Valley, Shasta Valley, and Siskiyou RCDs (Siskiyou County); Gold Ridge, Sonoma RCDs (Sonoma County); and Central Modoc, Humboldt County, Marin County, Mendocino County, Trinity County, and West Lake (respective counties). These RCDs primarily occur entirely within the Region, but those in the Northeastern and Southern portions extend beyond the Region's boundaries. In most cases, RCD jurisdictional boundaries are shared with county boundaries, with the exception of Sonoma, Siskiyou, and Modoc counties.



MAP 8 RESOURCE CONSERVATION DISTRICTS

2.2.1.9 RESOURCE CONSERVATION AND DEVELOPMENT COUNCILS

The Region has four Resource Conservation and Development Councils (RC&D). The purpose of an RC&D is to accelerate the conservation, development, and utilization of natural resources to improve the general level of economic activity, and to enhance the environment and standard of living in authorized RC&D area. An RC&D area covers several counties and is locally defined and directed by a council consisting of public and private sponsors. Currently, Del Norte and Humboldt counties do not have a RC&D council. The authorized RC&D areas within the Region are as follows:

- Ore-Cal = Siskiyou County into Oregon
- North Cal-Neva = Modoc County
- Northwest California = Trinity, Del Norte and Humboldt Counties
- North Coast = Sonoma, Mendocino, Marin and Lake Counties

2.2.1.10 LOCAL AGENCY FORMATION COMMISSIONS

Local Agency Formation Commissions (LAFCO) are independent agencies established by State law. A LAFCO in each North Coast county is responsible for reviewing, approving or disapproving changes in organization to cities and special districts including annexations, detachments, new formations and incorporations. Much of the current authority for LAFCO came from the Cortese-Knox Hertzberg Local Government Reorganization Act (CKH Act) of 2000. The objectives of LAFCO are to encourage the orderly formation of local governmental agencies, to preserve agricultural land resources and to discourage urban sprawl.

2.2.1.11 NEIGHBORING IRWM EFFORTS

The North Coast Region is bounded on its northeast corner by the Upper Pit River Watershed and Upper Sacramento-McCloud IRWM groups, to its east by the North Sacramento Valley and Westside (Yolo, Solano, Lake, Colusa) IRWM groups, and to the south by the San Francisco Bay Area IRWM. The Upper Pit River IRWMP includes small portions of Siskiyou and Shasta Counties and larger portions of Modoc and Lassen Counties. The Upper Sacramento-McCloud IRWMP includes the Upper Sacramento, McCloud, and Lower Pit River watersheds as well as the Medicine Lake Highlands, a significant groundwater recharge area lacking in streams that is of cultural significance to local Tribal groups. This group includes the southern part of Siskiyou and northern part of Shasta Counties and is called the Upper Sacramento Regional Water Action Group. The Sacramento Valley IRWMP encompasses a portion of the Sacramento River Hydrologic Region and contains parts of Shasta, Tehama, Glenn, Colusa, Sacramento, and Placer Counties and all of Sutter, Yuba, and Butte Counties. The Westside IRWMP contains the Cache Creek and Puta Creek watersheds and portions of Lake, Colusa, Napa, Solano and Sacramento Counties and all of Yolo County. The San Francisco Bay Area IRWM contains all watersheds that drain to San Francisco Bay and all nine Bay Area counties participate: Sonoma, Napa, Marin, Solano, Contra Costa, Alameda, Santa Clara, and San Mateo Counties.

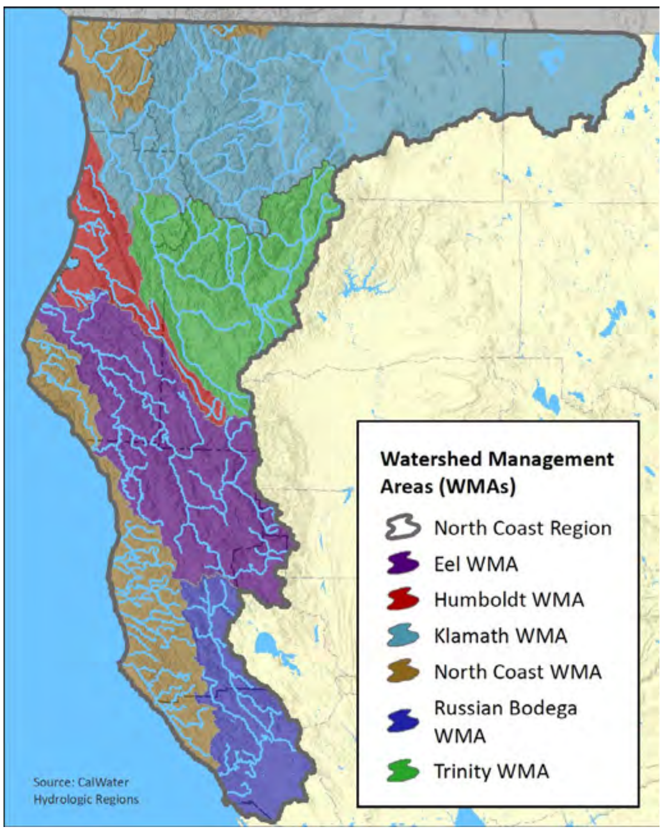
2.2.2 PHYSICAL BOUNDARIES

The NCRP process utilizes a hydrologic, basin-level approach to regional water management planning and project implementation. This approach integrates planning and implementation for physical (as opposed to jurisdictional) areas bounded by drainage basin, groundwater, and/or watershed boundaries.

2.2.2.1 WATERSHED MANAGEMENT AREAS

The Water Quality Control Plan ("Basin Plan") for the North Coast Region delineates two large natural drainage basins covering the entire Region: the Klamath River Basin and the North Coastal Basin. For water management planning purposes, and to promote the statewide goal of protecting water through the Watershed Management Initiative (WMI), the NCRWQCB has further divided the Klamath and North Coastal Basins into six designated "watershed management areas" (WMA). At the finer scale, the Region's WMA comprise 14 individual Calwater Hydrologic Units and 42 composite Hydrologic Areas (*see Appendix F, Watershed Management Area Profile*).

The NCRP utilizes WMAs as the broad-scale planning unit for among other purposes integrating multiple implementation projects within the Region's basins. Using watershed-based (as opposed to strictly jurisdictional/administrative) boundaries as the Plan's geographic planning unit also allows the NCRP to integrate with other regional, state, and federal planning, implementation, and funding efforts that use a watershed-based approach (e.g. including those already in place with CDFG, CCC, SWRCB, Regional Boards, and DWR).



MAP 9 WATERSHED MANAGEMENT AREAS

2.2.2.2 GROUNDWATER BASINS

The North Coast Region contains 58 delineated groundwater basins (plus nine sub-basins) totaling approximately 1,015,139 acres, distributed across the Region. Groundwater basins are designated by DWR on the basis of geological and hydrological conditions, these usually being the occurrence of alluvial or unconsolidated deposits (*see Appendix F, Table 15, Groundwater Basins of North Coast Counties*).

2.3 BIOPHYSICAL ATTRIBUTES

The Region has abundant surface water and groundwater resources. The North Coast geographically represents 12% of the state, yet produces about 40% of statewide runoff, replenishing stream flow, reservoirs, and groundwater stores and providing numerous beneficial uses of water to people and ecosystems (NCRWQCB 2011). Annual precipitation is greater in this Region than in any other part of the state and floods are a fairly regular phenomenon. The Region's watersheds drain to the Pacific Ocean from the Oregon border in the north, south to Marin County.

2.3.1 GEOLOGY

The North Coast Region is characterized by sedimentary geology with inclusions of metamorphic, granitic, and volcanic rock. The presence of northwest-southeast trending faults and geologic structures largely defines the river systems located in the Coast Ranges of the southern coastal area of the Region. Larger metamorphic and intrusive blocks form the Siskiyou Mountains in the northern coastal and interior region. The eastern extent of the Klamath basin lies within the volcanic Cascade Mountain range. The soils underlying the Region have direct implications for maintenance of water quality and beneficial uses of waters. The California Division of Mines & Geology and the California Department of Forestry & Fire Protection (CALFIRE) provide detailed mapping of the Region's geology and the geomorphic features affecting landslide potential, soil erosion, and stream bank erosion in sensitive watersheds (mainly in Mendocino, Humboldt, and Del Norte counties) [5].

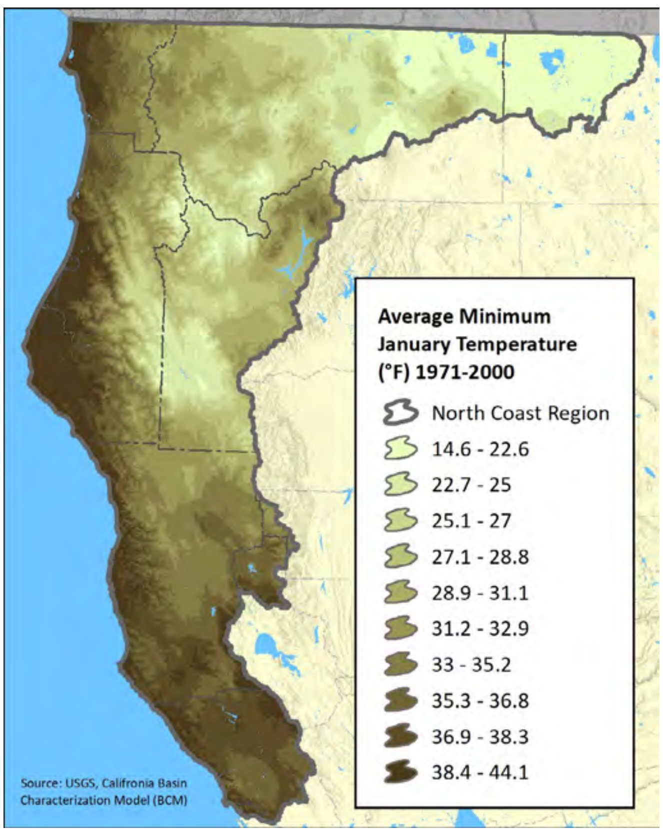
2.3.2 CLIMATE

Distinct climate zones characterize the North Coast Region and are defined by the California Energy Commission: Zone 1 (Arcata), Zone 2 (Santa Rosa), Zone 11 (Red Bluff), and Zone 16 (Mt. Shasta). Each zone exhibits similar climate attributes, relative to surrounding zones. In general, the coastal climate is "oceanic" with regular precipitation and frequent fog; temperature does not vary greatly by season. Inland parts of the Region are less affected by the moderating coastal influence and experience a more "Mediterranean" temperature regime, with seasonal temperatures ranging from over 100 degrees Fahrenheit during the summer to below freezing in winter. Farther inland, a "continental" climate prevails, with even more pronounced temperature extremes and the potential for semi-arid conditions. For example,

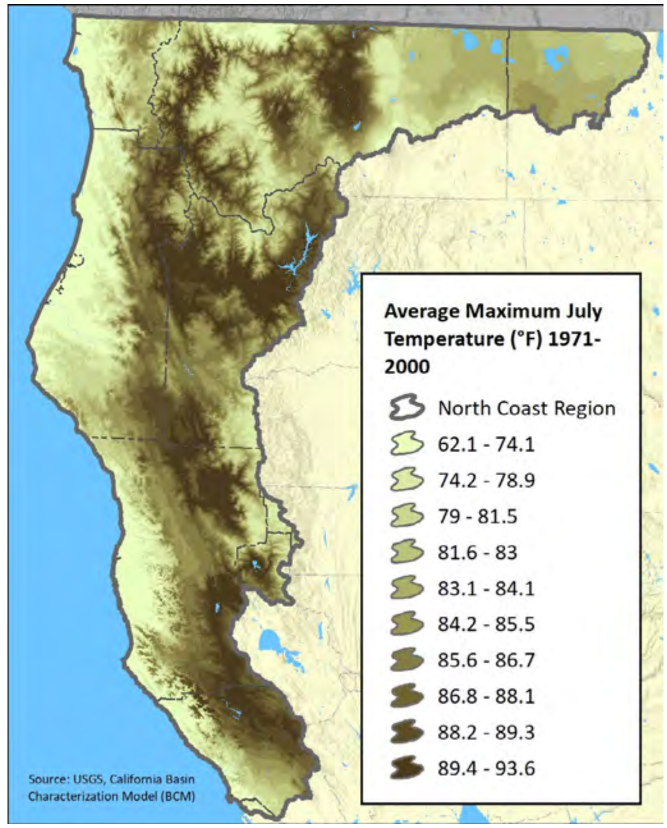
5 https://frap.fire.ca.gov/mapping/gis-data/

in Eureka (Humboldt County), the seasonal variation in temperature has not exceeded 63 degrees F for the period of record. Inland, however, seasonal temperature ranges in excess of 100 degrees F have been recorded.

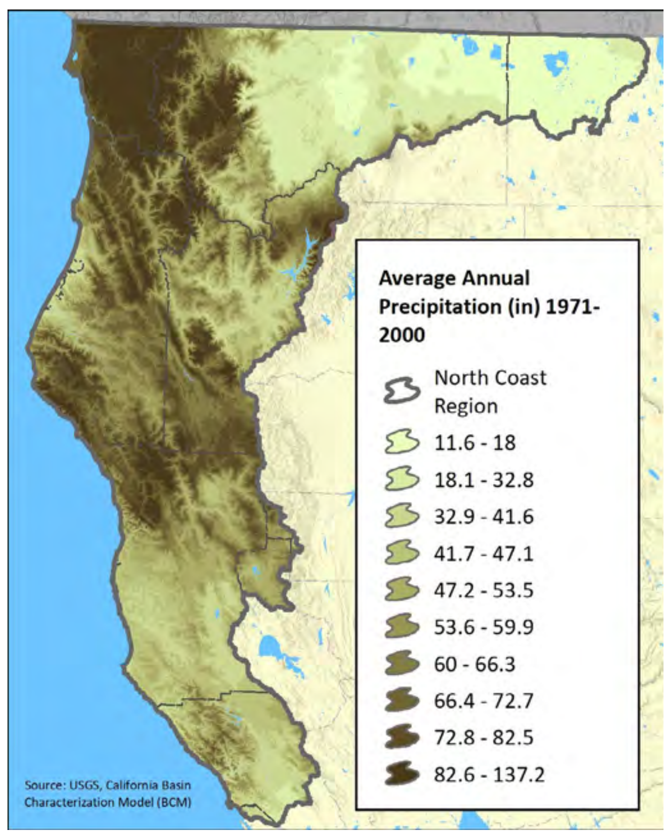
The North Coast receives more precipitation than any other part of California. The Mattole watershed in Mendocino County has the highest recorded rainfall and has received as much as 125 inches of rain per season. By county, average annual rainfall varies drastically: in water year 2012 (Oct 2011-Sept 2012), precipitation ranged from just 4.81 inches (38% of normal) in Mt. Hebron (Siskiyou County) to 76.42 inches (114% of normal) in Crescent City (Del Norte County). Some high-elevation areas (e.g. north-central) of the Region receive and store significant precipitation as snowfall/snowpack. Precipitation, temperature, and other climate variables at any particular location vary from year to year, with relatively wet years and dry years (characterized by flooding and drought, respectively) occurring at somewhat unpredictable frequencies.



MAP 10 AVERAGE MINIMUM JANUARY TEMPERATURE (1971-2000)



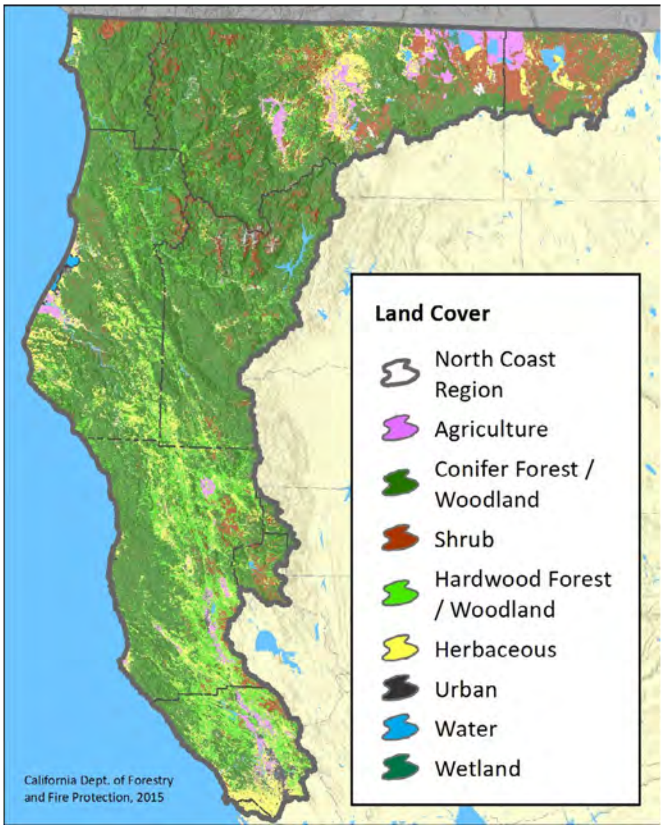
MAP 11 AVERAGE MAXIMUM JULY TEMPERATURE (1971-2000)



MAP 12 ANNUAL AVERAGE PRECIPITATION (1971-2000)

2.3.3 LAND COVER

The North Coast Region comprises a mosaic of varied land cover/vegetation types, ranging from vast forests and grasslands to smaller areas of urban and agricultural lands. An understanding of the variation in local land cover is vital to understanding the context of NCRP project planning and implementation in different parts of the Region (*see Appendix C, Table 9 Land Cover Types of the North Coast Region*).



MAP 13 LAND COVER

2.3.3.1 LANDSCAPE SEQUESTRATION

The NCRP commissioned a carbon inventory estimate that was produced in October 2017 (Nickerson 2017). The inventory quantifies above-ground carbon and carbon stored in the soil in the major biological reservoirs in the North Coast using a landcover class analysis. This inventory tiers from and adds to a statewide inventory developed by the California Air Resources Board. Carbon inventories are presented in Carbon Dioxide Equivalent (CO_2e), a quantity that describes, for a given mixture and amount of greenhouse gas, the amount of CO_2 that would have the same global warming potential when measured over a specified timescale (generally 100 years).

Forest cover dominates landcover classes in the North Coast with almost 70% of its surface area (~ 3.5 million hectares) in forest cover. Forested lands store almost 4 gigatonnes of CO2e, or 90% of the above-ground carbon within the study area. The highest concentrations of carbon are stored within the redwood belt, particularly in state and national parks as well as Jackson State Forest. Wood products play a substantial role in helping forests achieve their greatest contribution to mitigating greenhouse gasses (GHGs). Harvested wood products contain a portion of the carbon in trees and keep it sequestered out of the atmosphere for long periods of time. Wood fiber can also be a renewable source of energy and replace fossil fuel energy.

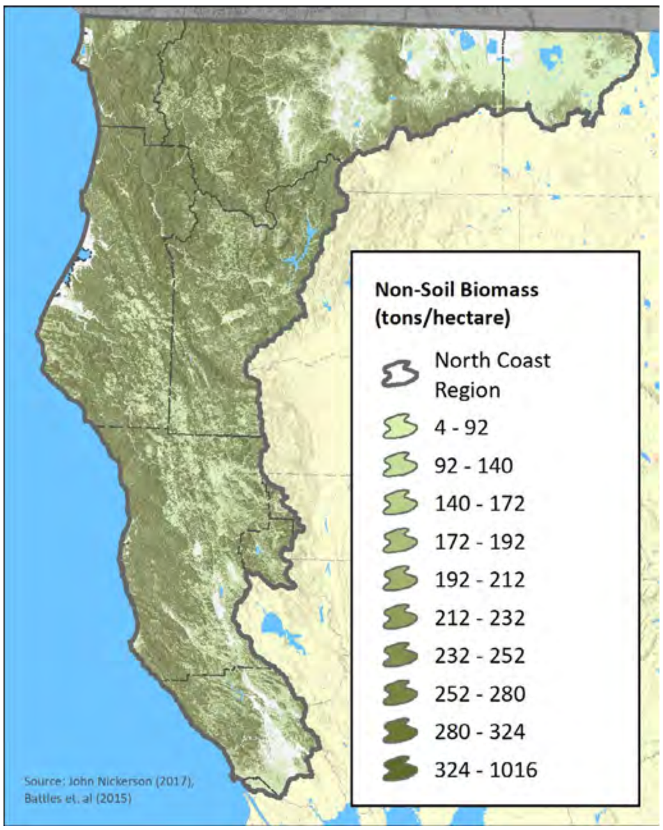
Managed forests approach their maximum contribution to mitigating GHGs when stocking levels support healthy trees that are resilient to wildfire and pests and the healthiest trees are grown to a mature condition before harvesting. The average timber harvest has averaged 850,637 board feet a year over the timeframe from 2012 to 2016. This amount represents 1,211,067 tonnes of CO_2e in sequestered wood products and landfill annually. This value is expected to increase as harvest volumes slowly increase in the future as forest inventories recover. Enhancing resiliency of forests to wildfire and pests can be achieved by removing biomass that historically was removed by more frequent wildfire; investments in fuel reduction help to ward off large scale losses of biomass from wildfire. The removed material can be used to produce energy while displacing energy production from fossil fuels and can be used as feedstock for innovative wood products such as cross laminated timber, which will increase the proportion of carbon in long-lived wood products.

The next closest landcover types, in terms of surface area, are grasslands and shrublands. Grasslands constitute approximately 12% of the region and contain approximately 4% of the carbon in the natural and working landscapes; most of the carbon in grassland ecosystems is found in the soil. Shrublands constitute another 12% of the region and contain approximately 5% of the carbon in natural and working landscapes.

With respect to carbon sequestration in working landscapes in the North Coast, orchards, vineyards, and row crops were identified in addition to the range (grasslands and shrublands) and forests. Orchards constitute approximately 36 hectares, less than 1% of the region, and contain less than 1% of the carbon in natural and working landscapes. Most of the carbon in the orchard landcover class (64%) is estimated to be contained within the soil. Vineyards comprise less than 1% of the surface area and contain less than 0.1% of the carbon stock within the region. Approximately 89% of the carbon in vineyards is contained in the soil. Row crops constitute approximately 1.6% of the area of the region and contain less than 1% of the carbon in the study area. More than 99% of the carbon in row crops is contained within the soil pool.

Wetlands are estimated to be the most carbon rich landcover classes within the study area on a per-acre basis, however, wetlands comprise less than 1% of the landcover and contain less than 1 % of carbon. Most carbon in wetlands is found in the soil. Wetlands identified within the region are found in Del Norte and Trinity Counties.

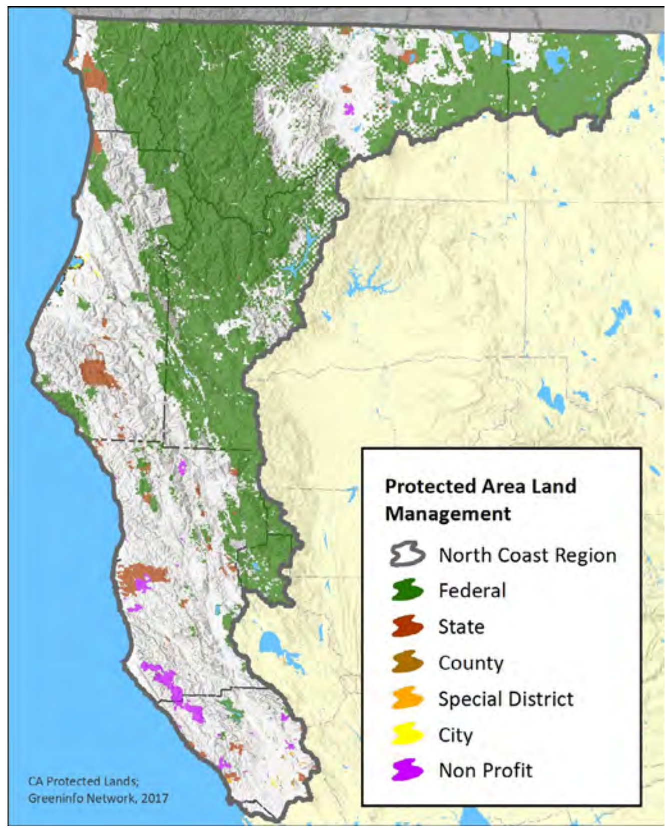
Urban areas contain carbon in trees, shrubs, herbaceous material and soils. They comprise less than 2% of the surface area within the region and less than 1% of the carbon in the region.



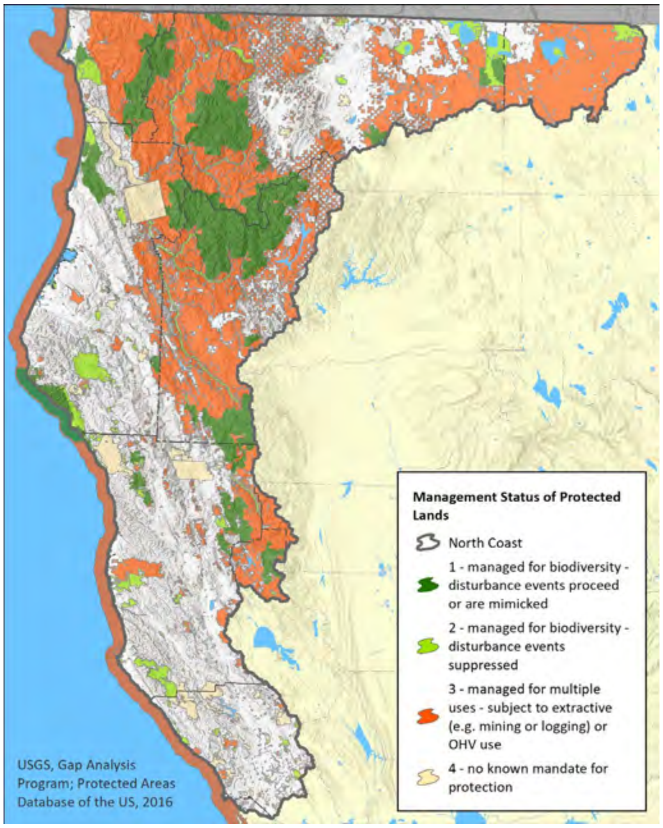
Map 14 NON-SOIL BIOMASS

2.3.4 PROTECTED AREAS

Approximately 49% of the North Coast Region is permanently protected by public agencies (e.g. federal, state, local), private entities, or non-profit organizations. Nearly 300 protected areas including parks, preserves, reserves, recreation areas, national/state forests, private lands, and other sites in the North Coast Region. Conservation easements offer one means through which public agencies and non-governmental organizations (NGO) can sell parcels and keep them protected while retaining private or NGO ownership. Conservation easements comprise approximately 100,000 acres in Sonoma County alone. Functionally, "protection status" for these lands varies, depending on a number of factors, including how lands are managed: for example, "protected lands" may be managed to mimic natural disturbance processes, or for multiple uses including resource extraction and recreational uses. Subsections below address two main protected area designations that are of particular relevance to the NCRP: Marine Managed Areas (MMAs), including Marine Protected Areas (MPAs) and State Water Quality Protection Areas (SWQPAs)/Areas of Special Biological Significance (ASBS) and 303(d)-Listed Impaired Waters. Also protected in the North Coast are Wild and Scenic Rivers and National Wilderness Preservation System Areas (*see Appendix G, North Coast Region Protected Areas*).



MAP 15 PROTECTED AREA LAND MANAGEMENT



MAP 16 MANAGEMENT STATUS OF PROTECTED LANDS

2.3.4.1 MARINE MANAGED & PROECTED AREAS

Legislative protection has been assigned to many of the North Coast's estuarine, marine, and terrestrial coastal resources that are considered to be environmentally sensitive and in need of protection or improvement by federal, state, and/or local government actions. Designation of the most significant of these as Marine Managed Areas serves to protect water quality and constituent ecosystems from further degradation. In 2013, there were 21 Critical Coastal Areas (CCAs) in the North Coast Region. Marine Managed Areas include MPAs, SWQPAs, and ASBSs.

Developed pursuant to the California Marine Life Protection Act (MLPA), MPAs have been established for conservation and management of the natural marine resources and allow specific recreation and commercial activities. MPAs are primarily intended to protect or conserve marine life and habitat, and are a subset of MMAs. MPAs may be classified as marine parks, marine reserves, or marine conservation areas. Pollution control and prevention measures for MPAs are set forth in the policies adopted by State and Regional Water Quality Control Boards. MPAs are generally subject to certain fishery restrictions. Provisions allow non-commercial take to continue, consistent with existing regulations, in MPAs other than State Marine Reserves, where there is a record of ancestral take by a specific North Coast Tribe. There are 19 MPAs, seven special closure areas, and one State Marine Recreational Management area in the North Coast Region. These areas cover approximately 137 square miles of state waters (*see Appendix G, Table 23, Marine Managed Areas*).

2.3.4.2 STATE WATER QUALITY PROTECTION AREAS & AREAS OF SPECIAL BIOLOGICAL SIGNIFICANCE

ASBS are a subset of SWQPAs, which, like MPAs, are a subset of MMAs. ASBS are designated and monitored by the SWRCB through its water quality control planning process. In ASBS, water quality conditions are maintained to protect against impacts to marine aquatic life. A SWQPA is a non-terrestrial marine or estuarine area designated to protect marine species or biological communities from an undesirable alteration to natural water quality. In a SWQPA, point source waste and thermal discharges are prohibited or limited by special conditions in discharge permits. Nonpoint source pollution (NPS) is controlled to the extent practicable but no other use is restricted. There are 8 ASBS in the North Coast Region, seven of which are co-located with existing MPAs (SWRCB 2003).

2.3.4.3 IMPAIRED WATERS

Most of the streams and rivers throughout coastal Northern California contain excessive amounts of pollutants (e.g. sediment) and/or exhibit increased water temperatures. These and other nonpoint pollution sources result in a reduction in water quality and in water quality impacts to the beneficial uses of those waters. These waterbodies (or portions of them) are defined "California Impaired Waters" per the Federal Clean Water Act, Section 303(d). The North Coast Basin Plan (NCRWQCB 2011) estimates there are 20,298 miles (32,667 km) of impaired streams in the Region (approximately 85% of streams). The federal Clean Water Act and CFR §130 require the state to identify water bodies not meeting water quality standards and update these lists biennially; to obtain the most recent information about water quality limited waterways in the North Coast, please see the North Coast Regional Water Quality Control Board (NCRWQCB) web page for the Integrated Report. Each impairment designation requires development and implementation of a Total Maximum Daily Load "TMDL" Plan to reduce pollution loads to recommended levels, which approach background/pre-resource extraction levels. Temperature and sediment are particularly widespread causes of impairment. For the most recent TMDL plans and developments please see the NCRWQCB Total Maximum Daily Loads web page. Some of the most sensitive beneficial uses defined for the Region are directly impaired by increased temperature and sediment, such as those associated with the migration, spawning, and early development of cold water fisheries (*see Appendix G, Table 24, Beneficial Uses of Water in the North Coast Region).*

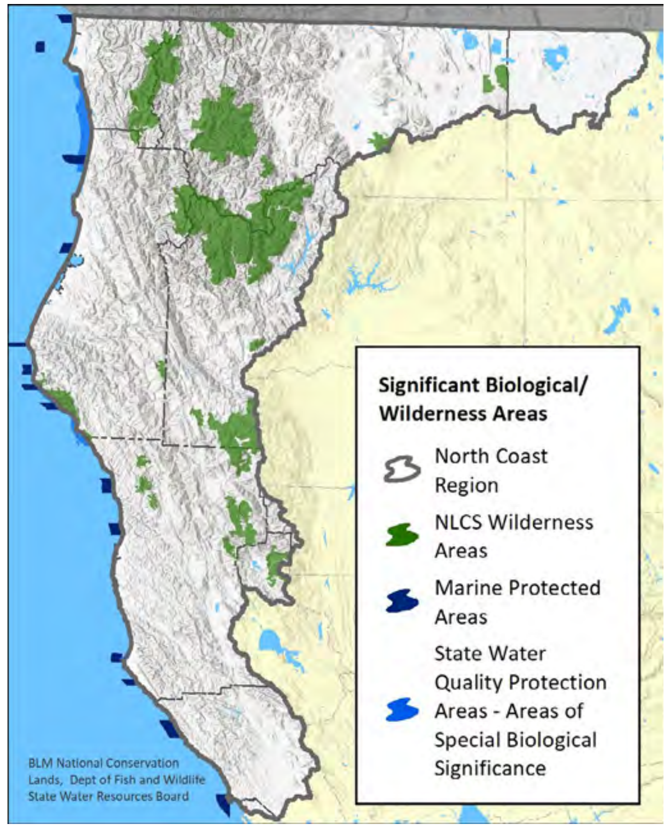
2.3.4.4 WILD AND SCENIC RIVERS

The California Wild and Scenic Rivers Act was passed in 1972 to preserve designated rivers possessing extraordinary scenic, recreation, fishery, or wildlife values. The Act provides three levels of protection: wild, scenic, and recreational. "Wild" rivers are free of dams, generally inaccessible except by trail, and represent vestiges of primitive America. "Scenic" rivers are free of dams, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads. "Recreational" rivers are readily accessible by road or railroad; may have some development along their shorelines; and may have been dammed in the past. Wild and Scenic Rivers are a component of National Conservation Lands.

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 (DWR 2013). In the North Coast, the Bureau of Land Management manages 38 Wild and Scenic Rivers comprising more than 2,050 river miles and 1,002,000 acres (*see Appendix G, Table 25, Wild & Scenic Rivers*). Further major developments on the Klamath and Trinity Rivers or on the Smith River and any of its tributaries are forbidden by the Wild and Scenic Rivers Act; only minor additional surface water development for local use is foreseen, primarily because of the high costs in relation to crops that can be grown in the area (NCRWQCB 2011). Nine Wild and Scenic Rivers have been 303(d) listed as impaired: Albion River, Albion River Lagoon, Eel River, Middle Fork Eel River, North Fork Eel River, Klamath River, Salmon River, Trinity River, and Van Duzen River (*see Appendix G, Table 26, Impaired Streams that Flow Directly to Wild & Scenic Rivers*).

2.3.4.5 NATIONAL WILDERNESS PRESERVATION SYSTEM AREAS

Approximately one fifth of the federally managed land in the Region has been designated as National Wilderness Preservation System (NWPS) areas, under the provisions of the Wilderness Act of 1964. NWPS areas are administered by the US Bureau of Land Management, US Fish & Wildlife Service, US Forest Service, and/ or US National Park Service. There are 11 NWPS in the Region. These areas are subsumed under "National Landscape Conservation System" areas (*see Appendix G, Table 27, National Wilderness Preservation System Areas*).



MAP 17 SIGNIFICANT BIOLOGICAL/ WILDERNESS AREAS

2.3.5 WILDLIFE

The North Coast region is a documented worldwide "hotspot" for biological diversity, with a wide variety of ecosystems and habitat types – including forests, rivers, shrub and grasslands, wetlands, lakes, salt marshes, estuaries, coastal scrub and dune and near shore marine. Extensive estuaries and varied shoreline environments throughout the North Coast are areas of high primary productivity critical to supporting marine fisheries and coastal biodiversity. There are over 526 plan and animal species in the North Coast region, and the region is home to 86 state or federally listed threatened and/or endangered species of plants and animals. The region retains some of the last viable runs of steelhead trout, Chinook and Coho salmon, though nearly 85% of the region's streams have impaired water quality.

The Region contains many species of concern, including thirty federally endangered plant species, four federally endangered fish species (including salmonids), four federally endangered bird species, and seven federally endangered mammals (see NCIRWM Plan Appendix H, Table 27; NCRP 2014). Additionally, the region's mountains, valleys, forests, and grasslands are home to deer (*Odocoileus hemionus*), common garter snake (*Thamnophis sirtalis*), elk (*Cervus elaphus*), Vaux's swift (*Chaetura vauxi*), bear (*Ursus americanus*), southern torrent salamander (*Rhyacotrition vareigatus*), mountain lion (*Puma concolor*) and many other wildlife species (*see Appendix G, Table 28, Threatened & Endangered Species*).

2.3.5.1 CORRIDORS & CONNECTIVITY

The North Coast region's ecological communities serve as habitat for a large number of plant and animal communities and its existing corridors of undeveloped land allow for migration, dispersal, and genetic exchange between locations. The presence of these lands is likely to become extremely important as climate refugia for wildlife to shift their ranges as current ranges become inhospitable due to increased temperature or other factors (Keeley et al. 2018). Not all species, particularly plants, and wildlife endemic to specific habitat types, such as serpentine communities, will be able to shift their ranges, but those that have the capacity to migrate will require movement corridors that aren't blocked by natural landscape features or human development.

In the California Department of Fish and Wildlife's State Wildlife Action Plan (2015), the Northern California Coast, Coast Ranges, and Klamath Province are generally considered to have sufficient connectivity among plant communities and ecosystems with the exceptions being Pacific Northwest Conifer Forests, Subalpine Forest, Wet Meadows, Mountain Riparian Scrub and Wet Meadow, and other upland grasslands and meadows. Approximately 49% of the North Coast Region land is permanently protected by public agencies (e.g. federal, state, local), private entities, or non-profit organizations. There are nearly 300 protected areas including parks, preserves, reserves, recreation areas, national/ state forests, private lands, and other sites in the North Coast Region (*see Appendix H, Table 19, NCRP IRWM Plan 2014*). Conservation easements offer one means through which public agencies and non-governmental organizations (NGO) can sell parcels and keep them protected while retaining private or NGO management. Conservation easements comprise approximately 100,000 acres in Sonoma County alone.

Functionally, "protection status" for these lands varies, depending on a number of factors, including how lands are managed. Extractive and recreational uses may be permitted on some public and private "protected lands," depending on the specified management status and protections afforded thereby; other protected lands are managed to mimic natural disturbance regimes and maximize biodiversity. The ability of a protected piece of land to act as a corridor is dependent on its location in the landscape, with parcels that connect two or more larger, disconnected areas providing greatest benefit to the region's wildlife and ecosystems.

Challenges to maintaining corridors and connectivity in the North Coast are those associated with climate change and human activity. Vineyards in the southern part of the region and cannabis cultivation in Humboldt, Mendocino, and Trinity counties have been identified as drivers of habitat fragmentation, stream sedimentation, and water diversion. Dams and small-scale diversions for agricultural and residential uses also impede aquatic connectivity. Additionally, in areas like Humboldt and Siskiyou counties, there is increasing subdivision of large landholdings into smaller parcels for rural residential development, which removes and fragments habitat, increases the spread of invasive species, and increases demand for limited water resources.

The California Essential Habitat Connectivity Project (Spencer et al. 2010) identifies tracts of land in the region which are vital to preserving corridors and connections that will enable wildlife movement for natural ranging (large megafauna, such as mountain lions and bears), seasonal migration (mule deer, elk, antelope), and climate refugees. Local models can refine the recommendations of the Essential Habitat Connectivity Project to prioritize areas for connectivity conservation by focusing on connecting areas of low climate velocity (the speed at which zones of suitable climate move across the landscape – generally slower for mountain slopes than flat terrain), predicted refugia, climate analogs, or linking current to predicted future suitable habitats (Keeley et al. 2018). Riparian corridors, because of their existing importance as natural movement corridors, should be prioritized.

2.3.6 SPECIAL STATUS SPECIES & CRITICAL HABITATS

Biogeographic analysis documents a total of 526 plant and animal species within the North Coast Region boundary (CNDDB, CDFW). Most if not all of the watersheds within the North Coast Region support some "special status" plant and animal species (e.g. those designated of special concern, rare, threatened, or endangered by state or federal governments). Not all of these special-status species occur in every watershed and there are likely additional special-status species present within the Region that are not yet accounted for.

2.3.6.1 FEDERAL & STATE LISTED SPECIES

Particularly relevant to implementing the NCRP and its projects is consideration of a subset of special status species: the Region's 86 state- or federally-listed threatened and/or endangered species (46 plants, 40 animals). These plant and animal species are currently (2013) on state and federal protection lists per the U.S. Endangered Species Act (ESA). The ESA is administered by two federal agencies: the United States

Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA).

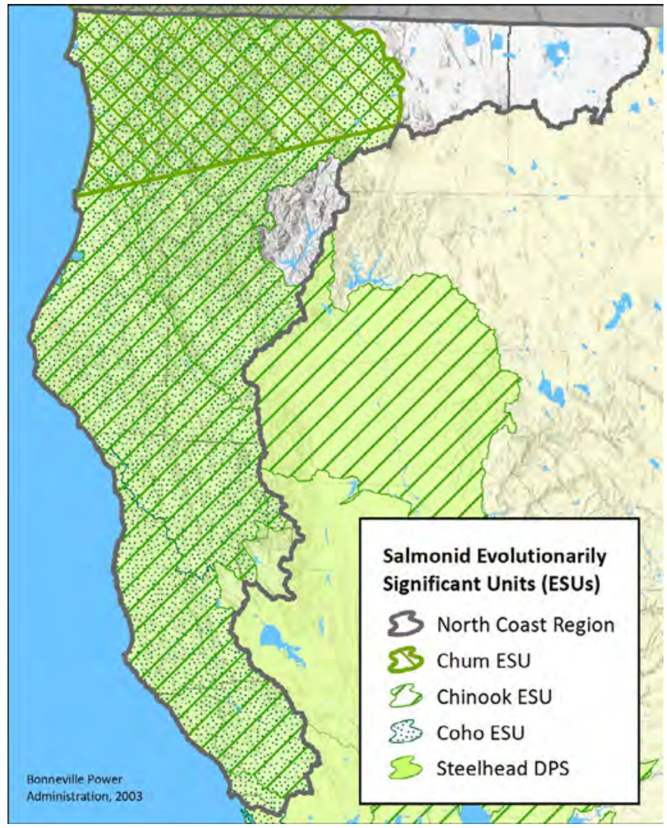
Enhancement of native salmonid species has been a priority of the NCRP since its inception in 2005. In theory and in practice, salmonids are a focal point for improving all beneficial uses of water: management strategies and projects that benefit salmonids will improve overall watershed health and quality of life for all watershed inhabitants. North Coast salmonid ESUs are well-studied and many comprehensive sources and interactive web-based tools exist for stakeholders interested in learning more about local and regional condition, status, and needs (*see Appendix G, Table 28, Threatened & Endangered Species*).

2.3.6.2 NORTH COAST SALMONIDS

Salmonids are fishes with cold-water requirements and anadromous lifestyles; three salmonid species inhabit the North Coast Region rivers, streams, estuaries, and coastal/ nearshore environments: steelhead (*Oncorhynchus mykiss irideus*), Chinook (*O. tshawytscha*), and Coho (*O. kisutch*) salmon. The current status of their populations (Evolutionary Significant Units, ESUs) under the federal and state ESAs is summarized below:

- Central California Coast Coho Salmon ESU: Federal and state listed endangered
- Southern Oregon/Northern California Coho Salmon ESU: Federal and state listed threatened
- California Coastal Chinook ESU, Central California Coast Steelhead ESU, Northern California Steelhead ESU: Federal listed threatened

Because their life cycle is intricately tied to conditions of water quality and quantity, salmon and steelhead are useful indicators of overall watershed health (DWR and USACE 2013) and may be appropriately applied at multiple geographic scales to address local stakeholder priorities. Recent numeric or narrative indicator for salmonid habitat and population conditions are available for the watersheds of the North Coast Region (NMFS 2010). In addition to providing an indicator of watershed health, salmonids also serve important socio-economic purposes. North Coast fisheries have traditionally supported a commercial and recreational fishing industry, and salmon have always been an important component in the traditional North Coast Tribal cultural and spiritual practices, social structure, and economy.



MAP 18 SALMONID EVOLUTIONARILY SIGNIFICANT UNITS

Population Trends

Abundance-trend information for salmonid populations in stream systems along the Pacific central and north coasts indicates an overall declining trend for salmonid populations. North Coast salmonid ESUs exhibit (1) low abundance (2) reduced distribution, and (3) generally negative trends in abundance (NOAA 2005). Survival rates in the marine environment can be strong determinants of population abundance. The observed and reported increases in some salmon populations and/or fisheries in recent years maybe largely a result of a combination of more favorable ocean and inland habitat conditions (i.e. increased marine productivity, spawning and juvenile habitat) leading to higher juvenile fish survival and significantly increased recruitment into North Coast streams.

Threats & Uncertainties

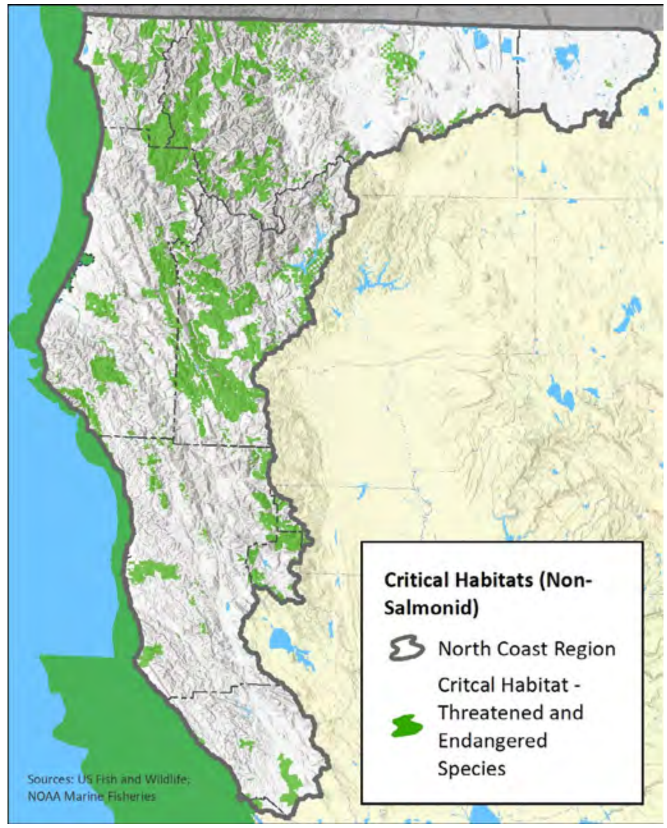
It is generally agreed that there is no single factor responsible for the observed continued decline in salmonid numbers and distribution. This is due to the complexity of the salmon species life history and the multiple ecosystems they inhabit during their life cycle. Factors responsible for salmonid declines include a combination of anthropogenic and naturally occurring causes that may be exhibited both in freshwater, in estuaries, and the ocean. Inadequate streamflow, impaired water quality, loss of access to habitat, past poor land use practices, and ocean-atmosphere climate variability are among the causes of salmonid decline. Freshwater fishes are highly vulnerable to climate change impacts, particularly native fishes and cold-water species, such as salmonids (Moyle et al 2013). Wide-reaching global and regional human activities constantly threaten to alter, damage, or destroy salmon habitat from spawning reaches through to marine habitats.

Conservation Efforts

Congress established the Pacific Coastal Salmon Recovery Fund in 2000, in support of salmonid restoration nationwide. At the federal level, efforts to restore and conserve salmonids are led by National Marine Fisheries Service (NMFS, a.k.a. NOAA), which is the entity with ultimate jurisdiction over North Coast salmonid ESUs, and that is charged with coordinating salmonid recovery in the North Coast. NMFS works closely with the state Department of Fish & Wildlife (CDFW) to implement substantial, salmonid habitat restoration and ongoing monitoring data collection and dissemination. NMFS considers a wealth of available salmonid- and watershed-related data, and has recently (2014) incorporated them into published recommendations that are specific to the stream basins of the North Coast Region. The CDFW in 2004 released the Recovery Strategy for Coho Salmon and previously published the Steelhead Restoration and Management Plan (CDFW 1996). The California Salmonid Stream Habitat Restoration Manual (CDFW 1994, 1998, 2010) is used as a guide by restoration practitioners throughout California, including for the implementation of several of the NCRP prioritized projects. Local watershed initiatives that benefit salmonids in the North Coast Region are numerous and include captive-rearing in hatcheries; removal and modification of dams that obstruct salmon migration; restoration of degraded habitat; acquisition of key upland, riparian, estuarine, and coastal habitat; improved water quality; and maintenance of sufficient instream flow.

Critical Habitats

The Endangered Species Act (ESA) requires the federal government to designate "critical habitat" for any species it lists under the ESA. However, a critical habitat designation does not set up a preserve or refuge; it applies only when Federal funding, permits, or projects are involved and to ensure projects are not likely to jeopardize the continued existence of a listed species, or destroy or adversely modify its designated critical habitat. Critical habitat requirements also do not apply to citizens engaged in activities on private land that does not involve a Federal agency (*see Appendix G, Table 29, Critical Habitats of the North Coast Region (Non-Salmonid) and Table 30, Critical Habitat for Marbled Murrelet in North Coast Counties*).

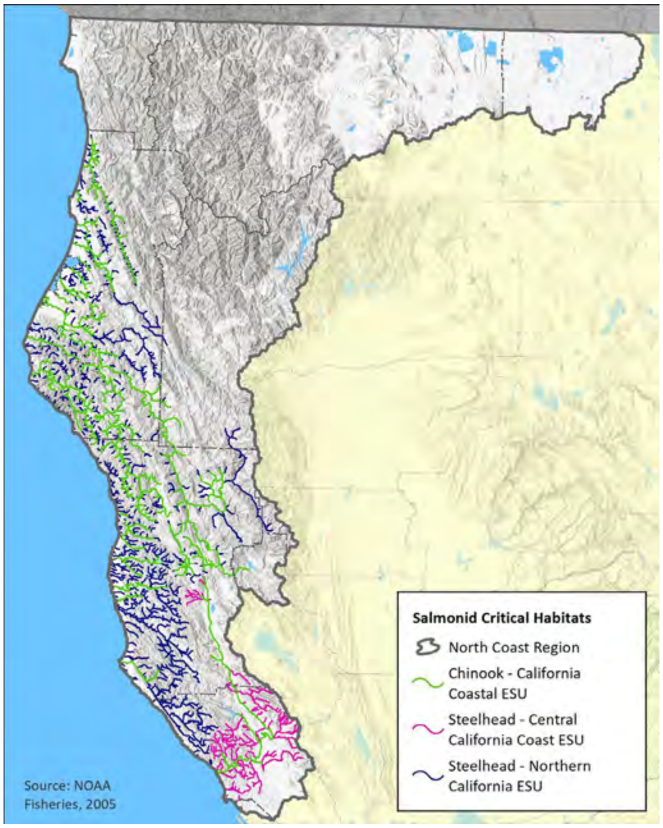


MAP 19 CRITICAL HABITATS (NON-SALMONID)

North Coast Salmonid Critical Habitat

Habitat factors related to water flow, water quality, and habitat complexity are known to be critical requirements for salmonid populations. Sedimentation, increased water temperature, and chemical and biological pollution can reduce habitat viability and negatively affect at least some stages of the salmonid life cycle. Spawning salmon are known to require adequate surface flows in order to return upstream to their natal streams and clean, appropriately sized gravel in which to spawn; juveniles need intact complex habitat (a matrix of pools, riffles, large woody debris, and riparian vegetation) to provide shelter, food, cool water temperatures, and other factors necessary for survival; and smolts seek intact, unpolluted estuarine habitat to physiologically adjust to the salinity environment prior to outmigration to the ocean.

Salmonid population declines are believed to result from a complex combination of numerous direct and indirect factors in freshwater, estuarine, and/or marine environments. Although the ultimate and proximate causes are uncertain, most factors impacting salmonids are expressed at the habitat level; protection and enhancement of the critical habitats salmonids might occupy is one strategy with strong potential to facilitate salmonid recovery to sustainable population levels (*see Appendix G, Table 31, Critical Habitat of Salmonids in the North Coast Region*).



MAP 20 SALMONID CRITICAL HABITATS

2.3.7 HYDROLOGY

Mean annual runoff in the North Coast is about 29 million acre-feet (maf), which constitutes about 41 percent of the state's total natural runoff (DWR 2013), greater than any other single hydrologic region in California. The estimated 2000-2010 water balance for the Region's four DWR-designated Planning Areas is provided in the California Water Plan (DWR 2013). The volume of water exported to other regions in the state is generally greater than all the water the North Coast Region consumes for urban, agriculture and wildlife refuges combined (*see Appendix H, Hydrology*).

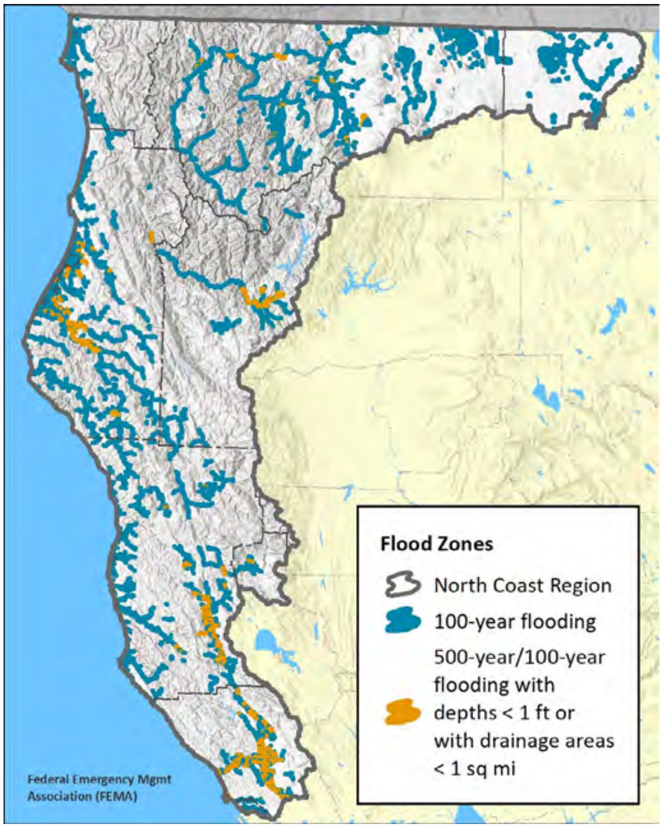
There are fundamental physical and mechanistic connections between groundwater basins and surface water bodies, although they are frequently designated "ground" and "surface" water for management and planning purposes. Although the two forms appear to be different supplies, they in reality, they form a single water supply joined by the hydrologic cycle. This understanding has direct implications for the Region's domestic and municipal water supplies, which depend heavily on a single ground-surface water supply. For example, lowering of groundwater levels can impact the surface water–groundwater interaction by inducing additional infiltration and recharge from surface water systems, thereby reducing the groundwater discharge to surface water base flow and wetlands areas. Extensive lowering of groundwater levels can also result in land subsidence (lowering of the ground surface) due to the dewatering, compaction, and loss of storage within finer grained aquifer systems (DWR and USACE 2013).

Beneficial management practices like "conjunctive water use" (storing excess surface waters in groundwater basins for use during dry periods) and ecosystem processes like water recharge also rely on this basic ground-surface relationship. Conjunctive use of surface water and groundwater has been utilized for decades by numerous coastal and inland basins throughout the North Coast Hydrologic Region, including the Eureka Plain, Eel River Valley, Santa Rosa Valley, Smith River Plain, Wilson Grove, Big Valley, Tule Lake Valley, Scott Valley, and Shasta Valley (DWR 2013). Many agencies have erected systems of barriers to allow more efficient percolation of ephemeral runoff from surrounding mountains (*see Appendix H, Table 34, Water Resources & Water Use for North Coast Region Basins*).

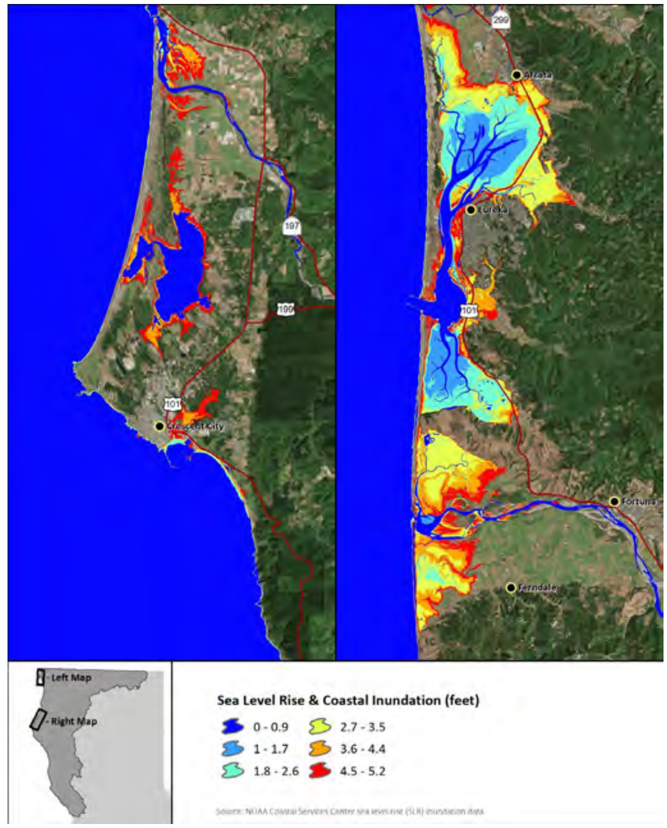
Seasonal flooding is characteristic of much of the Region, including along river floodplains and low-lying coastal areas. The intensity, distribution, and duration of precipitation are strongly correlated with flood potential. Proximate factors may either facilitate or confound effective management of flood levels, depending on how water and land are managed. These factors may include the size of the watershed drained; channel capacity; infiltration and runoff rates; urbanization; dams and reservoirs; snowmelt, stormwater runoff retention; and natural and built infrastructure capabilities. Damaging floods occur relatively frequently in the Region, with particularly destructive floods documented in December 1955, December 1964, February 1986, spring 1995, and January 1997 and 2006 (NCRWQCB 2011, DWR 2013).

The extent and nature of impacts to stream morphology from flooding depends on the channel geometry, longitudinal slope, channel material type(s) and size(s), and the type and density of channel vegetation (Center for Watershed Protection 2003, Roesner and Bledsoe 2003). For example, increased flows within a deep, narrow channel may result in significantly higher shear stresses at the bed; this same increase in a wide, shallow channel may become predominantly overbank flow. Where all other factors are equal, fewer impacts would be expected where flows have access to broad overbank areas (i.e., floodplains) during relatively common floods (Segura and Booth 2010), channel materials are more resistant, and stabilizing riparian vegetation is present. Conversely, where erosion and bank instability result in the loss of vegetation reinforcement, a positive feedback response may cause erosion to be accelerated.

A number of areas in the Region experience 100- and 500-year floods, as defined by the Federal Emergency Management Agency. In the North Coast, more than 30,000 people (5% Region population) and $3 billion in assets lie within the 100-year flood zone. Some 40,000 people and over $4 billion in assets are exposed to the 500-year flood event (DWR 2013).



MAP 21 FLOOD ZONES



MAP 22 SEA LEVEL RISE & COASTAL INUNDATION

2.3.7.1 HYDROMODIFICATION

Changes in flow and sediment loads to streams and other watercourses associated with storm and flood events can result in significant and long-standing impacts to beneficial uses of North Coast waters. These changes are collectively referred to as "hydromodification". Most jurisdictions in California are now required to address the effects of hydromodification through either a municipal stormwater permit or the statewide construction general permit. The State and Regional Water Boards have recognized the need to manage and control the effects of hydromodification in order to protect beneficial uses in streams and other receiving water bodies. This recognition has led to the inclusion of requirements for development of "hydromodification management plans" (HMPs) in many Phase 1 and some Phase 2 Municipal Stormwater (MS4) permits.

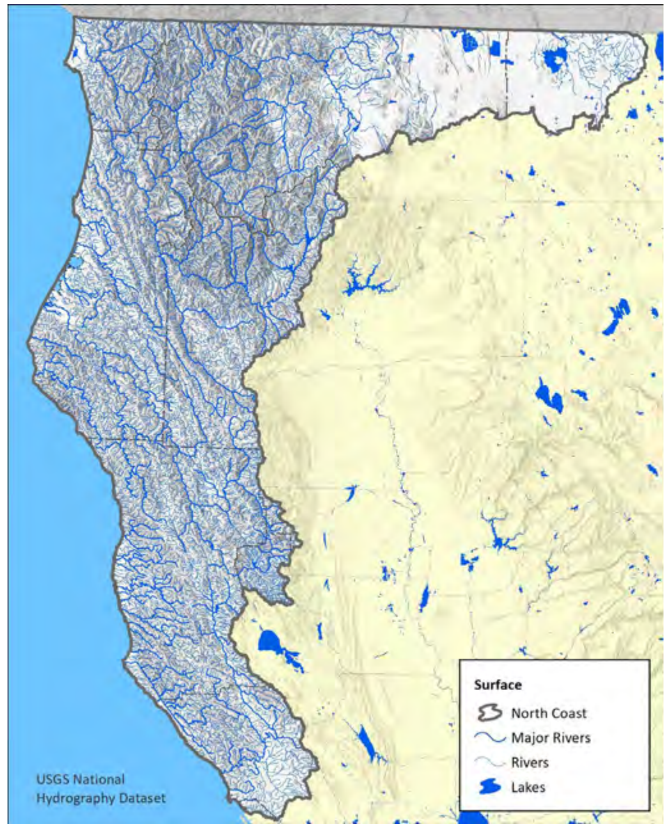
2.3.7.2 SURFACE WATERS

The North Coast Region contains numerous rivers, streams, and creeks, some of which flow year-round and others that were more or less seasonally intermittent historically, or are now intermittent due to overdrafting. A total of approximately 34,586 kilometers (21,491 miles) of rivers and streams drain watersheds of the Region (*see Appendix H, Table 33, Rivers & Streams of* *the North Coast Region*). The total length of streams varies across the Region's WMAs and counties. They rank, from highest to lowest, of total stream length for WMAs is: Klamath (9,056 km.), Eel (8,351 km.), North Coast Rivers (6,082 km.), Trinity (5,567 km.), Russian/Bodega (3,270 km.), and Humboldt (2,260 km.). The rank for counties is: Mendocino (7,798 km.), Humboldt (7,356 km.), Siskiyou (6,976 km.), Sonoma (2,481 km.), Del Norte (1,940 km.), Lake (937 km.), Modoc (801 km.), Glenn (174 km.), and Marin (71 km.).

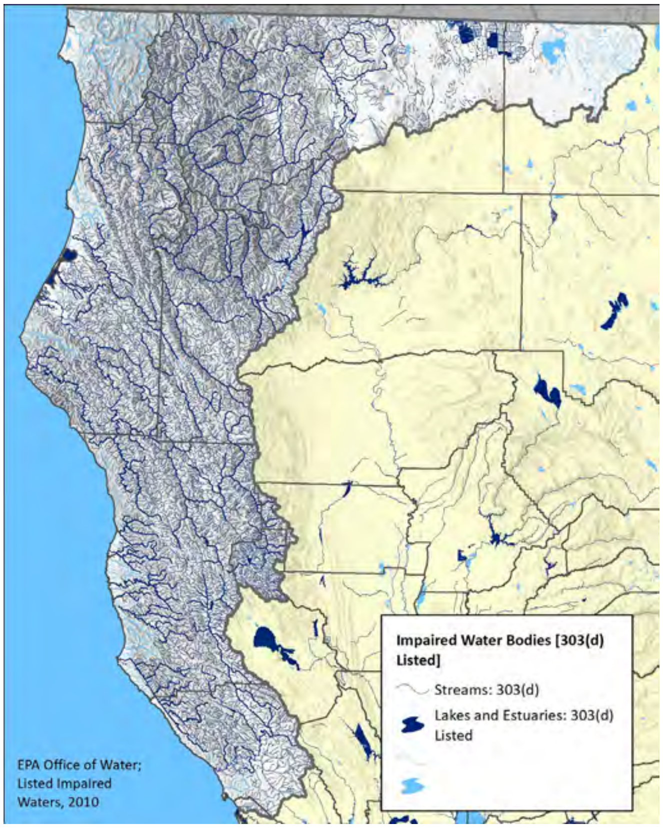
Other than the extensive river and stream networks referenced above, major natural freshwater bodies are relatively rare in the North Coast Region. Major natural freshwater bodies include Meiss Lake in Siskiyou County, the Laguna de Santa Rosa in Sonoma County, and historic Tule Lake in Modoc County. Small natural lakes are few relative to other regions, and are particularly common (though again, not numerous) in Siskiyou and Trinity counties. Human-built reservoirs and lakes (e.g. of all sizes and for flood control, recreation, agriculture, or other purposes) are numerous.

Extensive estuaries (brackish and associated with mouths of rivers) and varied shoreline environments occur throughout the North Coast. Estuarine environments are areas of high primary productivity and thus critical to the support of marine and coastal biodiversity. Coastal and estuarine habitats are critical for many species of waterfowl and shore birds, which feed and nest there. Intertidal areas throughout the Region are used extensively as nursery habitat for many types of marine organisms, including shellfish and fishes. Salmonids require estuaries as a staging area to physiologically adapt to environmental changes in salinity. Marine invertebrates and fish utilize the rich resources in tideland areas along the North Coast, and serve as forage for seabirds and marine mammals. Offshore coastal rocks are used for resting and reproduction by marine mammals and as nesting areas by many species of seabirds. Examples are Lake Earl in Del Norte County, Humboldt Bay and lagoons in Humboldt County, and Bodega Bay in Sonoma County. Also included in this category are the extensive estuarine environments of rivers at their confluence with the Pacific Ocean (e.g. the Smith, Klamath, Tenmile, Noyo, Albion, Big, Navarro, Gualala, and Russian Rivers, plus numerous smaller waterways). These important areas include a number of protected coastal and near-shore marine areas.

Various pollutants have compromised the quality of many North Coast surface waters (lakes, estuaries, bays and others, in addition to rivers). These are designated as "impaired waterbodies" (or "waters" or "segments") under Section 303(d) of the California Clean Water Act. The state publishes surface water monitoring results for select water bodies throughout the Region; data may be uploaded or downloaded from the Surface Water Ambient Monitoring Program (SWAMP).



MAP 23 SURFACE WATERS



MAP 24 IMPAIRED WATER BODIES [303(D) LISTED]

2.3.7.3 GROUNDWATER

Use of groundwater resources is regulated through the Sustainable Groundwater Management Act (SGMA), a three-bill legislative package (AB 1739, SB 1168, and SB 1319) signed into law in September 2014. This bill creates a framework for sustainable groundwater management with the goal of using groundwater "in a manner that can be maintained during the planning and implementation horizon without causing undesirable results." The act requires governments and water agencies of high and medium priority basins (see below) to halt overdraft and bring basins into balanced levels of pumping and recharge. The act empowers local agencies to form Groundwater Sustainability Agencies to manage basins and requires them to adopt Groundwater Sustainability Plans for high and medium priority basins. The California Statewide Groundwater Elevation Monitoring (CASGEM) Program, established in 2009, tracks seasonal and long-term groundwater elevation trends in groundwater basins statewide and is a tool to help achieve goals set out under the SGMA.

Groundwater resources in the North Coast Hydrologic Region are supplied by both alluvial and fractured-rock aquifers. Alluvial aquifers are composed of sand and gravel or finer grained sediments, with groundwater stored within the pore spaces between sediment particles. Fractured-rock aquifers, in contrast, consist of impermeable rocks with groundwater stored in cracks, fractures, or other void spaces. The distribution and extent of alluvial and fractured-rock aquifers and water wells vary significantly within the Region. Alluvial groundwater basins and subbasins underlie approximately 1,600 square miles (8 percent of the region). Fractured-rock aquifers in the foothill and mountain areas adjacent to the many alluvial groundwater basins also provide groundwater supply in the region. Groundwater from fractured-rock aquifers tends to supply individual domestic and stock wells, or small community water systems. Fractured-rock aquifers, and the wells that they supply, tend to have less capacity and reliability than wells in alluvial aquifers. However, localized fractured-rocks within the Klamath, Butte, and Shasta Valley groundwater basins tend to form some of the most highly productive fractured-rock aquifers in California.

Groundwater is functionally linked to surface water although they may or may not be physically connected (i.e. water in fractured-rock aquifers is physically disconnected from the surface, relative to the water alluvial basins). Groundwater basins do not always follow the same boundaries as surface waters and groundwater sources likely exist even where groundwater basins have not been identified (NCRWQCB 2011). The volume of groundwater cached in North Coast basins is not fully quantified. In some areas (e.g. Klamath Basin), groundwater quality may not be adequate to support use as drinking water, due to naturally occurring elements (e.g. arsenic). Where feasible, North Coast groundwater is pumped for consumptive uses related to agricultural, domestic, and municipal supply. In some areas, surplus pumped groundwater is returned to the hydrologic cycle to regulate the water table (e.g in the Butte Valley, via Lake Meiss, to the Klamath River; NCRWQCB 2011).

The Department of Water Resources has identified a minimum of 63 groundwater basins and subbasins underlying the North Coast Region (DWR 2013). Groundwater basins are unevenly distributed throughout the Region's WMAs and counties. The two largest groundwater basins in the Region are described in some detail below (see the California Water Plan (2018) for details on other basins).

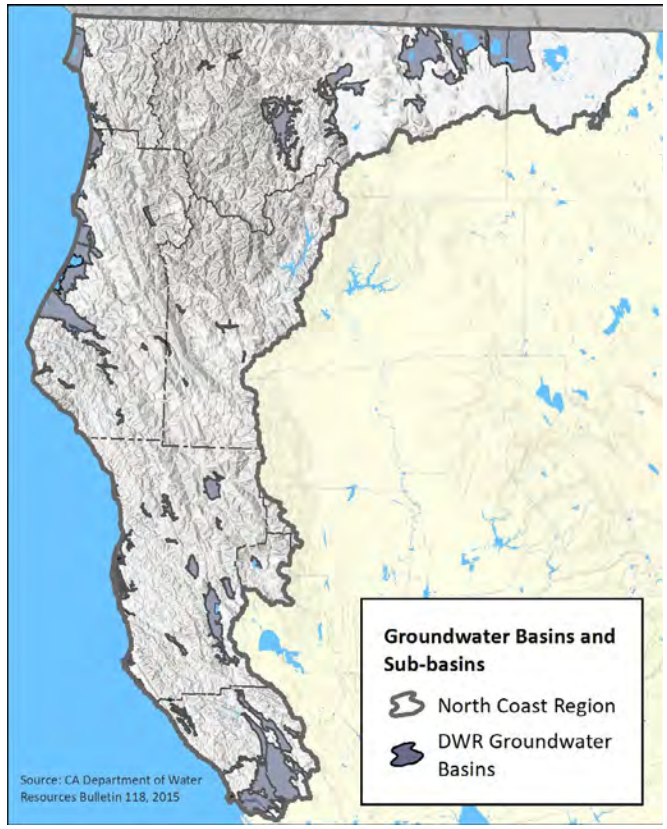
- The Upper Klamath River Valley Groundwater Basin is the largest groundwater basin in the North Coast Hydrologic Region, encompassing approximately 161,260 acres. It is the most heavily used of the Region's basins, and is shared with users across the Oregon border. It is composed of two subbasins — the Tule Lake and Lower Klamath Lake Subbasins. The primary water-bearing formations include Tertiary to Quaternary lake deposits and volcanics. Recharge occurs through infiltration of surface water from channels, lakes and sumps of the Lower Klamath and Tule Lake basins along with underflow from adjacent, rapidly-replenished volcanic rocks.

- The Santa Rosa Valley Groundwater Basin in Sonoma County is the second largest groundwater basin in the Region, encompassing approximately 79,000 acres. It is located within the larger 167,410-acre Santa Rosa Plain watershed, which includes all of the Mark West Creek watershed (161,410 acres) with areas to the northwest and south of the Mark West Creek watershed boundary added to include most of the Santa Rosa Plain groundwater subbasin as defined by the California Department of Water Resources. The Mark West Creek watershed includes the Mark West Creek, Santa Rosa Creek and Laguna de Santa Rosa basins. The four principal aquifer units are the Glen Ellen Formation, Wilson Grove Formation, Petaluma Formation and the Sonoma Volcanics. Significant sources of recharge are infiltration of precipitation, infiltration from streams, and irrigation-return flow (USGS 2013)., the Santa Rosa Plain Groundwater Sustainability Agency is developing a Groundwater Sustainability Plan, which is expected to be completed in 2021.

DWR ranks the Region's groundwater basins and sub-basins as "high," "medium," or "low" priority for monitoring/ response. DWR currently requires compliance with CASGEM and the SGMA only in high and medium priority basins, and restricts many of its funding programs to these same basins (Revelle 2014). There are no high priority basins in the North Coast Region, but there are five medium priority basins (the 58 remaining basins are designated as low or very low priority) (see SGMA Basin Prioritization Dashboard Final 2018). They are:

- Klamath River Valley – Tulelake (1-002.01)
- Butte Valley (1-003)
- Scott River Valley (1-005)
- Eel River Valley (1-010)
- Ukiah Valley (1-052)

Substantial data on groundwater basins exist: however, there are still data gaps related to the extent and function of groundwater basins; some basins are not documented at all; and there is an imperfect understanding of the role that the "recharge landscape" (i.e. the surrounding watershed) plays in the functioning of groundwater basins. The state maintains a robust website for Groundwater Management where updates to basin prioritization, the SGMA Groundwater Management Program, CASGEM Groundwater Monitoring, and associated groundwater management information can be accessed. Additionally, DWR publishes "California Groundwater Bulletin 118" (updated 2003, and partially updated in 2016), which presents comprehensive results of state groundwater evaluations including of groundwater quantity, quality, and management strategies for each basin in the state. In 2020 and every 5 years after, the DWR will release comprehensive updates to Bulletin 118. The State Water Resources Control Board monitors groundwater quality at select wells throughout the Region.



MAP 25 GROUNDWATER BASINS & SUB-BASINS

2.3.8 WATER QUALITY

The present water quality within the Region generally meets or exceeds state and regional water quality objectives set forth in Section 3 of the "Water Quality Control Plan for the North Coast Region" (a.k.a. Basin Plan, NCRWQCB 2011). In most cases the water quality is "sufficient to support, and in some cases, enhance the beneficial uses assigned to water bodies." The Basin Plan continues "However, there are a number of present or potential water quality problems which may interfere with beneficial uses or create nuisances or health hazards."

Assembly Bill 1249 went into effect January 1, 2015. It requires IRWM regions with areas of arsenic, perchlorate, nitrate, or hexavalent chromium contamination to include a description of the location and extent of contamination, and impacts to communities within the region caused by the contamination. It further requires a description of existing efforts being undertaken to address the impacts and any additional efforts needed (*see Appendix H, Table 35, AB 1249 Groundwater Contaminants on the North Coast*).

2.3.8.1 SURFACE WATER QUALITY

The North Coast Region faces many water quality challenges. The US EPA has listed 85 percent of the Region's rivers and streams as impaired (NCRWQCB 2011), per the Clean Water Act Section 303(d). The federal Clean Water Act and CFR §130 require the state to identify water bodies not meeting water quality standards and update these lists biennially; to obtain the most recent information about water quality limited waterways in the North Coast, please see the North Coast Regional Water Quality Control Board (NCRWQCB) web page for the Integrated Report.

The majority of Total Maximum Daily Loads (TMDLs) (benchmarks established by the EPA) are developed in response to sediment and temperature. Sediment and temperature are thought to be associated with salmonid decline and impairment of beneficial uses (NCRWQCB 2011). The primary surface water impairment is NPS pollution produced by a variety of sources including stormwater runoff, erosion and sedimentation from roads, agriculture, and timber harvest, channel modification activities, gravel mining and dairy operations, failing septic tanks and MTBE, PCE, and dioxin contamination from gas stations and industrial activities (NCRWQCB 2011). The North Coast does not contain any known contamination of arsenic, chromium 6, nitrate, or perchlorate in surface waters (SWRCB 2017).

2.3.8.2 GROUNDWATER QUALITY

Groundwater quality issues in the North Coast Region include seawater intrusion and elevated nutrients in shallow coastal groundwater aquifers; high total dissolved solids (TDS), elevated mineral and heavy metal concentrations and alkalinity in groundwater in the Modoc Plateau basins; and iron, boron, and manganese in the inland groundwater basins of Mendocino and Sonoma counties. Legacy pollution from abandoned mines and historical lumber mills and present-day forest and agricultural herbicide application also pose a potential threat to regional groundwater, as do septic tank failures throughout the Region. Additionally, there are numerous small wastewater treatment plants operating in violation of waste permit discharges due to issues with aging infrastructure, equipment malfunction, limited capacity, or a combination of these problems.

In 2009, the USGS, in conjunction with the SWRCB, collected groundwater data from 58 wells selected from the California Department of Public Health database within 34 groundwater basins located in the North Coast Region (DWR 2013). Randomly selected wells included locations in Lake, Mendocino, Glenn, Humboldt, and Del Norte counties. 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 (however, these are likely related to the area's geology). The results of this study (Mathany et al. 2011) indicate that community drinking water systems drawing from primary aquifer systems in the North Coast region generally provide safe drinking water, although there are exceptions, which are detailed below for arsenic, chromium 6, nitrate, and perchlorate in accordance with AB 1249 (*see Appendix H, Table 35, AB 1249 Groundwater Contaminants on the North Coast*).

Arsenic

Arsenic is naturally occurring statewide (SWRCB 2013) and is the most prevalent groundwater contaminant affecting the North Coast region (DWR 2015). The primary environmental source is weathering of arsenic-containing rocks, including a component of volcanic glass in volcanic rock, adsorbed to and co-precipitated with metal oxides (especially iron oxides), adsorbed to clay-mineral surfaces, and associated with Sulfide minerals and organic carbon. Stanford researchers recently found that intensive pumping of groundwater aquifers can increase arsenic levels in groundwater basins in certain cases. The experiences of the Town of Windsor reflect this: arsenic levels have been found to increase with increased pumping (E. Cargay, Town of Windsor; personal communication 9/ 2017). Groundwater basins that contain alternating layers of clay and sand, an arsenic source, and relatively low oxygen content are vulnerable to increased arsenic contamination when subsidence due to overdrafting is greater than 3 inches per year (Garwaite 2018).

TABLE 1 NORTH COAST CWS WITH WELLS HAVING CONSISTENTLY HIGH ARSENIC LEVELS

County	Facility	Treatment Method
Humboldt	Palomino Estates Mutual Water Company	Triple media filtration
Mendocino	Laytonville County Water District	Coagulation/ oxidation
Sonoma	Loch Haven Mutual Water Company	Point of use arsenic removal inside each residence, approved by SWRCB, about 12 homes.
Sonoma	Mount Weske Estates Mutual Water Company	Working with SWRCB

TABLE 1 NORTH COAST CWS WITH WELLS HAVING CONSISTENTLY HIGH ARSENIC LEVELS

County	Facility	Treatment Method
Sonoma	Sebastopol	Two methods: • Blending water from adjacent zone with low As levels • Media filter system using adsorption with Ferric Oxide and SORB 33
Sonoma	Shamrock Mobile Home Park	Precipitative process using FeCl3
Sonoma	Town of Windsor	Currently, wells not potable due to arsenic, treatment methods under investigation. Alternative sources are in use.
Sonoma	Western Mobile Home Park	Two wells, one above MCL, one below. Water from both sources is blended in tank so water delivered to homes is not above MCL.

There are several Community Water Systems (CWS) in the North Coast that rely on a groundwater source determined to be contaminated with arsenic at levels over the MCL (Table 1). These facilities are using different methods to decrease arsenic contamination which are briefly described in Table 1. Some communities that had problems with arsenic contamination in the past have successfully consolidated with city water systems; this may be a solution for systems in close proximity to municipalities, especially those in the southern part of the Region.

Hexavalent Chromium (Chromium 6)

Chromium is a metallic chemical that is widely found in natural metal deposits, soils, and plants that generally occurs in the environment as trivalent chromium (Cr-3). However, under certain environmental conditions, Cr-3 will oxidize to hexavalent chromium (Cr-6), which is a suspected human carcinogen. Groundwater can contain both naturally occurring and anthropogenic Cr-6. Naturally occurring Cr-6 may be associated with serpentinite-containing rock (present throughout the Franciscan formation or chromium containing geologic formations, and can also indicate oxidation of natural Cr-3 from chrome-iron ore deposits. Anthropogenic sources of Cr-6 include discharges of dye and paint pigments, wood preservatives, metal-plating liquid wastes, and leaching from hazardous waste sites (SWRCB 2016b).

In July 2011, after several years of study, California's Office of Environmental Health Hazard Assessment (OEHHA) established a public health goal for Cr-6 of 0.02 µg/L. This number represents a "de minimis" lifetime cancer risk from exposure to Cr-6 in drinking water based on studies in lab animals. The California Department of Public Health (CDPH) was then enabled to set a primary drinking standard, which was proposed to be 0.010 milligrams per liter (mg/L) (equivalent to 10 µg/L). After public comment and review for compliance with the Administrative Procedure Act, the Minimum Contaminant Level (MCL) was set at 0.01 mg/L in July 2014. In September 2015, SB 385 was signed by the Governor; its primary purpose was to provide public water systems with water sources above the State's adopted MCL time to come into compliance without being deemed in violation. The bill required a public water system to submit its plan for achieving compliance within the shortest period of time, not to extend beyond January 1, 2020.

On May 31, 2017, the Superior Court of Sacramento County issued a judgment invalidating the Cr-6 MCL, finding that the CDPH failed to comply with the requirement in the Safe Drinking Water Act for adopting an MCL. It found that the department "failed to properly consider the economic feasibility of complying with the MCL" and ordered to SWRCB to adopt a new MCL for Cr-6. The SWRCB chose not to appeal the trial court's decision, but is instead focused on adopting a new regulation more quickly. It will not enforce any compliance plans entered into by public water systems for Cr-6; the MCL for total chromium (Cr-3 and Cr-6) of 50 parts per billion (equivalent to 0.05 mg/L) will remain in place.

The SWRCB contends that "hexavalent chromium remains present in the water supply of many public water systems, and continues to pose a threat to public health." The Board will establish a new MCL which could be the same level as the invalidated MCL. It encourages public water systems that have already installed and are operating treatment systems for Cr-6 to continue to do so. Operators who wish to discontinue treatment for Cr-6 may request a change in their operating permit by submitting a permit application. Public water systems will be able to use all information and experience gained from working towards compliance of the invalidated MCL to comply with the new MCL when it is adopted; SWRCB will establish a new MCL for Cr-6 as close to the public health goal set by the OEHHA as is technologically and economically feasible. New regulation development is expected to be completed by mid-late 2019 (SWRCB 2017).

The SWRCB developed the online GAMA Program that integrates and displays groundwater quality data derived from different sources. Following is county-level information from the GAMA Program database:

- **Del Norte County**
  In the Crescent City area, a few locations have exceeded the invalidated MCL (10µg/L) in the past three years; these are located at the Pine Grove Trailer Park, Northcrest Trailer City, and Butte Court Mobile Home Park (GAMA Geotracker, accessed July 2017). Las Palmas Mobile Home Park (MHP) also exceeded the invalidated MCL in 2015 and 2017 (K. Pryor, Las Palmas MHP, pers. comm., 2017). Of these locations, the Pine Grove Trailer Park and

West Park Properties showed a decrease in Cr-6 levels in 2017. At the current Health Advisory Level (HAL-US) for Cr-6, which is 21 µg/L, West Park Properties (GAMA Geotracker, accessed June 2018) exceeded the HAL in March and September 2015, but has not exceeded it since

The Las Palmas Mobile Home Park management did extensive research and found seven alternatives for treatment including the alternative to do nothing and continue monitoring, but its efforts were put on hold when the MCL was invalidated. Its preferred option was to consolidate with the City of Crescent City; however, costs to the MHP were prohibitive. Since most state funding is funneled towards 501 C3 NGOs, special districts, and local governments, private entities have historically had difficulty competing for grant and other funding, and a small water supplier such as the Las Palmas MHP does not have the capital reserves to enter into such a project as an equal partner with the City of Crescent City. West Park Properties is looking into treatment methods for Cr-6 and is also investigating options for consolidation with the City of Crescent City (*NCRP Economically Disadvantaged Community Water and Wastewater Service Provider Water Needs Survey 2018*).

- **Humboldt County**
  In the Eureka area, one well tested above the invalidated MCL for chromium-6 during the last three years, but none have tested above the current MCL during the past ten years. The well that tested above the invalidated MCL tested at 14 – 16 µg/L in 2014 and 2015 (GAMA Geotracker, accessed June 2018); it was a water supply well for a mobile home park (Mobile Estates FN) that appears to no longer be in business.
- **Sonoma County**
  Three locations in the Wilson Grove Formation Highlands groundwater basin (1-59), Andy's Produce Market and Fircrest Mutual Water Company each exceeded the invalidated MCL for Chromium-6. Andy's Produce Market exceeded the Invalidated MCL in October and November 2014 (25 and 29 µg/L respectively) and quarterly in 2015, 2016, and 2017 (ranging from 21 – 29 µg/L) (GAMA Geotracker, accessed June 2018). One well in the City of Sebastopol exceed the HAL in October 2015, however, 24 water samples since them have shown no Cr-6 contamination (GAMA Geotracker, access June 2018).

Nitrate

Nitrate is the most common chemical contaminant in the world's groundwater aquifers and in California is a regulated drinking water contaminant with an established MCL of 45 mg/L. It is produced in the atmosphere from nitrogen and occurs naturally in groundwater at concentrations below 2 mg/L.

At higher levels, nitrates are usually introduced into ground water through human activities. High nitrate concentrations in groundwater are usually associated with use of fertilizers and/or human and livestock fecal waste as well as the production of explosives. In the North Coast, although nitrate is not a common groundwater contaminant, nitrate levels in groundwater along the coast have shown a steady increase in the past decade (J. Puget, NCRWQCB, pers. comm. June 2017). In general, nitrates in shallow aquifers are problems in the coastal groundwater basins (DWR 2015).

Nitrate dissolves rapidly in water and is difficult to remove once dissolved; once nitrate enters groundwater, it can remain there for decades. High levels of nitrate in drinking water are associated with adverse health effects including methemoglobinemia (infants under 6 months are at greatest risk), birth defects, and certain types of cancer (DWR 2016c).

Perchlorate

Perchlorate is a regulated drinking water contaminant; its MCL is currently 6 µg/L (0.006 mg/L). In July 2017, the SWRCB accepted the Division of Drinking Water's recommendation to establish a lower detection limit for the purposes of report perchlorate in drinking water in an effort to gather addition data to determine whether to revise the MCL. Although naturally occurring in salts in thick unsaturated zones in the southwestern USA, when found at levels above MCL (6 µg/L), perchlorate contamination is generally due to industrial and military use. Perchlorate and its salts are used in solid propellant for rockets, missiles, and fireworks; their use can lead to release of perchlorate into the environment. It is also present in matches, auto air bag inflators, nuclear reactors, electronic tubes, and lubricating oils and is used in leather tanning, as a fixer for fabric and dyes, electroplating, paint and enamel production, and other industrial uses. It is highly soluble in water, highly mobile and persistent once within groundwater (SWRCB 2013d). Perchlorate is a chemical that interferes with uptake of iodine by the thyroid gland, causing disruption of thyroid hormone production, which can impact metabolism and physical growth.

Perchlorate was detected in 14/58 monitoring wells in the Northern California GAMA study unit (24%), with 9/28 wells in Northern California Coastal GAMA study unit (32%), and 5/30 wells in the Northern California Inland GAMA study unit (17%). In the Cascade Range and Modoc Plateau GAMA study unit, perchlorate was detected in 40 of 84 wells; however, for both studies there were no perchlorate concentrations in excess of MCL. No community water systems in the North Coast have reported exceedances of the perchlorate MCL in the past decade.

2.3.8.3 RECLAIMED/ RECYCLED WATER QUALITY

The practice of collecting and reusing (rather than disposing of) "excess" water from storm runoff and "used" water from municipal treatment plants is utilized in the North Coast to improve local water supply security. Programs that capture urban runoff and/or reclaimed (i.e. recycled) water must incorporate protection of human health and the environment per state and federal water quality laws (e.g. recycled water criteria in Title 22 of the California Code of Regulations) and the state Recycled Water Policy. The level of treatment varies depending upon the intended end use of the recycled water. For the most part, agriculture can usually utilize lower quality water than most urban users, but some crops will be sensitive to certain constituents such as boron, and there may be perception issues with using treated wastewater for some applications (e.g. irrigating crops). The quality of recycled water is of less concern for projects such as recharging the aquifer that supplies the Geysers geothermal facility in Sonoma and Lake Counties.

2.3.8.4 FLOODWATER/ STORMWATER QUALITY

During rainfall events, water runs across surfaces that may be contaminated by pollutants. The stormwater runoff is often directed into storm drains, which then discharge to nearby creeks and rivers. Stormwater runoff is a significant contributor to regional and local non-point source water pollution and impacts both surface and groundwater supplies. Water runoff from cities, highways, industrial facilities and construction sites can carry pollutants that harm water quality and impair the beneficial uses of waters. Urbanization also can reduce the quality of stormwater runoff (Brabec et al. 2002) by increasing pollutant loads (Owe et al. 1982), increasing nutrient loads (Hubertz and Cahoon 1999), and diluting dissolved minerals through increased runoff and decreased infiltration and soil contact (Loucaides et al. 2007).

The California Flood Future Report (DWR and USACE 2013) provides comprehensive information about flood risks and integrated flood management strategies with direct applications for the North Coast Region. According to the report, common pollutants contained in stormwater runoff include:

- *Sediment:* Construction or other activities expose and loosen soils, while vehicles break-up pavement. Excessive sediment in water can affect the respiration, growth, and reproduction of aquatic organisms, cause aesthetic impacts to receiving streams and affect spawning habitat for salmonids.
- *Nutrients*: Sources include fertilizer, lawn clippings, and car exhaust, which contain nutrients like phosphorous and nitrogen. An overabundance of nutrients can accelerate the growth of algae, which is a key factor in the decline of water clarity in some waterbodies.
- *Heavy metals and toxic chemicals*: Sources include cars (brake pads, engine wear, etc), pesticides and herbicides. Maintaining and cleaning transportation vehicles can release solvents, paint, rust, and lead. These chemicals may poison organisms or cause serious birth defects.
- *Bacteria*: Sources include failing septic tanks, sewer overflows, decaying organic material, and the improper disposal of household pet fecal material. Some bacteria found in stormwater runoff can result in disease. Beach closures result from high bacteria levels.

The federal Stormwater Permit Program attempts to curtail stormwater pollution by requiring specific industries and municipalities to obtain a permit for stormwater discharges. The permit regulates permittee activities to ensure the proper management of pollution sources. There are three types of permits required under the federal program:

- *Industrial Permits*: Stormwater discharges to surface waters from companies involved in manufacturing operations, transportation facilities where vehicles are maintained (maintenance includes fueling and washing), landfills, hazardous waste sites, and other similar operations must be covered by a stormwater discharge permit.
- *Construction Permits*: The major pollutant expected from construction sites is erosion-related, where large amounts of sediment laden water flows into storm drains. Construction activities that involve more than one acre of land disturbance must obtain a permit for discharges of storm water.
- *Municipal Permits:* Large cities or other municipalities must obtain a stormwater permit for discharges of urban runoff from municipal storm drain systems. The only municipality currently under a permit with the NCRWQCB is Santa Rosa, with the County of Sonoma and the Sonoma County Water Agency as co-permittees. The permit for the City of Santa Rosa requires

specific practices associated with street cleaning, roadside maintenance, toxic/sewage spill responses, and public outreach, to name a few.

SWRCB has regulatory and permitting oversight over stormwater. Cities and other jurisdictions that operate large, medium, and small stormwater systems as well as specific industrial activity sites, including constructions sites that disturb more than an acre of land, must apply for stormwater permits. SWRCB provides policy and regulatory oversight, on behalf of the federal government, drawing authority for stormwater regulation from the federal Water Pollution Control Act (Clean Water Act) and from direction within the Clean Water Act which puts the framework for regulating stormwater discharges under the National Pollutant Discharge Elimination System (NPDES) Permit system. The state has established an online database to allow regulated entities to view reports and information on water quality control efforts related to stormwater.

Realizing that more action was necessary with respect to managing stormwater in the state, the California Water Action Plan, released in January 2014, called for multiple benefit stormwater management solutions and more efficient permitting programs. As a result, in April 2014, the State Water Board formed a team of State Water Board and Regional Water Board staff (Initiative Team) to develop a Storm Water Strategic Initiative to guide the Water Board's Storm Water Program for at least the next ten years. After extensive public outreach, review, and comment, SWRCB staff created a strategy-based document called the Strategy to Optimize Resource Management of Storm Water (STORMS). STORMS has led to the development Phase I, II, and II projects; the latter phases incorporate lessons learned from earlier phases and expand upon the realization that stormwater is an underutilized resource.

In April 2018, the State Water Resources Control Board (SWRCB) adopted a resolution approving formation of the California Stormwater Authority as a California Joint Powers Agency (JPA). The JPA is intended to provide facilitation of collaborative stormwater management efforts and develop tools to assist public and private permittees to comply with municipal, industrial and construction stormwater permits. This is one of several initiatives the SWRCB is implementing in an effort to change the perception of stormwater from a nuisance that mobilizes pollutants to a resource for groundwater recharge, among other uses. It is with this intent that the SWRCB is requiring IRWM plans to incorporate local and regional Storm Water Management Plans (SWMPs) (see Section 1.2.6 for the NCRP's process for incorporation of local and regional SWMPs). Optimization of stormwater resources include capture and use and development of a monetary value for storm water as well as increasing stakeholder collaboration to promote storm water as a resource, increasing Storm Water Permit Compliance, and alignment with other statewide planning efforts such as the Biological Integrity Plan.

Several entities in the North Coast have developed Storm Water Resource Plans (SWRP) and these have been incorporated into the NCRP Plan per the NCRP Plan & Storm Water Resource Plan Integration Process Policy, (see NCRP Leadership Guidance Handbook, Policy Appendix and the NCRP Integrated Local Plans webpage).

The Russian River SWRP utilizes a metrics-based analysis to demonstrate that proposed storm water and dry weather capture projects and programs satisfy the State's water management objectives and provide multiple benefits. Due to the wide variety of potential benefits to different areas within the watershed, the analysis weighs the importance of each potential project benefits, normalizes the amount of benefit expected into a point score, and sums the total point value for all project benefits, allowing for local control while optimizing regional benefits. This methodology is open and transparent, allowing input from the public and stakeholders and can be adapted to analyze a variety of project proposals. Of 95 projects submitted for consideration, 51 met the screening criteria and were then prioritized according to the matrix described above. The prioritized projects will provide multiple benefits including:

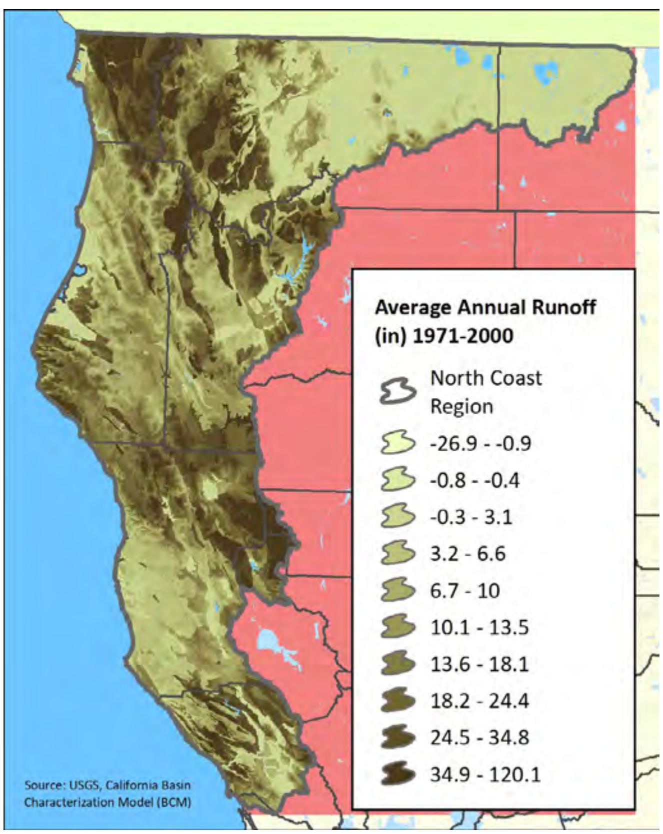
- Sediment reduction (27 million pounds per year)
- Flood mitigation (20 local sites)
- Riparian habitat restoration (46 acres)
- Wetlands restoration/ creation (44 acres)
- New urban green space (90 acres)
- Educating over 100,000 people
- Involving over 66,000 community members
- Improving recreational areas that collectively receive over 1 million visitors per year

The Coastal Mendocino County SWRP encompasses three coastal watersheds: Pudding Creek, Noyo River, and Big River watersheds. The SWRP provides a framework for identifying and selecting potential projects that use stormwater as a resource for multi-benefit projects that augment water supply, identify areas of concern, enhance water quality, reduce flooding, and create environmental and community benefits. The County of Mendocino has a web page for submitting local project proposals with a submittal deadline of December 31, 2019.

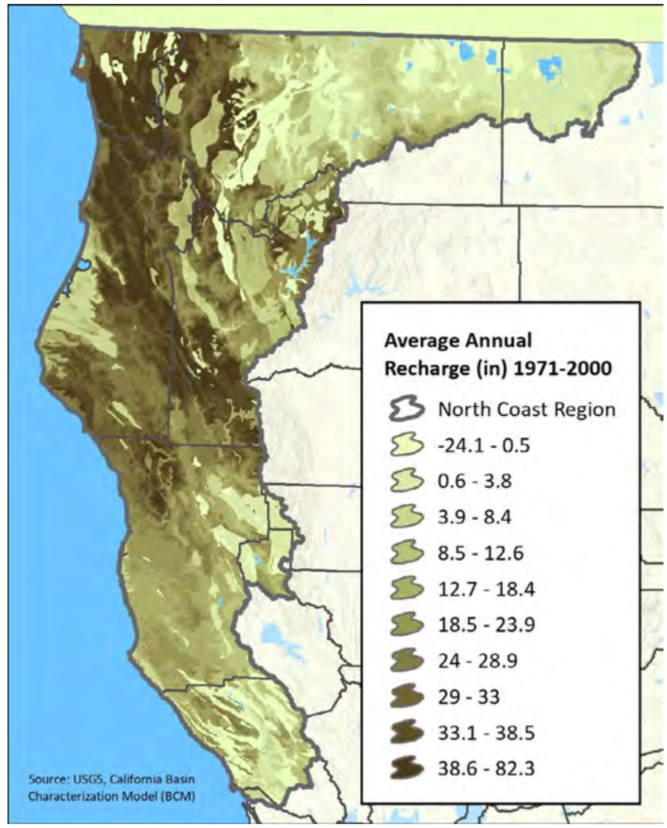
The Eureka Area Watersheds SWRP "facilitates a watershed-based analysis of storm water issues and opportunities within select watersheds that drain to Humboldt Bay." The Eureka Area Watersheds SWRP is intended to maximize cooperation and collaboration among state, regional and local agencies and NGOs during the development and implementation of storm water projects in addition to providing guidance for the identification and prioritization of those projects. The North Coast Stormwater Coalition provides a web page for project proponents to submit projects for inclusion in the SWRP.

2.3.9 WATER QUANTITY

According to the Basin Plan for the North Coast (NCRWQCB 2011), the Region is abundant in surface water and groundwater resources. Though the Region constitutes about 12% of the area of California, it produces about 40% of the annual runoff. This runoff contributes to flow in surface water streams, storage in lakes and reservoirs, and replenishes groundwater. The potential for greater variability in precipitation, runoff, recharge, and other hydrologic variables as a result of climate change, lends an additional degree of uncertainty to local and regional water supply forecasting. The potential impacts of climate change on hydrologic variables related to water supply are quantified and mapped in the *Climate Change Vulnerability Assessment*, which is available on the NCRP website.



MAP 26 AVERAGE ANNUAL RUNOFF (1971-2099)



MAP 27 AVERAGE ANNUAL RECHARGE (1971-2000)

2.3.9.1 *SURFACE WATER QUANTITY*

The North Coast Region contains numerous rivers, streams, and creeks, some of which flow year-round and others that are more or less seasonally- intermittent. Approximately 34,586 kilometers (21,491 miles) of rivers and streams drain watersheds of the Region.

Surface waters are diverted to supply urban, municipal, and rural residential needs, agriculture, state and federal water supply projects, managed wetlands, required Delta outflow, instream flow, and Wild and Scenic Rivers flow. Surface water supplies in the North Coast Region are relatively dependent upon rainwater (as opposed to snowpack, though snowpack represents a significant source in Siskiyou and Trinity counties). In years when demand by water users remains stable and rainfall is abundant, only local water quality issues and the need for more adequate water-related infrastructure will limit future water supply. In years of scarce rainfall, however, surface water supplies will be stressed and several years of drought will likely produce more water supply-related conflicts. Greater use of water recycling for irrigation, improvements to water recycling technology, multi-benefit stormwater resource planning and projects, increased judicious use of small-scale rainwater harvest systems, and other compatible uses such as the Geysers project may alleviate some of the Region's reliance on adequate rainfall amounts.

2.3.9.2 GROUNDWATER QUANTITY

There are 63 groundwater basins/subbasins delineated in the North Coast Region, two of which are shared with Oregon (DWR, Bulletin 118). These basins underlie approximately 1,022 million acres (1,600 square miles). 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 (DWR 2011). Groundwater may provide a supplemental source in some localities. Despite the limits on large-scale infrastructure development, groundwater is used widely throughout the Region for individual domestic, agricultural, and industrial water supply (NCRWQCB 2011). Many rural areas rely exclusively on private wells for residential water.

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 groundwater 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. In California, prior to 2015 when the Sustainable Groundwater Management Act (AB 1739), regulation of extraction and appropriation of groundwater was the responsibility of local agencies. Siskiyou County had developed several codes regarding groundwater and a Groundwater Advisory Committee has been appointed and is active for Scott Valley (Siskiyou County Code of Ordinances 2012) and much of the valley is under adjudication. Adjudication for the Scott Valley includes a defined interrelated groundwater area.

The Sustainable Groundwater Management Act (SGMA) (AB 1739) creates a framework for sustainable local groundwater management by requiring local agencies to establish a governance structure known as a Groundwater Sustainability Agency (GSA) prior to developing groundwater sustainability plans (GSPs) for groundwater basins or subbasins. Currently, the North Coast has four GSAs developing GSPs for the five groundwater basins/ subbasins designated medium priority by the DWR (see section 2.2.7 Groundwater). Other communities may elect to develop GSPs; however, they are not required for communities that rely on groundwater basins with "low" or "very low" prioritization. The California Statewide Groundwater Elevation Monitoring (CASGEM) Program has been tracking seasonal and long-term groundwater elevation trends in groundwater basins since 2009 and is now considered a tool to help local communities monitor and adaptively manage to achieve goals developed in their GSPs.

2.3.9.3 RECLAIMED/ RECYCLED WATER QUANTITY

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." Water reclamation is the process of treating wastewater, storing, distributing, and reusing the water. The practice of capturing or treating water (treated wastewater, captured stormwater) for reuse in non-potable applications can reduce demand on potable surface and groundwater supplies and thereby increase local water supply security. Existing uses of reclaimed water, including for 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 Region's most significant water reclamation project is operated in conjunction with the Geysers steamfield in Sonoma County.

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 steam that is 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 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 mgd 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 proposed 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 per year. Santa Rosa has completed negotiations with Calpine, the steamfield operator, and has signed a contract to send more water to the steamfield (DWR 2013).

2.3.9.4 IMPORTED & EXPORTED WATER QUANTITY

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 agricultural and urban uses. Claire Engle Reservoir (Trinity Lake) and the Trinity River Diversion (TRD) represent the only exportation of water outside of the Region, supplying water to the Central Valley as well as major urban centers in the San Francisco Bay Area, including the Petaluma Aqueduct (DWR 2013). Prior to construction of the TRD, average annual discharge at Lewiston was approximately 1.2 million acre-feet (af); following construction in 1963, instream flow releases were set at 120,500 acre-feet (af)/yr (10 percent of the average unimpaired inflow) (DWR 2013).Since then up to 90 percent of releases from Lewiston Dam have been diverted for agricultural use south of the Bay Delta. The Trinity River Flow Evaluation (TRFE), completed in 1999 by the Hoopa Valley Tribe and US Fish & Wildlife Service, has recommended average annual releases of 594,500 af, with 47 percent to be released to the Trinity River and 53 percent to be diverted to the Central Valley (USFWS and Hoopa Valley Tribe 1999).

In March 2017, Northwest California Resource Conservation & Development Council's Five Counties Salmonid Conservation Program (5C) completed an economic valuation of natural capital and economic analysis for Trinity River Water. In the report, they cite a range in value for agricultural irrigation to the Central Valley ranging from $47,000,000 to $5,397,000,000 annually. The total asset value of all ecosystem and related services that could be quantified range from $347,885,735,423 to $716,916,714,923 over the next 100 years, assuming a steady state in ecosystems in the Trinity River watershed. The report also discusses how local communities in the watershed are currently uncompensated (except for reduced electric rates) for the large quantities of water diverted from the watershed for agricultural irrigation in the Central Valley. Local government may be interested in obtaining some compensation for this large water export, particularly given the local impacts that diversion causes, including impacts to fisheries and local water availability for both drinking water and crop irrigation. The exportation of water also impacts flows required for Tribal ceremonial purposes, such as the Hoopa and Yurok Boat Dance ceremonies; in this case, the value of flow in the Trinity River is priceless.

2.3.9.5 DESALTED WATER QUANTITY

Currently the North Coast Region does not possess any desalination plants or have any plans for development of desalination facilities.

2.3.9.6 FLOODWATER/ STORMWATER QUANTITY

The North Coast Region experiences more precipitation than any other part of the state. Seasonal flooding is characteristic of much of the Region. The intensity, distribution, and duration of precipitation are strongly correlated with flood potential. Damaging floods occur relatively frequently, with particularly destructive events documented in December 1955, December 1964, February 1986, spring 1995, and January 1997 and 2006 (NCRWQCB 2011, DWR 2013).

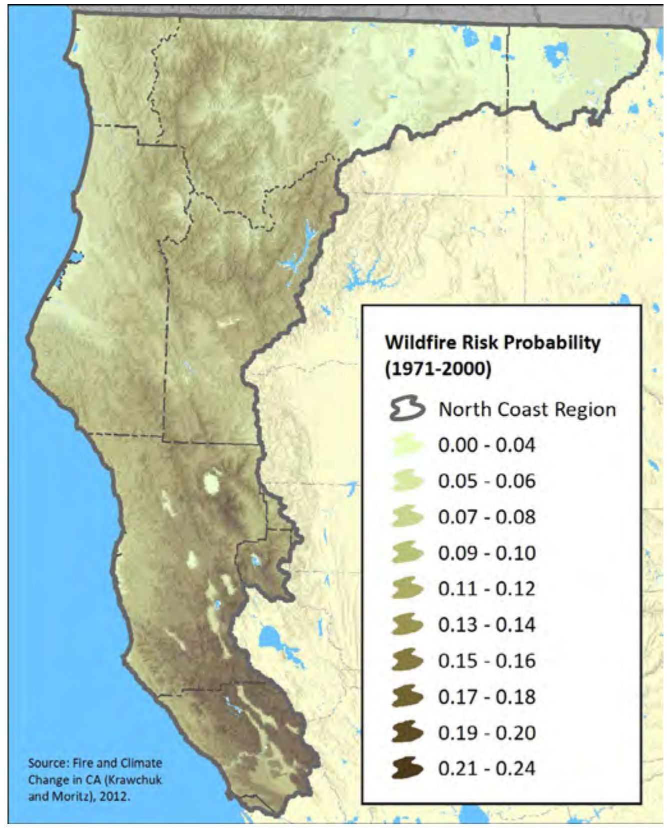
According to DWR (2013), flooding is likely to become more frequent, severe, and unpredictable under climate change scenarios, as more precipitation is delivered by intense storms, and as storms drop more of their precipitation as rain rather than as snow. Storms and snowmelt may thus coincide and produce higher winter runoff from the landward (eastern) side. Meanwhile, to the west, accelerating sea-level rise will produce higher storm surges during coastal storms. In relatively developed coastal floodplains, storm related coastal flooding might coincide with high tides and stream runoff, creating particularly severe flooding. The California Water Plan (DWR 2013) provides a snapshot of the communities, structures, crops, infrastructure, and sensitive species exposed to flooding in the Region.

Section 2.2.8, Water Quality, Floodwater/ Stormwater Quality briefly describes the three SWMPs that have been incorporated into this NCRP Plan as described in *Section 1.2.6 Integration.* These plans, as an integral part of the multiple benefits they aim to achieve, include goals, objectives, and projects to limit flooding and capture storm water for later use. One of the goals of the SWRCB's Storm Water Program is to change the perception of storm water from a dangerous nuisance that leads to flooding and water quality impacts to a potential resource that when well-managed, can supplement existing water supplies and provide a wide array of complementary benefits, such as wildlife habitat, recreation, and improved water quality. In incorporating these plans, the NCRP is contributing toward achievement of this and other goals of the state's Storm Water Program.

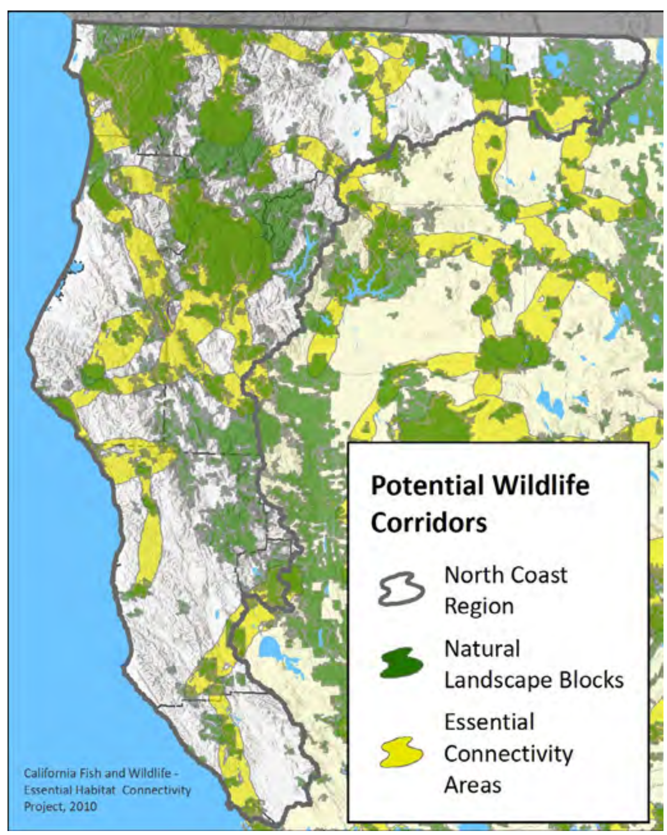
2.3.10 ECOLOGICAL PROCESSES

In addition to the key watershed attributes described above (e.g. land features, vegetation, species, and habitats) there is a suite of equally important, but less tangible elements that are fundamental to watershed function: these are ecosystem processes. Natural ecosystems are the result of the interactions of the abiotic and biotic (nonliving 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 it, including forests, rivers, estuaries, coastal tidelands, and — in portions of Siskiyou and Modoc counties – treeless sagebrush steppe (CWP 2013).

The ecological processes that support North Coast ecosystems may include, but are by no means limited to water and nutrient cycling; streambed and sediment dynamics; flood attenuation; wildfire; migration and dispersal; habitat connectivity; genetic exchange; pollination; and sequestration of atmospheric carbon into soil and plant biomass. The North Coast Region provides relatively clean air and water resources and aesthetic resources which results in a high quality of life for residents. In non-drought water years, the Region receives plentiful rainfall to support environmental resources and other beneficial uses. Furthermore, the Region's environmental resources serve as habitat for a large number of plant and animal communities and large corridors of undeveloped land allow for migration, dispersal and genetic exchange.



MAP 33 WILDFIRE RISK (1971-2000)



MAP 34 POTENTIAL WILDLIFE CORRIDORS

With the exception of dammed watersheds, many of the river systems in the North Coast Region still possess intact fluvial geomorphic processes and the habitats that form in response to them, although many of those habitats have been impacted by timber harvest, invasion of non-native plant species, or other intensive/extractive land uses. Additionally, in some locations, the geomorphic and ecological processes have been negatively affected by a variety of land use changes including channelization, road development, agriculture, gravel mining, and dam construction.

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 provide ecological services that directly maintain and improve water quality. Forest cover is correlated to drinking water treatment costs: the more forest in a source watershed, the lower the treatment costs (DWR and USACE 2013). According to the Trust for Public Lands (in Ernst et al. 2004):

- For every 10 percent increase in forest cover in the source area (up to about 60 percent cover), treatment costs decreased approximately 20 percent
- About half the variation in operating treatment costs may be explained by percent forest cover (the rest by facility and management practice variation)

Riverine ecosystems are complex and result from the physical, chemical, and biological processes acting upon them. Many of the rivers of the North Coast retain functional habitats and geomorphic processes but are affected by land use practices and invasion of non-native plants. The life cycle of salmonids is closely interwoven with water quality and quantity and, therefore, is an excellent indicator of the "health" of streams and rivers (DWR and USACE 2013).

Ecological processes should not be confused with ecosystem services, although the two are interrelated: When the ecological processes are operating normally, they provide critical benefits ("ecosystem services") to North Coast stakeholders. Services that are provided by ecosystems include: water filtration and storage; oxygen production and carbon dioxide removal; soil improvement, crop pollination and food production; flood control and risk reduction; fish and wildlife habitat; outdoor recreation, spiritual fulfillment, and aesthetic enjoyment; and many others. Ecological processes often overlap with ecosystem services (e.g. water filtration and carbon sequestration both involve functional forested watersheds).

The ecosystem services provided by working lands, open spaces, and wilderness may be quantified and monetized using a variety of accepted economic tools. In some cases, economic valuation studies have demonstrated that the conservation of natural infrastructure (such as a forested intact watershed) is a more cost-effective method to deliver services (e.g. clean drinking water, abundant water supply, flood attenuation) to human communities than traditional built infrastructure. Also, built infrastructure generally depreciates in value over time, while a well-maintained natural capital investment appreciates in value. These ecosystem services provided by natural capital have the additional benefit of meeting multiple other objectives, including agricultural viability, recreation, scenic viewsheds, and the maintenance of biological diversity. In some cases, land and water stewards have begun to generate voluntary, market-based incentives to assess, protect, and enhance the function of ecosystems (Schrier et al. 2013).

2.3.11 NATURAL CAPITAL VALUES

Natural capital is a vital resource in the North Coast and to document its value, the NCRP commissioned a regional economic valuation from Earth Economics. The *Technical Report for the North Coast of California Ecosystem Service Valuation* (Fletcher and Soares 2016), is available in its entirety on the NCRP website. We provide a brief excerpt below.

California's North Coast Region produces a multitude of goods—timber, wild mushrooms, milk and cheese, salmon, wine, and clean water, among others. These products are bought and sold in markets—they have economic value. Natural and working landscapes in the North Coast region provide a suite of services and benefits that—although less tangible than the goods outlined above—provide economic value through flood risk reduction, carbon sequestration, groundwater recharge, recreation opportunities such as hiking and camping, and the removal of air pollutants. An ecosystem that reduces the risk of flood damage, for example, also provides benefits by protecting local jobs, preventing costs such as infrastructure repairs, reconstruction, and restoration, and by keeping people safe. The goods and services of a healthy landscape provide a steady stream of benefits to residents, creating a stable, resilient, and prosperous economy and a healthy quality of life

The identification and monetary valuation of nature's goods and services provide evidence of the economic importance of the North Coast's landscape. Ecosystem services are the beneficial conditions and processes through which natural ecosystems sustain and fulfill human life. Unlike ecosystem goods, ecosystem services are not tangible items that you can hold. Flood risk reduction, recreational value, aesthetic value, water filtration to increase water quality, carbon sequestration, pollination, and wildlife habitat are a few examples of the services that ecosystems provide. By nature, many ecosystem services are non-excludable. They cannot be privately owned and are not traded in markets. Natural flood risk reduction, for example, cannot be owned or traded, unlike built infrastructure such as a dam or levee. Flood risk reduction is a non-excludable service because all downstream residents benefit from the flood risk reduction provided by forested land or dams upstream. Similarly, when one person enjoys a view of the sunset, it does not prevent another person from enjoying the same sunset.

Many ecosystem services, such as oxygen production, soil regulation, and storm protection, either are not or cannot be, sold in markets. However, markets for some ecosystem services are possible and slowly growing; water temperature trading and carbon sequestration markets are examples.

Within the past decade, considerable progress has been made to systematically link functioning ecosystems with human well-being. Earth Economics has developed a framework to articulate and monetarily value some of the critical services and benefits provided by natural capital (ecosystems). Earth Economics conducted an analysis to value natural areas of the North Coast Region. Its report quantifies the valuable contributions to the economy that the working lands and natural systems of California's North Coast provide – not only internal to the North Coast region, but also services such as carbon sequestration, biodiversity, and water supply and quality that benefit all of California and the world.

Using a landcover analysis as a starting point, the report then uses existing peer-reviewed economic and ecosystem service literature to calculate monetary values for each landcover type based on the economically quantifiable ecosystem services each landcover type provides. Primary studies are selected from Earth Economics' Ecosystem Service Toolkit (EVT). The EVT is one of the largest repositories of published, peer-reviewed primary valuation studies, reports, and gray literature on the value of ecosystem services. Primary valuations use techniques developed and vetted within environmental and natural resource economics communities over the last four decades. Using this methodology, the value of working lands and natural ecosystems of the North Coast region are approximately $861 billion using a 3% discount rate or $1.3 trillion using a declining discount rate. These values demonstrate that investment in natural capital can provide vast long-term benefits if these assets are conserved or enhanced. Moreover, investment in natural capital can yield a tremendous return on investment due to both the low cost of investment and the large amount of benefits received.

2.3.12 LAND USE

The NCRP's stakeholder-driven approach to regional resource management acknowledges and incorporates the unique issues, information, and planning approaches of local areas within a framework that integrates statewide water resource-planning priorities. Regional planning does not replace or supersede local planning; rather regional planning should appropriately incorporate local planning elements (DWR 2012). Integrating land use into water planning allows the NCRP to provide local land planners with access to pertinent water information from the NCRP Plan (e.g. regarding floodplain management, stormwater runoff management, or water conservation), and for local land planners to share pertinent land use information with the NCRP (e.g. regarding land use changes that affect water resources, General Plan updates, and water supply needs). In this way, land use and water management decisions, which usually are under the purview of separate agencies but are inextricably linked, may become better coordinated.

Text and tables herein are intended for informational and facilitative purposes only; nothing in this Section is intended to interfere with or supersede the planning efforts of local entities (e.g. counties, municipalities, Tribes, RCDs).

2.3.12.1 OVERVIEW OF LOCAL WATER & LAND USE PLANNING

In order to gain insight into current planning efforts, needs, and opportunities, the NCRP in 2013 conducted extensive interviews with dozens of professional planners working in the North Coast on water and/or land resource issues. Supplementary interviews were conducted in 2018 in the North Coast and Trinity WMAs to support ongoing planning efforts. The results of those interviews are available through the NCRP website. Twenty types of water or land use plans were defined by NCRP staff, based on the interviews and on extensive research into existing document libraries.

The NCRP website Resources section includes the North Coast Plans, Policies and Reports as a sortable and hyperlined excel spreadsheet. Approximately 900 relevant plans, assessments, and reports (as of March 2019) have been identified as relevant to North Coast natural resources and water management planning. Over 17 percent of identified plans were related to "Land Use Planning," 13 percent were related to "Watershed Assessment/ Restoration/ Management, about 12 percent dealt with "Salmonid Recovery," and nearly 10 percent to "Water Quality Planning." It is apparent that entities in some Watershed Management Areas have developed a greater number and/or a more diverse array of plan types than others. For example, Russian/

Bodega (216) and the North Coast Rivers (190) have significantly more plans than Humboldt Bay (159), Klamath River (150), Eel River (103), and Trinity River (82). Tribal entities have prepared 16 local plans.

The number of plans developed locally is not necessarily a reflection of local priorities; in many cases, this is simply an outcome of the economically disadvantaged status of much of the North Coast. Entities with fewer financial and human resources will produce fewer plans because of resource limitations, not lack of interest/need. The types of plans developed locally may reflect local priorities: for example, Trinity County plans are focused on state-mandated county planning (8), watershed management and salmonid recovery (20), and wildfire prevention and readiness (13), while Sonoma and Mendocino Counties are represented by a diversity of plan types in multiple categories. Tribal plans are moderately diverse, focused on traditional ecological knowledge, water quality, water supply, and salmonid recovery.

2.3.12.2 INTEGRATION OF LOCAL WATER AND LAND USE STRATEGIES

The NCRP and North Coast stakeholders (including water resource and land use planners at all scales) continue to consider a diverse range of opportunities afforded the Region by participating in NCRP planning and implementation. In support of NCRP goals and objectives, the Plan addresses and integrates all or part of the following strategies, which are equivalent to state-recommended Resource Management Strategies (RMS) in the California Water Plan (DWR 2013): agricultural water management; city and county general planning; disaster planning and emergency response; wildfire prevention and mitigation (including forest management); flood protection and floodplain management; groundwater management, recharge, and conjunctive use; multi-purpose program planning; salt and salinity management; stormwater and runoff management; urban water management and water supply assessment; water conservation planning; and watershed management and restoration.

From its inception, the NCRP has fostered a collaborative, proactive relationship between land use planners and water managers by stressing the interconnectedness of watershed processes and the multiple benefits that most projects provide, regardless of whether their focus is on land or water resources. The composition of the PRP makes such integration unavoidable: PRP members are the decision makers for the region's counties and Tribes, thus through their participation in the process, they each bring their own jurisdiction's challenges, solutions, and lessons to the group for others to use. For example, in the past few years, wildfires and cannabis cultivation have been major issues for some of the NCRP member counties and Tribes. Through NCRP meetings, these issues have been explored with local, regional, and state stakeholders, resulting in a broader exchange of information, more feasible and locally-based solutions, and reducing the likelihood of duplicative efforts. For example, discussions around wildfire prevention at an NCRP meeting led to Humboldt County staff giving presentations on their fire reduction strategies to Sonoma County staff. The NCRP will continue this model by continuing to bring both water resource managers and land use planners to the table to discuss mutual concerns, opportunities, and strategies for optimizing resources and effort. As the region continues to experience effects of climate change, such collaboration will become increasingly important for regional self-sufficiency and self-determination.

Subsections below outline some of the major plans, programs, and policies identified in the planning synthesis that relate to these actions (i.e. RMS). Opportunities for the NCRP to integrate with these existing efforts, and their updates, are indicated where appropriate. Formal integration of plans into the NCRP is described in *Section 1.2.6 Integration*.

Agricultural Water Management

- ***Policy for Maintaining Instream Flows in California Coastal Streams***
  The North Coast "Instream Flow Policy" (SWRCB 2014) establishes principles and guidelines for maintaining instream flows for the protection of fishery resources; may potentially introduce widespread impacts for agricultural and rural water users on the North Coast.
- ***NCRWQCB Water Quality Compliance Program for Dairies & Concentrated Animal Feeding Operations***
  This regional dairy permitting process was developed by the North Coast Regional Water Quality Control Board (NCRWQCB) to regulate concentrated animal feeding operations that discharge into waters of the United States.
- ***NCRWQCB Agricultural Lands Discharge Program***
  This regional program of the North Coast RWQCB addresses water quality impacts associated with irrigated agricultural lands in the North Coast Region.
- ***California Agricultural Water Stewardship Initiative***
  This initiative raises awareness about approaches to agricultural water management that support the viability of local agriculture, conserve water, and protect the Region's ecological integrity. Launched in 2008, the initiative became a project of the California Roundtable on Water and Food Supply in fall of 2011. Their website is a

resource center for growers, ranchers, and others interested in sound farm water management, providing case studies and practices to promote agricultural efficiencies and sustainability.

- ***Cannabis Cultivation***
On October 17, 2017, the State Water Resources Control Board (State Water Board) adopted the Cannabis Cultivation Policy- Principles and Guideline for Cannabis Cultivation (Cannabis Policy) and the General Waste Discharge Requirements and Waiver of Waste Discharge Requirements for Discharges of Waste Associated with Cannabis Cultivation Activities (Cannabis General Order). On December 18, 2017, the state's Office of Administrative Law approved the Cannabis Policy, making the Cannabis Policy and Cannabis General Order effective as of that date. The Cannabis Policy will be implemented through the Small Irrigation Use Registration (SIUR) Program and the Cannabis General Order. Compliance with the Cannabis Policy is required to obtain a license from the California Department of Food and Agriculture (CDFA) under its CalCannabis Licensing Program. Growers also need to comply with county cultivation regulations.

- ***Cannabis Cultivation Waste Discharge Regulatory Program***
Cultivators are required to enroll in the State Water Board's cannabis cultivation regulatory program if growing more than 6 mature plants for personal use, or over 1000 square feet of combined cannabis and disturbed area, subject to additional conditions.

- ***Humboldt Agricultural Enhancement Program***
This program assists local dairy operators in the Eel River Delta and Humboldt Bay Regions with implementation of operations management practices intended to improve the quality of ground and surface water resources. Includes best management practices (BMPs) for animal waste storage facilities, waste distribution systems for nutrient management, and roof runoff management.

- ***University of California Cooperative Extension (UCCE) Humboldt Del Norte Counties Livestock and Range Management Program***
This program informs livestock, range, and pasture producers about a variety of topics related to ranch, livestock, and rangeland management in Humboldt and Del Norte Counties. It focuses on efforts to keep livestock and rangeland healthy and productive, but may have relevance to NCRP effort at agricultural water management.

- ***Trinity County Resource Conservation District Strategic Action Plan***
The "agriculture" Strategic Area of the Trinity County Resource Conservation District (RCD) action plan provides a framework to promote voluntary application of site-specific BMPs and offers technical assistance with the goal of improved water quality and soil conservation.

- ***Mendocino County Resource Conservation District***
Mendocino County RCD provides coordinated permitting services: they are a "one-stop shop" for permitting. Projects qualifying for streamlined permitting are covered by nine standard USDA-Natural Resources Conservation Service restoration practices. The program is based on a successful model developed for the Navarro River watershed (there, a workshop series was conducted with resources to help farmers implement conservation practices).

- ***Sonoma Resource Conservation District***
Sonoma RCD (serving majority of Sonoma County) offers a Conservation and Stewardship Program that works with agricultural producers to develop Farm Conservation Plans and implement BMPs related to water conservation and streamflow restoration; watershed planning; habitat enhancement; and agricultural and natural resources education. Their Russian River Coastal Tributary Improvement Program also has great relevance to the NCRP. Sonoma RCD offers publications to guide water/land management decisions, including for vineyard frost protection, Russian River stewardship, livestock grazing, and management to enhance land/water quality for small properties.

- ***Gold Ridge Resource Conservation District***
The Gold Ridge RCD (serving parts of Sonoma County) has worked closely with the NCRP to produce the Integrated Coastal Watershed Management Plan (ICWMP) for Salmon Creek. They also have produced the "Nutrient Management Planning Guidance for Small Coastal Dairies."

- ***Del Norte Resource Conservation District***
The Del Norte RCD hosts an Agricultural Enhancement Program to improve resource management by assisting local farmers improve nutrient management and waste distribution systems to meet standards for waste discharge requirements and avoid enforcement fines.

- ***Shasta Valley Resource Conservation District***
Shasta Valley RCD (serving central Siskiyou County) has conducted and reported on projects related to Shasta River instream flow assessment and spawning gravel evaluation and enhancement plan.

- ***West Lake Resource Conservation District***
West Lake RCD (serving western Lake

County) has conducted invasive plant surveys and removals (i.e. *Arundo donax*) and conducts trainings for stream monitors.

- ***North Sonoma County Agricultural Reuse Project*** Initiated in 2007, this project utilizes existing network of RCDs, National Resource Conservation Service, Farm Bureau, UCCE offices, and California Agricultural Water Stewardship Initiative (described above) to investigate expansion of or satellites similar to "LandSmart" in Sonoma and Napa Counties: a collaborative program to help land managers meet natural resource management goals. The collaboration between these different entities expands each RCD's capacity and increases RCD capacity to better serve landowners and provide access to various skills and expertise.

City and County General Planning

General Plans form the foundation for land and water planning in the North Coast. Every city and county in California must adopt a comprehensive long-term General Plan in accordance with Section §65300 of the California Government Code. There are seven required elements of a General Plan (land use, circulation, housing, conservation, open space, noise, and safety): water-related issues (e.g. water supply and treatment) are included in each General Plan's "Conservation" element. There are over 100 general planning documents in the North Coast. These range from detailed, formal General Plans for counties and incorporated municipalities developed in accordance with state requirements, to local coastal plans, to informal "visioning" planning documents for neighborhoods or specific areas. Updates to General Plans are required by the state every 10 years: 2013 is the latest year for decadal updates. All projects must conform to regulations and ordinances in county general plans.

See North Coast Plans, Policies, and Reports, May 2019 on the NCRP Resources web page; it provides the NCRP's most recent list of planning documents relevant to water and natural resources on California's North Coast. The list will be periodically updated; please check the website for the most recent version.

Disaster Planning and Emergency Response

Types of natural disasters recognized by local planners that are of concern to the NCRP (i.e. relate directly to land/water use and management) include dam failure, drought, flood, landslide, severe weather, tsunami, and wildfire. The Disaster Mitigation Act of 2000 requires local governments to adopt a federally approved Multi-Hazard Mitigation Plans (HMP) to receive pre- and post-disaster mitigation funds. Three North Coast counties and many Tribes have developed Hazard Mitigation Plans to date. The level of concern with various potential natural disasters varies for North Coast counties. To date (2019), all seven counties have developed plans that include identification of medium and high-risk hazards. These are for:

- Del Norte County Operational Area Hazard Mitigation Plan Volume 1 – Area-Wide Elements (2018) ranks earthquakes and tsunamis as high risks, with severe weather, wildland fire, flooding, and landslide ranked as medium risk.
- Humboldt Operational Area Hazard Mitigation Plan, (March 2014) identifies risk of earthquake and severe weather as high and risk of flood, wildfire, and landslide as medium.
- 2014 Mendocino County Multi-Hazard Mitigation Plan identifies dam failure, drought, earthquake, epidemic/ pandemic, flood, hazardous materials, hazardous materials: naturally occurring asbestos, insect pests/ invasive species, landslide, tsunami, wildland fires, and windstorm as hazards for assessment. They are unranked.
- Modoc County Local Hazard Mitigation Plan Update (March 2016) identifies agriculture hazards, drought and water shortage, severe weather (all instances except extreme heat), and wildfire as of high significance, and dam failure, earthquake, erosion, flood, landslide, levee failure, volcano, and hazardous materials transport of medium significance.
- Siskiyou County Hazard Mitigation Plan Volume 1: Planning-Area-Wide Elements (Draft, 2018) identifies dam failure, drought, earthquake, flood, landslide, severe weather, volcano, and wildfire as hazards of concern and avalanche, air quality/ smoke pollution, energy shortages, hazardous materials, fish disease, and noxious weeds as hazards of interest.
- Sonoma County Hazard Mitigation Plan (2017) identifies earthquake, flood, wildland fire, and landslides as constituting the greatest risk to the County based on past disaster events, future probabilities, and degree of vulnerability. The HMP also addresses secondary and tertiary hazards such as winter storms, coastal erosion and bluff failure, tsunamis, and post fire erosion and also discusses the implications that climate change may have on hazard trends, including sea level rise and drought.
- Trinity County Hazard Mitigation Plan (2016) considers only dam failure and earth quakes of high priority due to the need for immediate notification and evacuation of people within the predicted inundation zone of the Matthews

Dam in Trinity County, the failure of which could be triggered by an earthquake.

Wildfire

Since the severe fires in Northern California in 2017 and 2018 that destroyed parts of Santa Rosa in Sonoma County (Tubbs Fire), homes and businesses in Potter and Redwood Valleys in Mendocino County (Redwood Complex Fire) and nearly all of the town of Paradise in Butte County (Camp Fire), much hazard mitigation focus in Northern California communities has been on fire preparedness and prevention. Most communities, especially those in forested areas, have prepared a fire safe plan; these plans are listed, summarized, and listed on the NCRP website (North Coast Plans, Policies, and Reports, May 2019).

Fire severity prevention is an aspect of land management that can benefit from the NCRP's *Goal 1: Intraregional Cooperation & Adaptive Management*, *Objective 3 – Integrate Traditional Ecological Knowledge in collaboration with Tribes to incorporate these practices into North Coast Projects and Plans*. Prior to European and American occupation of the North Coast region, many Tribes practiced setting fires to keep forests open for wildlife and to favor growth of plants that are useful for medicine, food, or cultural and spiritual practices. These practices are becoming more frequent as land managers realize the multiple benefits to forest health, habitat diversity, and mitigation of fire severity. Near the town of Orleans in the Six Rivers National Forest, foresters are using fire to increase biodiversity and support the ecology of the forests. Fire is used to stimulate the growth of plants that can withstand periodic drought and that can also benefit from fires that accompany the droughts, promoting both ecological and cultural resilience (Krol and Herrera 2018). It is not always easy to obtain the permits necessary to conduct prescribed burns, however; the Karuk Tribe has had issues dealing with the multiple state and federal agencies governing the use of their Tribal territory. To engage in traditional burning, the Tribe must spend limited resources negotiating individual agreements with the multiple agencies that have jurisdictional power over their land. They have, however, initiated the Somes Bar Integrated Fire Management Project in cooperation with state and federal agencies to oversee the prescribed burning of 5,570 acres in the Six Rivers National Forest in 2019. Lands outside of that area, however, may be burned clandestinely if permits cannot be obtained (Du Sault 2019).

Even in contemporary society, prescribed burns provide multiple benefits. The Yurok Tribe's Forestry Programs fire department has revived prescribed burns; after about six years, the landscape has opened and more wildlife is using the burned forests. The Tribe is benefitting monetarily from this improvement in habitat; for each metric ton of carbon that the Tribe can prove its forests have sequestered from the atmosphere, the California Air Resources Board issues them one offset credit that they can then sell to polluting industries that need to comply with the state's GHG emissions cap. This program has become the Tribe's main source of discretionary income and has helped them buy back nearly sixty thousand acres in ancestral territory. The program is not without controversy, however; some Tribal members believe that the Tribe should not facilitate industry pollution (Kormann 2018). It is important to note that prescribed fires do not prevent future wildfires; however, they minimize the severity when those wildfires occur.

The Indigenous People's Burn Network is a collaboration between the Yurok, Hupa, and Karuk Tribes; it seeks to revitalize cultural burns while simultaneously revitalizing their unique cultures. FireScape Mendocino is a multi-stakeholder collaboration located in the Mendocino National Forest and surrounding areas comprised of forest managers, ranchers, timber companies, environmental advocacy organizations, and several Tribes. Follow the Smoke is a group formed to develop protocols to deal with the aftermath of fires and develop relationships with the National Park Service, California State Parks, and Bureau of Land Management so Native people can gather traditional cultural materials after a fire has passed through (Kroll and Herrera 2018). These groups may be helpful to Tribes and others seeking to implement prescribed burns for forest health. Pepperwood Preserve, which has been using prescribed burns on its property in the Sonoma Valley in part using Traditional Ecological Knowledge, is in the process of developing an online fuels management toolkit. This North Bay Area research institution held a *Living with Fire in California's Coast Ranges Symposium* in May, 2018, the results of which are available online.

In the aftermath of the Tubbs and Pocket fires, which decimated parts of Sonoma County in October 2017, Sonoma County Ag + Open Space embarked on a research program funded by NASA. The research focused on vegetative and soil response to the severe fires. USGS researchers associated with the study found that soil water infiltration rates recovered in one year through all studied ecosystems and the major geologic types where wildfires occurred. This reduces concern about fire-related landslides in similar ecosystems with similar geology in the North Coast. FireSmart Lake Sonoma is developing a list of recommendations at multiple spatial scales and time scales for landowners to protect private property as are the region's RCDs, FireSafe Councils, and other organizations. Also, in response to these fires, FireSmart Lake Sonoma has increased its fire camera network to a network of fifteen "pan-tilt-zoom" cameras that can detect fires in remote areas faster and pinpoint their location through triangulation as well as monitoring the rate of spread and containment. The cameras are controlled by CalFire and REDCOM (a provider of secure communication software) and are available for public viewing. The ALERTWILDFIRE consortium can assist other areas in building fire camera infrastructure from the ground up and/ or using existing infrastructure to rapidly deploy a system within a few months. Funding for these efforts has come from a variety of sources, including the Bureau of Land Management, US Forest Service, utilities, state emergency services, counties, and NGOs.

In February 2019, the NCRP was awarded funding in support of regional planning for priority fire resiliency opportunities through the California Department of Conservation's Regional Forest and Fire Capacity Program. With this funding the NCRP will develop a Regional Priority Plan that outlines a region-wide strategy for fuel load reduction and forest health, including a list of priority forest health and fire resiliency projects, strategies, and tools. Based on the priorities identified in the RPP, NCRP staff and consultants will conduct outreach to property owners and stakeholders in the region, facilitate project development and permitting to generate implementation-ready projects for funding consideration by a variety of grant programs, and provide grants for demonstration projects that implement actions that maximize desired program outcomes. Sub-grants for demonstration projects will be allocated based on the project's ability to achieve the goals of fuel load reduction, long term forest and ecosystem health, local jobs and revenue, workforce development, support for local infrastructure, and capacity enhancement. Project evaluation criteria will include project readiness, the ability to model and share key practices, measurability, the testing of new and innovative methods and tools, and the ability of the project to be scaled up and applied to other areas in the region and state.

See North Coast Plans, Policies, and Reports, May 2019 on the NCRP Resources web page; it provides our most recent list of planning documents relevant to water and natural resources on California's North Coast.

Flood Protection and Floodplain Management

Flood protection and floodplain management planning is incorporated into stormwater management efforts and other local planning documents. Flood-related elements are addressed in all the North Coast General Plans. Six plans outside of General Plans address flood protection and floodplain management: these are restoration/ watershed enhancement plans and address floodplain management in the context of restoring natural hydrologic regimes or restoring native vegetation buffers; one source (developed by the Sonoma County Water Agency) provides flood forecast and emergency, programs, and recharge information from a water management perspective.

Groundwater Management, Recharge and Conjunctive Use

The Sustainable Groundwater Management Act (SGMA) was enacted in 2014 in order to halt overdraft and bring groundwater basins into balanced levels of pumping and recharge. The long-term planning required by SGMA is expected to provide a buffer against drought and climate change, and contribute to reliable water supplies regardless of weather patterns in the State. Formed in 2009 to establish permanent, locally-managed regular and systematic monitoring programs in all of California's alluvial groundwater basins, the California Statewide Groundwater Elevation Monitoring (CASGEM) program is now considered a tool to help achieve the goals set out under SGMA.

As explained in Section 2.3.7, only groundwater basins identified by DWR as "medium" or "high" priority are required to comply with CASGEM and SGMA. The four agencies that have notified DWR that they are the Groundwater Sustainability Agencies (GSAs) for those basins and their progress towards completing.

- Klamath River Valley – Tulelake (1-002.01)
  The Tulelake Irrigation District Groundwater Management Plan was developed in 2013 to work

cooperatively with landowners to most efficiently monitor groundwater resources and develop an efficient and effective conjunctive use program during years when surface water supplies are limited or not available. The Tulelake Irrigation District is currently the GSA for the Tulelake Subbasin and is undertaking development of a Sustainable Groundwater Management Plan.

- Butte Valley (1-003)
- Scott River Valley (1-005)

The Siskiyou County Flood Control and Water Conservation District has registered with the Department of Water Resources to act as the Groundwater Sustainability Agency for the Butte Valley, Shasta Valley, and Scott River Valley Groundwater Basins.

- Eel River Valley (1-010)
  The Humboldt County Public Works Department has submitted a Groundwater Sustainability Plan Alternative; the alternative "provides information demonstrating that the Basin has operated within its sustainable yield over a period of at least 10 years."
- Ukiah Valley (1-052)
  The Ukiah Valley Basin Groundwater Sustainability Agency was created by a Joint Powers Agreement to serve as the Groundwater Sustainability Agency for the Ukiah Valley Basin.

Multi-Purpose Program Planning

In order to meet resource use challenges and pursue increasingly integrated grant opportunities, most planning entities in the North Coast utilize at least some multi-purpose program planning. For example:

- Wetlands restoration to restore salmonid habitat and ameliorate flooding
- Riparian restoration to cool stream water temperatures and sequester pollutants, nutrients.
- Uplands restoration to alleviate sedimentation, increase CO2 sequestration, improve habitat, allow for recreation
- Failing infrastructure repair to conserve water, increase water supply reliability, improve environmental justice

Salt and Salinity Management

The SWRCB and local water and wastewater entities, together with salt/nutrient contributing stakeholders, fund locally driven and stakeholder controlled collaborative processes to prepare salt and/or nutrient management plans for each groundwater basin and sub-basin in the North Coast. Presently, there is one salinity management planning effort in development for the North Coast: The City of Santa Rosa is leading the development of a Salt and Nutrient Management Plan for the Santa Rosa Plain Sub-basin. The plan has identified the need for additional monitoring wells in areas where there are data gaps.

Management of salt and nutrient pollution represents another opportunity for regional collaboration/cooperation using the NCRP framework (similar to Water & Wastewater Service Provider Outreach & Support Program, as described for groundwater above). Salt and salinity management may become more of an issue in the North Coast with sea level rise as coastal aquifers potentially experience salt water intrusion; these plans will be vital in developing and implementing mitigation and adaptation measures.

Stormwater and Runoff Management

Stormwater and runoff management are closely related to flood protection and floodplain management, but are not precisely equivalent. However, the State has recently recognized that there is significant potential for integration of stormwater/runoff with (1) floodwater management, e.g. LID using stormwater runoff (below) and (2) water supply e.g. grey water and other reuse & conservation.

The California Stormwater Authority, formed in 2018, is intended to provide facilitation of collaborative stormwater management efforts and research services, as well as develop tools to assist California public and private permittees to comply with construction, industrial, and municipal stormwater permits, including the challenge of funding programs and projects. The California Stormwater Authority products and services are expected to serve as key components to improve surface water and groundwater quality and enhance California's water supply. This agency may be a source of project funding and technical assistance.

Storm Water Resource Plans

Storm Water Resource Plans (SWRP) are a requirement for receiving grant funds for storm water and dry weather runoff capture projects from any bond approved by voters after January 2014, per Senate Bill 985, the Storm Water Management Planning Act. SWRP's encourage the use of storm water and dry weather runoff as a resource to maximize water supply, water quality, flood management, and other community benefits within the watershed. North Coast SWRPs incorporated into the NCRP Plan (see *Section 1.2.6 Integration*) include:

- Final Russian River Storm Water Resource Plan
- Final Mendocino Coast Storm Water Resources Plan

- Final Eureka Area Watershed Storm Water Resources Plan

It is important to note that many of the communities, towns, and cities within the North Coast are not required to develop stormwater resource plans because they are "DACs with a population of 20,000 or less and" are not co-permittees "for a municipal separate stormwater system national pollutant discharge elimination system permit issued to a municipality with a population greater than 20,000."

Stormwater Management Plans & MS4 Permits

Thirty-seven stormwater management plans or programs have been identified for North Coast agencies/ municipalities. These range from formal plans that comply with federal and state regulations to more informal Low Impact Design Manuals, BMPs, or informative web pages. The state and federal governments issue Municipal Separate Storm Sewer System (MS4) permits, which require local agencies to implement a suite of programs to prevent pollution; improve and protect storm water quality; reduce storm water runoff; and enhance the ecologic vitality of local creeks and waterways. SWMP/Programs are required only for large and medium sized municipalities:

- MS4 permits require the discharger to develop and implement a SWMP/Program with the goal of reducing pollutant discharge to the maximum extent practicable.
- In the North Coast, only the Cities of Santa Rosa, Cloverdale, Cotati, Healdsburg, Rohnert Park, Sebastopol, Ukiah, and Windsor, Sonoma County Water Agency and County of Sonoma are regulated under an MS4 permit.

All municipalities serving populations less than 100,000 (small) are regulated by the Phase II Small MS4 permit. Most of North Coast communities are in this category. Small MS4 permits:

- Eliminate need for the municipality to prepare a SWMP/Program
- Specify actions necessary to reduce the discharge of pollutants in storm water to the Maximum Extent Practicable (MEP)
- Require implementation of LID Principles
- Incorporate Special Protections for discharges to ASBS
- Incorporate implementation requirements for adopted TMDLs

- Phase II Small MS4 permittees:

COMMUNITY	COUNTY
Bayview CDP	Humboldt
City of Arcata	Humboldt
City of Crescent City	Del Norte
City of Eureka	Humboldt
City of Fort Bragg	Mendocino
City of Fortuna	Humboldt
City of Trinidad	Humboldt
City of Ukiah	Mendocino
City of Yreka	Siskiyou
County of Mendocino	
Cutten CDP	Humboldt
Forestville CDP	Sonoma
Guerneville CDP	Sonoma
Humboldt County	
Humboldt Hill CDP	Humboldt
McKinleyville CDP	Humboldt
Monte Rio	Sonoma
Myrtletown CDP	Humboldt
Occidental CDP	Sonoma
Pine Hills CDP	Humboldt

In addition to Stormwater Permits/MS4, there are local collaborative efforts underway to manage stormwater/runoff on a watershed basis, including the NCRP's Flood and Stormwater Report for the North Coast Hydrologic Region.

North Coast Stormwater Coalition

The North Coast Stormwater Coalition is composed of stormwater management staff from the participating cities and counties on the North Coast, as well as local, state, federal agency representatives, non-profit organizations, Tribes, SWRCB, and others. Members are City of Arcata, City of Eureka, City of Fortuna, County of Humboldt, County of Mendocino, City of Fort Bragg, and Mendocino County Water Agency/ Mendocino County Planning and Building Services. They meet monthly and provide public education, outreach, events and workshops throughout the year.

Russian River Watershed Association

Russian River Watershed Association (RRWA) is a coalition of eleven cities, counties and special districts in the Russian River Watershed that have come together to coordinate regional programs for clean water, fisheries restoration and watershed enhancement. Members are City of Cloverdale, City of Cotati, City of Healdsburg, City of Rohnert Park, City of Santa Rosa, City of Sebastopol, County of Mendocino, City of Ukiah, County of Sonoma, Sonoma County Water Agency, and Town of Windsor. Provides MS4 (Phases I & II) Permit support to member agencies. RRWA also serves as a forum for sharing ideas and coordinating efforts to meet permit requirements.

Water Supply and Urban Water Management Planning

Urban Water Management Plans

Fourteen entities in the Region have prepared Urban Water Management Plans (UWMPs) in compliance with California Water Code §10610 – 10656, Division 6 Part 2.6. UWMPs are prepared every five years by each urban water supplier that provides over 3,000 acre-feet of water annually or serves more than 3,000 connections. UWMPs are required to assess the reliability of its water sources over a 20-year planning horizon during normal, dry, and multiple dry years. DWR provides workshops, webinars, online tools, and a guidebook to assist in UWMP development.

Water Conservation Planning

Water conservation planning in the North Coast is incorporated into other local planning documents; there are not required "Water Conservation Plans" per se. Water conservation planning may be addressed in General Plans or UWMPs, or may be integrated into plans with broader water/land management goals (e.g. farm Nutrient Management Plans and local watershed plans) as part of a many-pronged approach to improve water quality and supply reliability. There are at least 52 plans in the North Coast with water supply/conservation as the primary subject. These plans are vital to local project implementation and project proponents frequently make use of their recommendations and data to improve project planning and implementation.

Watershed Management and Restoration

There are numerous (146+) plans in the North Coast to manage and restore watersheds and watershed function. These include habitat restoration plans, watershed assessments, and watershed restoration and management plans. Another 111 plans have been identified that focus on some aspect of salmonid recovery, including instream habitat restoration. The majority of these have been developed in the North Coast Rivers (68), Russian/Bodega (55), Klamath (50), and Humboldt (34) WMAs; most others span multiple WMAs. On a local scale, these plans are vital to successful implementation of many of the projects included in the NCRP Plans. Project proponents are required to integrate their projects with these planning efforts to avoid duplicative efforts and ensure complementary implementation.

AGRICULTURE

Agriculture and working lands are an important part of the North Coast Region's economy, history, and identity. Although not a geographically-large part of the Region's area (herbaceous rangeland covers 7.26 %; cultivated agriculture covers about 3.57%), agriculture looms large in the Region's identity: the southern part of the Region, "Wine Country," is known for its vineyards and fine wines, fresh organic vegetables, and artisanal cheeses while further north along the coast are dairies, ornamental flowers, and bulb production. Pasture, orchards, alfalfa, grain, and potato production accounts for much of the major inland agricultural enterprises. The Region is also home to the "Emerald Triangle," portions of Trinity, Humboldt, and Mendocino counties where conditions are favorable for cannabis cultivation, which was legalized in California in 2018.

TRIBAL LAND USE

While Tribal land use is similar to land use that occurs elsewhere in the region there are stewardship responsibilities of Tribes that are unique, and each Tribes' traditions and cultures are interconnected to their traditional territories.

WATER SUPPLY AND WASTEWATER SERVICE INFRASTRUCTURE

The North Coast Region is relatively large, rural, and rich in natural surface and groundwater sources. However, the communities tend to be geographically isolated, economically disadvantaged, and more-or-less dependent on locally provisioned water for domestic and other uses. In general, drinking water systems in the Region deliver water to their customers that meet federal and State drinking water standards (DWR 2013). In other cases, local water supplies are defined as "impaired" by the state, meaning pollutants like sediment or chemicals have rendered them unsuitable for various beneficial uses, including drinking water. Failing wastewater treatment facilities in disadvantaged communities pose a threat to public health and impair water bodies. Throughout the North Coast, there is great need to replace or upgrade failing, aging systems with current technology and reliable systems. A number of Publicly Owned Treatment Works (POTWs) in the region are in chronic violation of permit compliance and currently may be under enforcement orders. For many homeowners, a lack of adequate and cost-effective septic pumping options for onsite systems can discourage regular maintenance and pumping of tanks, which ultimately can harm local ground and surface waters (*see Appendix H, Table 36, Disadvantaged Community Water & Wastewater Service Providers*).

Communities in the Region are serviced by hundreds of individual water supply and wastewater service providers, but many of these are understaffed and underfunded. Further, many of the systems are aging, failing, or are otherwise are inadequate to service local populations. The NCRP, via extensive surveying of North Coast water supply and wastewater service providers (see *Section 3.5.2 NCRP Water Supply and Wastewater Service Provider Outreach and Support Program*), has identified the following critical needs to support clean drinking water and healthy communities:

1. Assistance with securing funding and navigating the process of replacing or upgrading aging or failed infrastructure
2. Assistance with general water and wastewater system infrastructure maintenance and repair
3. Technical training to support compliance with state standards, especially drinking water standards
4. Assistance identifying funding opportunities and preparing grant applications
5. Technical support to develop and maintain maps of water and wastewater systems

2.3.12.3 FLOOD/STORMWATER MANAGEMENT INFRASTRUCTURE

Flood and stormwater runoff volume is highly dependent on watershed land cover and management. In relatively undeveloped watersheds, only a portion of total precipitation enters the stream channel. Instead, it may be evaporated off the ground surface, intercepted by vegetation, transpired from the soil, or infiltrated deeply into groundwater aquifers. Urban elements, such as roofs, gutters, storm sewers, culverts, pipes, impervious surfaces (e.g. parking lots and roads), and cleared and compacted surfaces fundamentally change the rate and character of flood/stormwaters (Stein et al. 2012). Generally, the hydrologic changes associated with development and urbanization increases the speed with which water enters and moves through the drainage system. Urbanization has been shown to increase the magnitude of stormflows, increase the frequency of flood events, decrease the lag time to peak flow, and quicken the flow recession (Konrad and Booth 2005, Walsh et al. 2005).

Traditional flood management in the North Coast (as elsewhere) has been focused on built flood control infrastructure projects such as floodwater storage facilities and channel systems funded and/or built by State and federal agencies. Winter floods between 1935 and 1945 in Sonoma County spurred the U.S. Army Corps of Engineers (USACE) to develop the area's major flood management plan and to construct Coyote Valley Dam, which impounded Lake Mendocino upon its completion in 1957 (DWR 2013).

In 2013, flood management agencies were responsible for operating and maintaining approximately 1,200 miles of levees, more than 110 dams and reservoirs, and other facilities within the North Coast Region (DWR 2013). The North Coast 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
- Matanzas Creek Reservoir on Matanzas Creek

Two smaller flood management reservoirs are kept on Paulin Creek and Middle Fork Brush Creek; and seven other reservoirs provide 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.

Several large water supply infrastructure systems with potential flood control functions are now established in the North Coast Region (DWR 2013). These include the U.S. Bureau of Reclamation Klamath Project, the US Army Corps of Engineers Russian River Project[6], the Humboldt Bay Municipal Water District Ruth Reservoir, and the U.S. Bureau of Reclamation Trinity Lake Reservoir, among other smaller projects for local flood control. The Basin Plan for the North Coast region provides detailed descriptions of these facilities.

6 Policy for Maintaining Instream Flows in Northern California Coastal Streams at http://www.swrcb.ca.gov/waterrights/water_issues/programs/instream_flows/docs/ab2121_0210/adopted050410instreamflowpolicy.pdf

Built infrastructure systems alter or confine natural watercourses with the indirect or direct intent of reducing the chance of flooding and thereby minimizing damage to lives and property. This traditional approach is based on the flood control principle of conveying floodwaters rapidly to a discharge point. Activities under traditional flood management include physical modification of stream channels, dam and surface impoundments, catchments, levees, and other structures. A more current understanding of flood dynamics recommends the application of an integrated approach[7] that accounts for the flood management functions of intact ecosystems and natural hydrologic processes ("natural infrastructure").

Although potentially having negative impacts on human communities, periodic floods have played, and continue to play, a critical role in formation and maintenance of channel geomorphology and the hydrologic processes that are necessary for proper ecosystem function and watershed health across the North Coast Region. Species and ecosystems in floodplain and riparian corridors are well adapted to such events: However, past and current land use practices have transformed historic flow and sediment patterns. Forest management practices are one of the most significant issues impacting flood management in the Region (DWR 2013), as is the impacts to floodplains from development and agricultural reclamation. Maintaining the natural attenuation and function of floodplains in this hydrologic region will help to protect more than 320 sensitive species that rely on functional floodplain habitats.

In many cases, land use has resulted in the physical and functional separation of many streams and rivers from their historical floodplains. Changes in flow and sediment loads to streams and other watercourses are collectively referred to as "hydromodification." Most jurisdictions in California are now required to address the effects on water quality of hydromodification, through either a municipal stormwater permit or the statewide construction general permit (Stein et al. 2012). In addition to water quality, however, hydromodification has reduced the adaptive capacity of riparian and wetland ecosystems, which impairs their ability to capture and manage stormwater runoff (CNRA 2009).

In urbanized or industrialized areas of the Region, stormwater that would normally infiltrate into soils or be captured by vegetation and topography instead are intercepted by impervious surfaces or compacted soils. In these cases, excess overland flow, or water captured in storm drains, flows directly into water systems, along with contaminants, sediment, and other pollutants. Increased runoff and the alteration of peak discharge rates may also result in stream bank erosion, modification of habitats, and increased flooding (NCRWQCB 2011). Increasingly, past and ongoing modification of surface water systems contribute to more frequent, widespread, and/or severe flood events, and associated risks to water quality and public safety.

Built flood control infrastructure (can unintentionally adversely impact ecosystem function, including salmonid habitat. For example, consider the Redwood Creek estuary, where the summer water quality is poor. Degradation of water quality in this estuary is directly related to the construction of the Redwood Creek Federal Flood Control Project. While these levees provide beneficial flood protection to Orick, they have significantly impacted estuary function by drastically altering the physical setting of the estuary and sloughs (RNSP 1997, NCWAP 2005). The condition of this estuary has been considered a major limiting factor to anadromous salmonid production in the Redwood Creek watershed (RNSP 1997, CDFG 2004, NCWAP 2005).

Although primary responsibility for flood management might be assigned to a specific local entity in the North Coast Region, aggregate responsibilities are spread among more than 100 agencies with many different governance structures. Local plans, by design, address local challenges and thus give some indication of local needs. The NCRP has determined through active outreach to stakeholders (e.g. interviews, surveys, meetings, conferences, see *Section 1.2.4, Stakeholder Involvement*) that "flooding", "floodplain management" and adaptation to sea level rise are among the highest priority issues in the region, requiring urgent, coordinated action. Local jurisdictions of the North Coast (i.e. Tribes, counties, municipalities) are at different stages of planning for flood and stormwater management, with the entities some at-risk watersheds in the region presumably more prepared for flood events than others.

7 DWR Statewide Flood Management Program, which is explicitly integrated with the IRWM Program, including for the North Coast Region https://water.ca.gov/Programs/Flood-Management

2.3.12.4 WATER STORAGE INFRASTRUCTURE

In the past, water storage infrastructure has mainly been large public works or ponds and watering holes associated with agricultural use. Large water supply infrastructure systems include the U.S. Bureau of Reclamation Klamath Project, the US Army Corps of Engineers Russian River Project, the Humboldt Bay Municipal Water District Ruth Reservoir, and the U.S. Bureau of Reclamation Trinity Lake Reservoir, among other smaller projects for local flood control. In the past decade, site-specific water storage has become increasingly common.

The Center for Ecosystem Management and Restoration (CEMAR) has conducted hydrologic studies of several North Coast watersheds and shown that both average annual rainfall and stream discharge are many times greater than the human water need in those watersheds (CEMAR undated). The challenge for water managers comes from the Region's climate: virtually no precipitation occurs during summer and fall, which are also periods of high water demand environmentally and for agriculture and sub/ urban settings. The NCRP has incorporated this information into its project prioritization process, effectively integrating the use of small-scale storage into the region's water and natural resource management strategies. These small-scale water storage projects (tanks or ponds) divert ample winter streamflows or capture rainwater directly to store for summer use. To date, the NCRP has obtained implementation funding for multiple small-scale water storage projects, including agricultural-scale rainwater catchment systems in the Bodega Bay HU, off-stream storage and rainwater catchment systems in the Gualala River watershed, water storage tanks in the Navarro River watershed, slow flow pumps to collect wet season water in the Trinity River watershed, a water storage and forbearance program in the Mattole River watershed, and Yurok Tribe water storage tanks in the Klamath Basin.

2.3.12.5 ENERGY SUPPLY & CONVEYANCE INFRASTRUCTURE: REGIONAL ENERGY PROFILE

The North Coast region has a diverse set of power generation sources, with the majority coming from renewable sources. Geothermal comprises the largest fraction of power generation, followed by hydro, natural gas, biomass, and solar, respectively (Table 2). Several counties have hydroelectric generators that have been affected in recent years by the historic drought in the Western United States starting in 2011 and continuing through 2015. Biomass power has also decreased slightly over the last few years. Power generation is greater than power consumption; the region is a net exporter of electricity. For example, in 2015 the region consumed 5,300 GWh of electricity, whereas about 6,200 GWh of electricity were generated, a net export of 900 GWh. Of the 6,200 GWh that were generated, approximately 5,800 GWh was from renewable energy sources, predominantly geothermal (nearly 90%). This 5,800 GWh of renewable electricity slightly exceeds the region's total 2015 electricity consumption of 5,300 GWh. For a more detailed analysis of the region's power infrastructure, see the *NCRP Integrated Strategic Plan: Climate Change Mitigation, GHG Emissions Reduction and Energy Independence*, available on the NCRP website.

TABLE 2. GENERATION CAPACITY AND NUMBER OF PLANTS BY FUEL TYPE FOR THE NORTH COAST REGION

Fuel	MW	Number of Plants
Biomass	74.7	4
Gas	176.6	4
Geothermal	1368	13
Hydro	233	15
Landfill Gas	16	3
Solar	17.2	13
Total	1886	52

In addition to large-scale energy production, small photovoltaic systems are prevalent throughout the North Coast, with the highest concentration found in Sonoma County. As of December 31, 2018, at least 17,775 PV solar systems – mostly residential rooftop – have been installed in Humboldt, Mendocino, Sonoma, and Trinity counties. These installations are those with net energy metering agreements (Go Solar California undated).

The list below identifies some of the energy related organizations and a brief description of services.

- Redwood Coast Energy Authority (RCEA) is a joint powers authority in Humboldt County whose purpose is to develop and implement sustainable energy initiatives that reduce energy demand, increase energy efficiency, and advance the use of clean, efficient and renewable resources available in the region. In mid-2017 RCEA plans to launch a community choice energy program to the vast majority of customers in Humboldt County (http://www.redwoodenergy.org/)

- Sonoma Clean Power (SCP) is a Community Choice Energy program in Sonoma County. In October 2016 the Board of Directors voted to include Mendocino County in the service region (excluding the city of Ukiah, which currently has a municipal electric utility)(https://sonomacleanpower.org/)
- Trinity County Public Utility District is a municipal utility of Trinity County, which supplies residents with 100 percent hydroelectric power through the Western Area Power Administration. (http://trinitypud.com/)
- The Northern California Center for Alternative Transportation Fuels and Advanced Vehicle Technologies (NorthCAT) creates a physical and virtual network of training and showcase centers and informational resources for alternative fuels and vehicle technologies. (http://northcat.org/)
- The Watershed Research and Training Center's (WRTC's) mission is to promote a healthy forest and a healthy community through research, training, and education. The WRTC was formed in order to rebuild the economy of Hayfork California based on an ethic of land stewardship and restoration. (http://www.thewatershedcenter.com/)
- Redwood Community Action Agency is a Humboldt County based, private non-profit organization that provides a wide range of services to low and moderate income residents of Humboldt County. The long-term goal is to develop programs through which people can become self-sufficient and empowered to improve their own lives. Their weatherization services also cover Del Norte and Modoc Counties. (http://rcaa.org/)
- Community Development Commission of Mendocino County is a public agency whose mission is to provide opportunities for decent, safe, affordable housing and a suitable living environment to low-and moderate-income, special needs households, and communities in an effective, efficient, and respectful manner.
- Teaching Employment, and Community Health Inc. (TEACH) is a broad based, multi-purpose non-profit community organization that serves the population of Modoc County. They offer a wide range of programs including heating assistance for low income households. (http://teachinc.org/)
- Klamath Alliance for Resource and Environment (KARE) is a grassroots, non-profit located in Siskiyou County dedicated to educating the public about the environmental benefits of responsible management of our natural resources on public and private lands with the purpose to inform and educate the public by providing science-based information on forest eco-systems, environmental issues, and the economic benefits of forest resources in our communities. (http://www.klamathalliance.org/)
- Great Northern Services (GNS) is a community organization serving Siskiyou County that seeks to invigorate community by initiating positive social change to improve economic conditions. They offer a variety of services including energy assistance and home weatherization services. (http://www.gnservices.org/)
- Northern California Indian Development Council is a private nonprofit corporation established to research, develop, and administer social and economic development programs designed to meet the needs of Indian and Tribal Communities to provide support and technical assistance for the development of such programs, and the conservation and preservation of historic and archeological sites and resources. They are the LIHEAP providers for 48 California Tribes, including many in the NCRP Region. (http://www.ncidc.org/)
- Del Norte Senior Center is a provider of LIHEAP and weatherization service to qualifying low income households in Del Norte County in addition to senior services. (http://www.delnorteseniorcenter.org/home.html)
- North Coast Energy Services is a not-for-profit organization that provides energy conservation, consumer education and advocacy, home improvement, utility assistance, job training, and other services to people in need in Lake, Mendocino, Solano, Sonoma, and Yolo Counties. (http://www.northcoastenergyservices.com/index.html)
- The Regional Climate Protection Authority (RCPA) is a Sonoma County agency that coordinates community-wide climate solutions for a better future. The RCPA is focused on securing grant funding for GHG reduction programs and projects, as well as leading countywide climate planning efforts. (http://rcpa.ca.gov/)

Regional Programs and Policies

Below are listed some of the regional programs and policies that promote energy efficiency and renewable energy throughout the region.

Energy Watch is a program administered by PG&E. In the NCRP region the following organizations provide services under Energy Watch. Trinity County has its own municipal utility and Del Norte, Modoc and Siskiyou Counties are outside of PG&E service territory and therefore are not covered by Energy Watch programs.

- Mendocino-Lake Energy Watch (http://mendoenergy.org/)
- RCEA administers the Redwood Coast Energy Watch (http://www.redwoodenergy.org/)
- Sonoma County (https://sonomacounty.ca.gov/General-Services/Energy-and-Sustainability/Site-Visits-and-Audits/)

The Rural Energy for America Program (REAP) provides guaranteed loan financing and grant funding to agricultural producers and rural small businesses for renewable energy systems or to make energy efficiency improvements. (https://www.rd.usda.gov/programs-services/rural-energy-america-program-renewable-energy-systems-energy-efficiency).

Property Assessed Clean Energy Financing is a program allowing for energy efficiency, water efficiency, and renewable energy projects to be financed through a voluntary property assessment that is attached to the property, not the owner, and is paid back through the property tax system. These programs are administered by a variety of lenders and public agencies. Information on PACE financing and other programs is available through the Sonoma County Energy Independence Program (http://sonomacountyenergy.org/) or the Redwood Coast Energy Authority's PACE webpage) https://redwoodenergy.org/customerprograms/financing/).

Community choice energy (CCE), also known as community choice aggregation, is a program that allows California cities, counties, and or joint powers agencies to purchase electricity on behalf of the customers in their territories. Transmission and distribution and their maintenance still remain the responsibility of the incumbent utility, as does billing, but CCEs are able to determine their own energy supply mixes and rate structures. Currently Sonoma Clean Power operates in Sonoma County and will be expanding to Mendocino County in 2017. The Redwood Coast Energy Authority is scheduled to launch a CCE program in mid-2017. This will mean that most of the population in the NCRP region will be served by a CCE or municipal utility by mid-2017.

2.3.12.6 TRANSPORTATION INFRASTRUCTURE

Throughout the North Coast, communities contend with challenges associated with transportation. The rural nature and widespread geography of North Coast communities facilitated development of roads and highways over non-motorized infrastructure; thus, vehicle transportation is most commonly used for both individual transit and freight transport. However, as concern about GHG emissions and interest in healthy lifestyles and walkable neighborhoods increases, many North Coast communities are planning for and implementing projects that improve public transit and bicycle and pedestrian pathways.

Obtaining sufficient funding for maintenance, repairs, and improvements is a challenge for many North Coast communities. Throughout the region, the condition of some roadways is compromised due to this funding deficit. Additionally, private roads, which have historically been lacking sufficient maintenance, are in various states of repair.

All counties in the North Coast have developed Transportation Plans and many communities have developed Bicycle and Pedestrian Plans. Some also possess airport, rail, and harbor plans. The challenge facing the region is to operate and develop these systems into the future so that they coalesce into a safe, efficient, integrated intermodal system that serves the mobility needs of people and freight while fostering economic growth and development.

2.3.12.7 BROADBAND INFRASTRUCTURE/ ACCESS

Telecommunications infrastructure and services are increasingly important for commercial competitiveness and regional economic growth. Additionally, residents increasingly rely on telecommunication for quality of life, education, research, and access to health care and government services. Improved telecommunications infrastructure also supports public safety and emergency services by improving communications and information availability. Additionally, broadband enables online education and work telecommuting opportunities, reducing the need for vehicle trips. The North Coast region, with its rural nature and dispersed population, lags in providing access to reliable telecommunications services when compared with urban centers such as the San Francisco Bay area.

North Coast communities are so widespread that satellite internet (as opposed to phone line or cable connections) is often the most practical mode for those in rural areas. However, the landscape can interfere with continuous access. Mountainous terrain, proximity to the Pacific Ocean, deep canyons, weather events, and winding roads can all cause spotty satellite reception when traveling through or visiting certain parts of the region.

In urban centers, residents and businesses have more options. Cable companies offer bundled services that include varying numbers of television channels and levels of internet data capacity. Additionally, all county libraries offer internet access through use of public computers. Use is timed to ensure equitable access, and is only available during hours of operation. In some county libraries and municipalities, free Wi-Fi is available to the public 24-7. However, accessing these internet services requires proximity, which is not always readily available to residents of disadvantaged rural communities.

In August 2008, telecom and cable company representatives stated that the remaining unserved and underserved communities in the region do not fit their "investment return models," and no effort would be made to expand services to them. Lack of adequate access is a recognized issue in the region: the Broadband Alliance of Mendocino County and the North Bay/ North Coast Broadband Consortium are two organizations working towards equitable broadband access. Not only are there issues with the widespread population and challenging topographic conditions, but there are also issues regarding equitable access to broadband service. In both Mendocino and Sonoma County, a digital divide is identified, where areas with a high population density have broadband access, but other portions of the County, its population, visitors, anchor institutions, government services, and transportation corridors are underserved.

In 2010, the Yurok Tribe used grant funding from the USDA Rural Utilities Service and the California Consumer Protection Agency to bring broadband internet to its Reservation. The Tribe's Information Services Department developed *A Rural Broadband Model: A Simplified Guide to Rural Broadband Deployment* to assist others through the process. The document provides an example model for replication, equipment needs list, and technology recommendations based on site characteristics. Since its initial foray into broadband provision, the Yurok Tribe has teamed up with the Karuk Tribe to extend high-speed broadband service in Tribal lands.

In 2014, a $138 million initiative to extend high-speed Internet capacity to about 150,000 rural Northern California households collapsed after nearly three years of negotiations. This new fiber-optic based network would have connected 16 northern counties and provided the anchor for expansion of fast, affordable service. Also, in 2014, a major outage in August interrupted Internet access for three days for a large part of Mendocino County. This type of outage basically puts health care professionals out of business until service is restored, affecting social health and safety. Additionally, loss of Internet capacity slows business for those using the Internet for sales, file storage, and general communication, potentially affecting the local economy.

In March 2017, Inyo Networks, Inc. was awarded funding through the California Advanced Service Fund of the Public Utilities Commission to provide high-capacity broadband backhaul infrastructure and interconnection points to communities along the Highway 299 corridor. The project will directly connect 307 underserved households to last-mile Internet services using underground and aerial fiber facilities. The infrastructure will provide internet access to as many as 102 schools, colleges, research institutions, hospitals, clinics, public safety offices, and Tribal concerns. It covers almost 2,400 square miles of rural Northern California between Redding and the California coast, encompassing portions of Shasta, Trinity, and Humboldt counties.

Continued collaboration by the Broadband Alliance of Mendocino County, Sonoma County, Redwood Coast Connect, Tribes, and entities such as Community Service Districts (CSDs) will be necessary to develop suitable infrastructure for reliable, complete broadband coverage on the North Coast. SB1191 expanded CSDs' powers to include broadband service. CSDs can offer an option for broadband service for those communities too small or too remote to interest commercial providers. CSDs are trusted community organizations with billing systems and the administrative support in place to outsource broadband operations. Additionally, CSDs are government agencies that are eligible to apply for many grant funds.

2.4 SOCIOECONOMIC ATTRIBUTES

Population density in the North Coast is low relative to other portions of the state: less than two percent of California's total population currently resides in the North Coast Region, with most inhabitants concentrated along the Pacific Coast and in the inland valleys immediately north of the San Francisco Bay Area. The largest urban centers are located in the Eureka area of Humboldt County and in the Santa Rosa area of Sonoma County; the latter has experienced the largest population growth of all the counties within the Region.

Most of the Region (by area), and a significant proportion of its residents, are characterized by the State as "economically disadvantaged communities". As a result of their rural location and financial challenges, economically disadvantaged communities often experience deteriorated, inadequate, or defunct water supply, treatment, and/or conveyance infrastructure and associated impaired water quality. The lack of quality water and wastewater infrastructure in these disadvantaged communities impacts economic vitality in a number of ways: causing communities to use scarce financial and human resources to temporarily shore up failing infrastructure while not having the resources to comprehensively addressing infrastructure needs; creating situations where small communities are subject to fines and regulatory actions that do not support the correction of the underlying problem; and impacts to water quality (both in drinking water and in stream systems) that affect the ability of these communities to attract the financial benefits associated with recreational tourism.

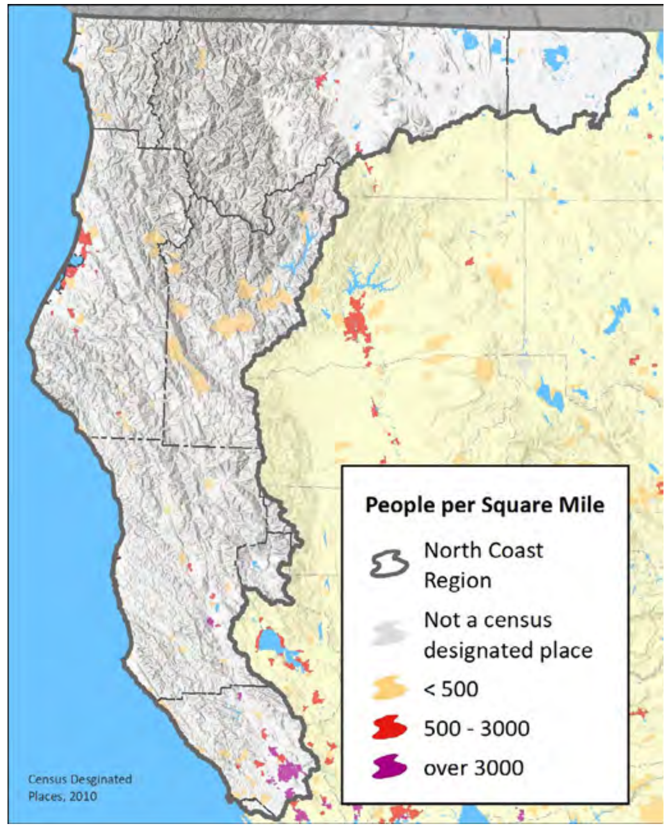
Tourism/recreation and natural resources-based industries (e.g. logging, timber milling, aggregate mining, fishing, livestock, dairy, vineyards, and wineries) provide the foundation for the Region's economy. While resource-based industry remains a factor in the regional economy, the North Coast is undergoing economic transition, with an increasing focus on service-based economies. This transition has been and will continue to be difficult for much of the Region, because the economic resources needed to build or update service-based infrastructure are limited.

2.4.1 DEMOGRAPHIC ATTRIBUTE

2.4.1.1 POPULATION SIZE, DENSITY, & DISTRIBUTION

The population of the entire North Coast Region was approximately 644,000 in 2000 (DWR 2005) and 675,845 in 2010 (US Census) and 679,741 in 2015 (American Community Survey 2015). This total continues to represent approximately 2 percent of California's total population. Regional population is unevenly distributed, with the majority of people concentrated in the southern portion of the Region in Sonoma (307 persons/mi2) and Marin (485 persons/ mi2) counties. The next highest population densities are an order of magnitude less and in the coastal counties: Humboldt has approximately 37 people per square mile, Del Norte about 27, and Mendocino County has roughly 25 people per square mile. The remainder of the North Coast's population occupies the interior sections of the Region. Only about 1 person per square mile inhabits the part of Modoc County contained within the North Coast Region, and Trinity County) has just 4 persons/mi^2.Trinity County's population is at about 13,363, down about 300 from 13,786 residents in 2010 (up from 13,022 residents in 2000). Urban boundaries occur primarily in Sonoma County, which uses the boundaries to protect agriculture and open space (*see Appendix I, Table 37, Socioeconomic & Demographic Attributes of North Coast Counties*).

According to projected urban growth data developed by the California Resources Agency, Legacy Project (now an archive, the Project was active until circa 2003), this urban boundary is expected to grow to 61,196 acres (42%) by 2020 and to 76,943 acres (78%) by 2050; all in Sonoma County. The growth is expected to continue in the Russian River watershed along the mainstem (Santa Rosa, Healdsburg, and Cloverdale) corridor and west along the Lower Russian River, with a couple just north along the coast in Sonoma County.



MAP 35 PEOPLE PER SQUARE MILE

2.4.1.2 POPULATION GROWTH

The North Coast Region as a whole has experienced steady population growth over the past two decades and is projected to continue positive growth through the year 2060 (CA Department of Finance 2018). The Region's other counties, however, are not projected to increase as significantly if at all. Del Norte, Humboldt, and Mendocino Counties' populations all are projected to experience only modest gains in the next 4 decades and Siskiyou and Trinity counties' populations are projected to stay relatively flat, with each expected to grow by less than 800 people, from 44,206 to 44,868 and 13,424 to 14,151 respectively. Modoc County's population is projected to decline slightly, from about 9,500 (total) to about 8,600 (total).

Recent model predictions by the Department of Water Resources (DWR 2013) indicate that the regional population is expected to grow to between 763,300 and 1,185,600 by the year 2050. Over half of this growth is expected to occur in the Santa Rosa region as housing pressure continues from the Bay Area. The slower growth rates expected in the northern part of the region are due to geographic isolation, lack of suitable transit corridors, and lack of adequate harbors.

However, despite low probability of urban development, the lower cost of living associated with the North Coast's rural areas has led northern communities within the Region to experience an influx of retirees from larger, more urbanized settings. This has placed pressure on existing community services, many of which were already financially encumbered. Additionally, as growing rural populations encroach into more urban settings, some of these communities are at risk of losing their local character and simply becoming "bedroom communities" for the Region's commuters.

There is also a rise in the migrant worker population within the Region: the trend for both Modoc and Siskiyou counties are that many of the migrant workers are becoming permanent residents, while younger non-migrant residents continue to leave the area. Modoc County now contains a county-operated migrant camp (DWR 2013). The fall 2017 Pocket and Tubbs fires in the Santa Rosa area led to an immediate and short-term housing shortage that increased property and rental costs to levels beyond the means of many paycheck-to-paycheck families. Many of these families left the area, but this population drop is likely temporary; when the housing supply is increased, they or others are likely to return (*see Appendix I, Table 39, Historic and Projected Population Growth of North Coast Counties*).

TABLE 3. HISTORIC & PROJECTED POPULATION GROWTH OF NORTH COAST COUNTIES

County	1980 historic	1990 historic	2000 historic	2010 historic	2020 projected	2030 projected	2040 projected	2050 projected
Del Norte County	18,217	23,460	27,507	29,126	26,997	27,570	28,104	28,568
Humboldt County	108,514	119,118	126,518	133,138	137,711	140,779	141,236	140,471
Mendocino County	66,738	80,345	86,265	94,300	90,175	93,452	95,124	95,403
Modoc County	9,449	9,678	9,449	9,547	9,422	9,267	9,061	8,746
Siskiyou County	39,732	43,531	44,301	46,611	44,186	44,406	44,253	43,938
Sonoma County	299,681	388,222	458,614	515,968	515,486	554,694	583,517	597,749
Trinity County	11,858	13,063	13,022	13,442	13,389	13,322	13,232	13,319
North Coast Region*	554,189	677,417	765,676	842,132	837,366	883,490	914,527	928,194

* excluding the portions of Glenn, Lake, and Marin Counties
Sources: Department of Commerce, CA Dept. of Finance 2012 and 2017

2.4.1.3 AGE DISTRIBUTION

The median age for residents throughout California is increasing. The state's estimated median age has increased slightly from 33 to 36, while the median ages in the six main counties in the North Coast Region are estimated to approach the mid-40s (CA DOF 2017a). While the Region's overall birthrate continues to decline, estimates point toward an increasingly aging Region population. Increasingly, retirees are settling in the North Coast as they value the area's rural quality of life and high standard of living. Modoc*, Trinity, and Siskiyou* Counties have the largest proportion of residents age 65 and over (25%, 23%, and 21% respectively) (Pederson 2018). This may lead to an increase in the demand for health-related services and related construction of retirement, healthcare, and other facilities in these remote areas. In contrast, the present lack and modest projected increases of population age 25 and younger is indicative of locations that are unable to provide living wage jobs that retain local youth (CA DOF 2017b).

2.4.1.4 EDUCATIONAL ATTAINMENT

The North Coast Region has a relatively high rate of people 25 years and older who are high school graduates and advanced degree recipients, matching (Del Norte County) or exceeding (Humboldt (90%), Mendocino (87%), Modoc (86%), Siskiyou (89%), Sonoma (87%), and Trinity (91%) counties) the state's percentage of 82 percent despite the lack of proximity to major centers of learning and related infrastructure.

The North Coast Region includes numerous state, private, community, and vocational colleges that serve to support secondary educational attainment; these are more heavily concentrated in the southern part of the Region. Sonoma County has more than the state average of graduates with a Bachelor's Degree or higher (33.1% versus 32.0%), with Humboldt County (28.2%) approaching the state average. In these areas, intellectual capital is also migrating to the Region, with educated professionals drawn by the high quality of life, natural surroundings, and technical opportunities.

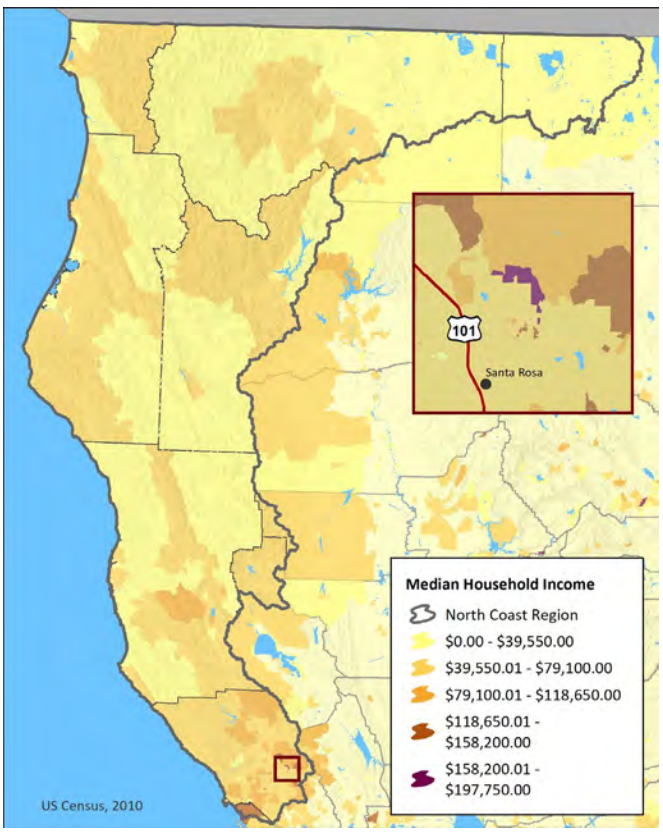
The other North Coast counties fall short of the state's percentage (32%) of residents who hold a bachelor's degree or higher, likely due to a combination of lack of institutions of higher learning in the northern part of the region coupled with access issues (even to attend online universities – there is a lack of reliable internet service throughout much of the region and a dearth of employment opportunities for graduates. In Del Norte County, only about 15% of the population 25 years and over has a bachelor's degree or higher while Modoc (18.3%), Trinity (20.1%), Siskiyou

(22.2%) and Mendocino (24.1%) counties also have significantly lower levels than the state average.

2.4.2 SOCIOECONOMIC INDICATORS

2.4.2.1 MEDIAN HOUSEHOLD & PER CAPITA INCOME

The 2016 median household income (MHI) of most North Coast Region counties was significantly below that of the state average ($63,783 per year). This statistic alone indicates that much of the North Coast Region is economically disadvantaged, as compared to the general population of the state. Of counties comprising the NCRP, only one (Sonoma, at $66,833) exhibited MHI above the state average. The other counties range between $35,270 (Trinity) to $43,510 (Mendocino). Like MHI, per capita income for all but one NCRP Region county is below the state average of $31,458: again, only Sonoma County ($35,639) exceeds this. By contrast, Del Norte and Modoc counties exhibit just 64 percent and 69 percent, respectively, of statewide per capita income.



MAP 36 MEDIAN HOUSEHOLD INCOME (MHI)

2.4.2.2 ECONOMICALLY DISADVANTAGED COMMUNITIES

A geographic information system (GIS) was used to analyze U.S. Census block group data (2015) to determine economically disadvantaged status of the North Coast Region and its counties relative to statewide MHI ($61,990) according to 2015 Census figures. Of the seven participating counties, three counties are completely (Modoc) or nearly completely (Siskiyou and Trinity, at 96%) designated as "Economically Disadvantaged Communities (DAC)[8]" or "Severely Economically Disadvantaged Communities (SDAC)[9]." SDACs are a subset of DACs; that is, every SDAC has an MHI that is less than both 80% of state MHI and 60% state MHI, making it both economically and severely economically disadvantaged. The total area of the North Coast Region area that is considered either DAC or SDAC is 90.2% (approximately 11,204,991 acres). About 161,800 people are living in DACs (but not SDACs) with another 138,000 residing in SDACs and the total population of the Region considered to be living in either DACs or SDACs is 299,598, or about 44% of the Regional population (see Tables 4 and 5). In 2016, 93.4% of the Region (11,598,962 acres) was considered an Economically Distressed Area[10] by the state (*see Appendix I, Table 38, Economically Disadvantaged Populations and Area in the North Coast*).

8 The State of California Health and Human Services Agency, Department of Health Services defines "Disadvantaged Community" as either places or tracts with a MHI of less than 80 percent of the 2015 statewide MIH. For 2015, the cut-off is $49,592.

9 The State of California Health and Human Services Agency, Department of Health Services defines "Severely Disadvantaged Community" as either places or tracts with a MHI of less than 60 percent of the 2010 statewide MIH. For 2015, the cut-off is $37,194.

10 Water Code §79702.(k) "Economically distressed area" means a municipality with a population of 20,000 persons or less, a rural county, or a reasonably isolated and divisible segment of a larger municipality where the segment of the population is 20,000 persons or less, with an annual median household income that is less than 85 percent of the statewide median household income, and with one or more of the following conditions as determined by the department:(1) Financial hardship.(2) Unemployment rate at least 2 percent higher than the statewide average.(3) Low population density.

TABLE 4. ECONOMICALLY DISADVANTAGED POPULATIONS IN THE NORTH COAST BY COUNTY						
	County	**Total Population**	**Population living in DAC**	**%Total Population in DAC**	**Population living in SDAC****	**%Total Population in SDAC****
Participating North Coast Counties	Del Norte	27,787	18,059	65%	12580	45%
	Humboldt	135,030	91,013	67%	38811	29%
	Mendocino	87,516	55,522	63%	37240	43%
	Modoc*	1,713	1,713	100%	791	46%
	Siskiyou*	34,798	28,691	82%	15228	44%
	Sonoma*	377,683	92,036	24%	23526	6%
	Trinity	13,363	10,730	80%	8378	63%
Other North Coast Counties	Glenn*	100.46	100	100%	58	58%
	Lake*	1,211.74	1,194	99%	1165	96%
	Marin*	540.00	540	100%	0	0%
North Coast Totals		**679,741**	**299,598**	**44%**	**137,776**	**20%**

TABLE 5. ECONOMICALLY DISADVANTAGED AREAS IN THE NORTH COAST BY COUNTY						
	County	**Total Area (acres)**	**Area considered DAC (acres)**	**% Total Area DAC**	**Area considered SDAC** (acres)**	**% Total Area SDAC****
Participating North Coast Counties	Del Norte	648,879	622,568	96%	568,048	88%
	Humboldt	2,310,054	1,783,497	77%	850,106	37%
	Mendocino	2,245,146	1,411,131	63%	969,604	43%
	Modoc*	751,022	751,022	100%	224,797	30%
	Siskiyou*	3,326,050	3,185,515	96%	1,591,994	48%
	Sonoma*	834,109	96,131	12%	18,282	2%
	Trinity	2,051,353	1,551,288	76%	1,090,498	53%
Other North Coast Counties	Glenn*	54,246	54,246	100%	32,346	60%
	Lake*	191,944	191,658	100%	191,145	100%
	Marin*	22,677	22,677	100%	0	0%
North Coast Totals		**12,435,479**	**11,204,991**	**90.2%**	**6,188,842**	**49.81%**

*Analysis includes only those portions of these counties that are within the North Coast Region

** Population and Area in SDAC are subsets of Population and Area in DAC; see text for details

Sources: All Population and County area data: American Community Survey (ACS) 2015 block group, North Coast Area Totals: (US Census American Community Survey (ACS) 5-Year Data: 2012–2016).

When considering North Coast WMAs, the same pattern is evident. The northern WMAs have much larger percentages of population living in DACs and SDACs than the Russian Bodega WMA in the southern part of the Region (see Tables 6 and 7). Eighty-five percent of the Eel, Klamath, and Trinity WMAs' populations reside in a DAC but only 27% (over ¼ of the population) of the Russian Bodega WMA's population lives in a DAC. Likewise, with land area, just 17% (still a significant figure – nearly a fifth of the land mass) of the Russian Bodega WMA contains communities considered disadvantaged.

Challenges associated with water for economically disadvantaged communities are those described in *Section 2.7.5 Impaired Water Bodies* and *Section 2.7.6 Water Supply & Demand: 20 Year Projection*. Aging infrastructure and lack of capital are issues that face most of the North Coast Region, particularly these communities, which often don't possess the technical expertise or staff required to develop competitive funding proposals.

TABLE 6. ECONOMICALLY DISADVANTAGED POPULATIONS IN NORTH COAST WATERSHED MANAGEMENT AREAS

WMA	Total Population	Population living in DAC	% Total Population in DAC	Population living in SDAC*	% Total Population in SDAC*
Eel	48,240	40,902	85%	21,423	44%
Humboldt	97,992	59,585	61%	27,178	28%
Klamath	39,766	33,659	85%	18,626	47%
North Coast 1	26,612	16,884	63%	11,405	43%
North Coast 2	34,334	23,120	67%	9,132	27%
Russian Bodega	416,573	111,659	27%	38,624	9%
Trinity	16,224	13,789	85%	11,388	70%
North Coast Totals	**679,741**	**299,598**	**44%**	**137,776**	**20%**

TABLE 7. ECONOMICALLY DISADVANTAGED AREA BY WATERSHED MANAGEMENT AREAS

WMA	Total Area	Area considered DAC	% Total Area DAC	Area considered SDAC*	% Total Area SDAC*
Eel	2,355,589	1,945,904	83%	1,619,208	69%
Humboldt	734,786	486,912	66%	163,705	22%
Klamath	4,502,147	4,361,613	97%	2,051,398	46%
North Coast 1	557,049	530,739	95%	476,219	85%
North Coast 2	1,342,599	599,338	45%	57,188	4%
Russian Bodega	1,043,886	174,989	17%	74,191	7%
Trinity	1,899,422	1,570,237	83%	1,094,912	58%
North Coast Totals	**12,435,479**	**9,669,731**	**78%**	**5,536,820**	**45%**

* Population and Area in SDAC are subsets of Population and Area in DAC; see text for details

Sources: All Population and WMA area data: American Community Survey (ACS) 2015 block group; North Coast Area Totals: (US Census American Community Survey (ACS) 5-Year Data: 2012–2016).

2.4.2.3 POVERTY STATUS & UNEMPLOYMENT

Unlike the definition of "economically disadvantaged" status referenced above, one's "poverty status" is not based on one single dollar amount (e.g. %MHI). Following the Office of Management and Budget's (OMB) Statistical Policy Directive 14, the Census Bureau uses a set of money income thresholds that vary by family size and composition to determine who is in poverty. These poverty thresholds are the dollar amounts used to determine poverty status. If a family's total income is less than the threshold, then that family and every individual in it is considered in poverty. The official poverty thresholds do not vary geographically so the same thresholds are used throughout the United States. There is no adjustment to account for some parts of the country (or region) being more expensive to live in than other parts. The North Coast Region's poverty status is generally higher than the rest of the state's rate of 11.8 percent of individuals living in poverty (CA DOF 2017a). Of the seven NCRP counties, Sonoma (7%), Modoc (8.4%), and Humboldt (11.2%) exhibit poverty rates below the state average. For the other counties, poverty rates are as high as 16.7 percent (Del Norte County).

Modoc and Sonoma counties have unemployment rates (6.8% and 7% respectively) lower than that of the state as a whole (8.7%), while Del Norte (10.4%), Humboldt (9.5%), Mendocino (11%), Siskiyou (11.7%) and Trinity (9.9%) have larger unemployment rates in keeping with their high poverty status and large number of Economically Disadvantaged Communities. Modoc County is an apparent anomaly; these statistics may suggest that while similar percentages of inhabitants are employed in Modoc and Sonoma County, Del Norte employees are paid less for similar work, or that the work they do, and related industries, are less profitable.

2.4.3 ECONOMIC SECTORS & TRENDS

The North Coast Region's economy has historically been one of resource extraction and agriculture. The majority of the region, except Marin and Sonoma counties, was until the last twenty years, dependent upon the timber, fisheries, and agriculture industries as primary revenue and employment generators. This has proven problematic for many communities reliant upon the timber and fisheries industries, where harvesting has declined significantly due to increased mechanization, stricter environmental laws, declines in supply due to over-harvesting and impacted environmental conditions, and increasingly competitive markets. Field crop agriculture has also suffered given the distance to market, inability to compete with production and lower costs in the Central Valley, and limited infrastructure. The overall decline in living-wage natural resources based jobs over the past twenty years has contributed greatly to the Region's overall profile as a high unemployment, low-income area (Mendocino County Joint Agriculture and Tourism Marketing Study 1997). The status of the North Coast Region's industries is assessed below using US Census American Fact Finder 5-Year Estimates 2012–2016.

2.4.3.1 Agriculture

Despite its overall decline in the regional economy, agriculture continues to be a significant industry for the North Coast counties, providing approximately 7 percent of employment, much higher than the State's 2.4 percent of all jobs. The agricultural sector includes timber harvesting, crops, aquaculture and fisheries. Current agricultural strengths include grape growing, almonds, and organic row crops. While organic crops currently represent a small percentage of production, they are growing significantly and capture more value per dollar than traditional crops (California Department of Agriculture Crop Report 2003). It should also be noted that the growth in grapes is presently being tempered due to the general perception that there are adequate grape plantings to meet demand for the foreseeable future.

There is also a very substantial underground economy based on the cultivation and sale of marijuana – much of which is illegally grown on public lands. Because of its federally illegal status and newly legal (2018) state status, it is difficult to assign an accurate dollar value to this economic sector. The water supply and quality impacts associated with illegal cultivation of cannabis likewise are not well quantified, but anecdotal evidence from local experts indicates that these impacts are significant. The emergence of new laws regarding marijuana – nearly all of which are in conflict with federal law – may provide more precise data regarding the economic contribution of the legal elements of this agricultural enterprise. For a more detailed discussion of cannabis cultivation and its economic impact on the North Coast, please see the *North Coast Healthy Watersheds & Vital Communities Economic Analysis*, available on the NCRP website.

The trend for agricultural land in the past few decades has been one of transformation to urban uses. This is in part due to low crop values and the high price of surface and developable groundwater (DWR 2005), but also can be attributed to an increased demand for housing in the southern part of the Region, which is close to the San Francisco Bay Metropolitan Area. The timber industry is presently in decline; however, production, profits and employment may improve with the growing demand for building products from sustainable forestry, affordable interest rates, and increased housing demand in the wake of the 2017 fire season. Although land in agriculture has declined, agricultural water use has not, reflecting the replacement of large tracts of un-irrigated orchards with smaller acreages of irrigated vineyards (DWR 2005). Finally, fisheries have experienced dramatic declines with many commercial fish seasons significantly shortened or eliminated entirely in order to allow population level recovery.

2.4.3.2 Construction

The construction industry, contributing 7 percent of jobs in the North Coast Counties, also plays an important role in the Region, and represents slightly more jobs proportionately than that of the State (6%). Prior to the global economic crisis beginning 2008, a widespread lack of housing supply and low interest rates had spurred housing construction throughout the Region. This had led to employment increases in construction, as well as the timber and wood manufacturing industries in the Region. The 2017 fires in the Region caused a severe housing shortage in the south portion of the Region, with 5,643 structures destroyed in the Tubbs Fire alone (CAL Fire2018), adding even more urgency to construction efforts.

WestviewJerseysDairy_gutter2.png

2.4.3.3 Government Employment

Government is a significant employer in most of the North Coast Region counties, and includes 24 percent of all employment, in contrast to the State, where government workers make up approximately 14% of the population. While not on a major upward swing, public agency employment is considered stable and unlikely to decline markedly in the coming decade. Government employees manage federal lands and programs, work for local jurisdictions, and manage educational institutions. Government workers comprise nearly a third of the work force in Del Norte, Modoc and Trinity counties, with Humboldt, Mendocino, and Trinity counties having about one fifth of their workers in government. Sonoma County, which is much more highly urbanized and close to the Bay Area, is closer to the State's ratio with 12.8% of the workforce employed with government.

2.4.3.4 High-Tech & Information Services

High-tech industries occur in the southern part of the Region due to the proximity to the San Francisco Bay Area. Additionally, professional consulting agencies specializing in engineering, restoration, geomorphology, and other applied sciences occur throughout the Region in response to the regulatory environment, urban growth, and infrastructural development.

2.4.3.5 Manufacturing

Compared to the California average of 13 percent, the North Coast Region has particularly low manufacturing employment with only about 7 percent of all jobs. The Region's manufacturing center is in Sonoma County, which shares the State's 13 percent rate for manufacturing jobs. Sonoma County is a manufacturing center for telecommunications, medical devices, and specialty food products, including the newly legalized cannabis food products.

2.4.3.6 Recreational Tourism

Tourism is strong in the Region, with arts, entertainment, food service and accommodations at 12 percent of employment in North Coast counties, a slightly higher rate than the State's 10 percent. Trinity and Del Norte counties have the highest percentages of tourism industry at 17.3% and 14.5% respectively. Only Modoc County has a rate lower than the State's; just 7% of the county's industry is attributable to tourism and recreational activities. Retail trade, a sector linked to tourism, is also thriving in the Region, and just surpasses the state's rate of 11 percent of all employment. A survey of Willits Chamber of Commerce members identified that over 30 percent of members established their businesses in the area due to a positive tourism experience (Willits Chamber of Commerce Membership Survey, 2003). In the past decade, there has been growing interest in the local, artisanal, organic food movement and associated tourism element (e.g. winery tours, cheese tasting, working-farm B & Bs, etc.).

2.4.3.7 Service Sector: Education, Health, & Social Services

The service sector includes health, social services, education, government, retail, and tourism related businesses, and is the largest employer of the Region with over 62 percent of employment in North Coast counties. Within the service sector, the education/health/social services industry cluster accounts for 25 percent of all employment, and exceeds that of the state's (21 %). This sector reflects the predominance of hospitals and educational and governmental facilities providing significant employment.

2.5 SOCIAL AND CULTURAL VALUES

Shared Values

The North Coast Region is comprised of counties, jurisdictions, and tribal communities that largely embrace their cultural and social diversity. Most counties include statements in the General Plans that reflect their commitment to embracing diversity and expanding public awareness. Identified shared values of the North Coast Region include:

- A strong connection to the land
- Interest in retaining a rural quality of life and small-town culture
- Scenic beauty
- Natural resource protection
- Outdoor recreation
- Protecting historic sites
- Honoring and encouraging public awareness of diverse cultures
- Fostering a vibrant, sustainable economy

Without exception, all the counties included in the North Coast Region have included statements in their General Plans and related documents that indicate their commitment to retaining the quality of life in their jurisdiction. An example is Mendocino County's Comprehensive Economic Development Strategy, 2004: "We believe that economic, environmental, cultural, and social values are inseparably related. The quality of life so valued by Mendocino County residents depends upon economic opportunity for all, while preserving the rural beauty and natural resources, and a thriving, diverse community. Our adventure is to use our creativity to find the balance."

Divergent Values and Water-related Conflicts

Water management issues at the regional scale cover a range of water quality, watershed health and water quantity concerns that occur widely throughout the North Coast. These issues have motivated state and federal agencies to develop a suite of programs, policies, and regulations to guide, encourage, and support protection and restoration of anadromous fish habitat, beneficial uses of water (including protection and enhancement of drinking water), and pollution prevention. Although usually developed at a statewide, regional, or basin (WMA) scale, many of the programs are implemented at the local scale by local jurisdictions, watershed groups, Joint Powers Authorities (JPAs) or other cooperative coalitions, Tribes, or state or federal agencies. Therefore, although regional in scope, these issues ultimately are addressed at the local scale by local entities, at times in cooperation with state and federal partners.

While most residents share the shared values expressed above, communities and individuals may differ in their beliefs about how those values should be implemented, thereby leading to conflicts. One leading area of conflict is that of resource protection. For example, although Tribal members, environmentalists and farmers all have a deep connection to the land, they have clashed over distribution of water in the Klamath River Basin. Tribal interests want the adequate river flow for cultural, subsistence, and environmental uses, environmentalists strongly believe that environmental uses of water, which maintain salmonid fisheries are the most important beneficial uses, and agricultural interests believe that agricultural uses, which maintain their historic way of life, are the most important use.

In the North Coast Region, conflict most often occurs between different types of resource users when water scarcity or impairment occurs, whether recreationalists, sport fishermen, commercial timber, fish harvesters, or other interests are involved. Similar conflicts occur between historical preservationists and development stakeholders when construction projects are proposed in historically sensitive areas.

While these conflicts between stakeholders can and do happen throughout the region, there are a few well-known instances of conflict, including dam removal and water rights issues in the Klamath River watershed (described above and in *Section 2.8.4 Salmonid Population Decline*), the historic and continued diversion of the Eel River into the Russian River watershed through the Potter Valley Project (*Section 2.8.6 Water Supply & Demand: 20 Year Projection*), and the expansion of the mariculture industry in Humboldt Bay (*Section 2.8.5 Impaired Quality of Water Bodies*).

While such conflicts seem intractable, with a group such as the NCRP providing a proven framework for conflict resolution and action towards agreed-upon, shared goals, solutions can be developed. Indeed, the history of the NCRP is in part a history of stakeholders who thought they had nothing in common learning that by collaborating and engaging with sincerity and honesty, mutually beneficial outcomes can be achieved.

2.6 NORTH COAST TRIBAL COMMUNITIES

There are 34 Tribes in the North Coast. North Coast Tribal communities are each unique, however information from the U.S. Census provides information at the county level. In 2016, about 4.7% of the population in the region as a whole identified as Native American with slightly higher percentages on the northwest coast (Del Norte 5.34% and Humboldt 5.15%) and lower populations inland and to the south (Modoc 1.99% Sonoma 1.29%). Many Native Americans live in Tribal or other communities that are considered Economically Disadvantaged or Severely Economically Disadvantaged communities. This data set does not differentiate between North Coast Tribal members and those who have moved into the region as part of federal policies such as the Indian Relocation Act.

Many North Coast Tribes remain on their traditional homelands and each has unique cultural lifeways including distinct Tribal languages and relationships with their traditional territories. Each Tribe's culture has developed in relationship with their natural environment. North Coast Tribes are known for different areas of expertise and focus, including basketry, fisheries management, Tribal science-based management of natural resources, societal relationships, and use of prescribed fires and other treatments related to traditional ecological knowledge. Over a century of discrimination and cultural suppression has challenged Tribal bonds and most of those who identify as Native American participate in contemporary American culture in addition to individual participation in traditional Tribal culture. Fortunately, in recent decades Tribes have exercised resiliency and continue to practice traditional ways and application of traditional ecological knowledge. Many North Coast Tribes maintain and are continuing restoration of their language, culture, religious ceremonies and traditional environmental stewardship.

Water-related challenges for North Coast Tribes include those challenges facing the entire region (*Section 2.8.3 Aquatic Ecosystem Decline*, *Section 2.8.5 Impaired Quality of Water Bodies* and *Section 2.8.6 Water Supply & Demand: 20 Year Projection*) however for Tribes these are also a threat to the continuance of cultural lifeways impacted by climate change, legacy and emerging contaminants, low stream flows, and lack of access to traditional territories and cultural resources. These and other challenges result in the loss of fisheries, wildlife, and plants for food, medicines and other cultural needs. As communities that are often economically disadvantaged, Tribes also contend with limited funding to repair and update outdated and failing water supply infrastructure. According to recent outreach efforts, septic issues are of increasing concern in several Tribal communities; there may be an opportunity for a regional approach in addressing this and other shared issues on Tribal lands and other rural areas.

2.7 POLICY LANDSCAPE

Water management and socioeconomic issues at the regional scale cover a range of water quality, watershed health and water quantity concerns that occur widely throughout the North Coast. These issues have motivated state and federal agencies to develop a suite of programs to guide, encourage, and support protection and restoration of anadromous fish habitat, beneficial uses of water (including protection and enhancement of drinking water, as well as Tribal cultural and subsistence fishing uses), and pollution prevention. Although usually developed at a statewide, regional, or basin (WMA) scale, many of the programs are implemented at the local scale by local jurisdictions, watershed groups, Joint Powers Authorities (JPAs) or other cooperative coalitions, Tribes, or state or federal agencies. Therefore, although regional in scope, these issues ultimately are addressed at the local scale by the Tribes themselves, by local entities, and at times in cooperation with state and federal partners.

2.7.1 WATER QUALITY

The overarching federal policy that protects water quality is the Clean Water Act, which sets the basic structure for regulating discharges of pollutants to waters of the United States. There are also federal laws regulating small drinking water systems, spill prevention control, and pollutant discharges (National Pollutant Discharge Elimination System (NPDES)). The NPDES addresses water pollution by regulating point sources that discharge pollutants to waters of the United States. Program areas that effect land use in the North Coast include: animal feeding operations, industrial wastewater, municipal wastewater, pesticide use, and stormwater.

Assembly Bill 885 (1999; authorized 2012) requires the state to regulate the 1.2 million Onsite Wastewater Treatment Systems (OWTS) (i.e. septic systems) operating in California. As described in this Plan, these domestic systems, when inadequately maintained, can contribute to significant septic leakage; compound failures from inadequate waste treatment infrastructure; and contribute to bacterial and pharmaceutical impairment of natural waterbodies.

The state regulates water quality of surface and groundwater, including sources for drinking and municipal water supplies (e.g. California Water Code, Water Quality Control Act, Health and Safety Code, others). Under the oversight of the USEPA Region IX, the State and Regional Water Boards have primary responsibility for maintenance of water quality in the North Coast Region. This is achieved in part through establishment of specific, measurable water quality objectives for rivers, lakes, estuaries, and other waters in Water Quality Control Plans. The Water Quality Control Plan for the North Coast Region (NCRWQCB 2011) defines beneficial uses for state waters, including for drinking water.

2.7.1.1 BENEFICIAL USES OF WATER

The California State Water Resources Control Board (SWRCB) regulates water quality in the state. In 1972 (updated in 1996), it adopted a uniform list codifying the various "beneficial uses" for waters of the state to protect water quality and supply to retain maximum benefits for current and future generations of water consumers and stewards. On May 2, 2017, the State Water Resources Control Board adopted Resolution 2017-0027, which approved "Part 2 of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California—Tribal and Subsistence Fishing Beneficial Uses and Mercury Provisions." Within these provisions the State Water Board established three new beneficial use definitions for use by the State and Regional Water Boards in designating Tribal Traditional Culture (CUL), Tribal Subsistence Fishing (T-SUB), and Subsistence Fishing (SUB) beneficial uses to inland surface waters, enclosed bays, or estuaries in the state. [source: https://www.waterboards.ca.gov/northcoast/water_issues/programs/basin_plan/triennial_review/]

As of 2019, there are twenty -eight beneficial uses are designated within the North Coast Region, affording protection to its bays, estuaries, minor coastal streams, ocean waters, wetlands, inland surface waters, and groundwater (NCRWQCB 2011). The North Coast Regional Water Control Board has included integration of three new statewide beneficial uses as a project within the workplan of the 2018 Triennial Review of the Basin Plan initiated by staff in 2017 (*see Appendix G, Table 24, Beneficial Uses of Water in the North Coast Region).*

It is the intent of the NCRP to simultaneously support as many beneficial uses of water as possible, through implementation of the Region's diverse portfolio of local projects. Protection of beneficial uses in the Plan Goals and Objectives emphasizes surface and groundwater sources; agricultural, municipal, cultural, and wildlife uses; public health and safety; and economically disadvantaged communities. The priorities placed on particular beneficial uses is often best determined at the local (e.g. county, municipality, Tribal) level.

According to DWR (2013), irrigated agriculture in the North Coast uses most of the Region's developed water supplies (81 percent of non-environmental water use), while municipal and industrial use comprise only about 19 percent. Approximately 422,300 acres in the Region are irrigated (3.4 percent). Approximately 65 percent the Region's irrigated agriculture is in the Middle and Upper Klamath River basins (including Scott, Shasta, and Butte valleys and Tule Lake), above the confluence of the Salmon and Klamath rivers.

With respect to drinking water, the State Water Resources Control Board (Resolution 88-63) defines "sources of drinking water" as water bodies with beneficial uses designated in Water Quality Control Plans as "suitable, or potentially suitable, for municipal or domestic water supply (MUN)" and that "all surface and ground waters of the State" are "suitable, or potentially suitable" for MUN uses, with the exception of (1) contaminated waters that cannot reasonably be treated; (2) sources that do not provide sufficient water to supply a single well a sustained average 200 gallons/day; (3) water systems designated or modified to collect or treat waste, stormwater runoff, and/or agricultural drainage; (4) groundwater aquifers regulated as geothermal energy producing sources; and (5) certain site-specific cases.

Critically important to North Coast Tribes are two relatively recently adopted beneficial uses (2017):

- Tribal Tradition and Culture (CUL): Uses of water that support the cultural, spiritual, ceremonial, or traditional rights or LIFEWAYS of CALIFORNIA NATIVE AMERICAN TRIBES, including, but not limited to: navigation, ceremonies, or fishing, gathering, or consumption of natural aquatic resources, including fish, shellfish, vegetation, and materials.
- Tribal Subsistence Fishing (T-SUB): Uses of water involving the non-commercial catching or gathering of natural aquatic resources, including fish and shellfish, for consumption by individuals, households, or communities of California Native American Tribes to meet needs for sustenance.

These beneficial uses protect ancestral practices including gathering basket-making materials and fish harvest. A 2005 study of the Karuk People that the elimination of traditional foods including salmon, Pacific Lamprey, Sturgeon and other aquatic species has had "extreme adverse health, social, economic, and spiritual effects on the Karuk people (Norgaard 2005)." In 2017, in response to depressed salmon populations, the federal government closed all ocean fishing for salmon north of Horse Mountain near Eureka. The subsistence quota for the Yurok Tribe was cut to zero and only 650 ceremonial fish were allowed for over 6,000 Tribal members. Poor run size continued to be a run size into fall of 2018 (Cannon 2018). North Coast region Tribes continue to use science and political mechanisms to protect, enhance, and ultimately restore the fisheries and the watersheds that support them.

2.7.1.2 Groundwater Quality Monitoring

The Groundwater Ambient Monitoring and Assessment (GAMA) Program, created in 200, is the state's comprehensive groundwater monitoring program. The main goals of GAMA are to improve statewide comprehensive groundwater quality monitoring and increase the availability of groundwater quality and contamination information to the public and decision makers. The GAMA Program's online groundwater information system integrates and displays groundwater quality data from multiple sources on an interactive Google-based map interface.

2.7.2 WATER QUANTITY

2.7.2.1 Groundwater Management

The Sustainable Groundwater Management Act (SGMA) is a three-bill legislative package (AB 1739, SB 1168, and SB 1319) that provides a framework for sustainable groundwater management. SGMA requires governments and water agencies of high and medium priority basins to bring groundwater basins into balanced levels of pumping and recharge by developing Groundwater Sustainability Plans.

2.7.2.2 Groundwater Elevation Monitoring

The California Statewide Groundwater Elevation Monitoring (CASGEM) Program, implemented in 2009, tracks seasonal and long-term groundwater elevation trends in groundwater basins statewide. The program's mission is to establish a permanent, locally-managed program of regular and systemic monitoring in all of the state's groundwater basins. It is currently being used as a tool to help achieve goals contained in the SGMA.

2.7.3 STORM WATER PLANNING

The State Water Board is actively involved in initiatives to improvement the management of storm water as a resource, and to that end has developed its Strategy to Optimize Resource Management of Storm Water (STORMS). The intent of STORMS is to support policies for collaborative watershed-level storm water management and pollution prevention, removing funding obstacles, developing resources, and integrating regulatory and non-regulatory interests.

- SB 985 amended Water Code § 10563(c)(1) to require a public agency to develop a Storm Water Resource Plan as a condition of receiving funds from any bond approved by voters after January 2014. This bill does not apply to disadvantaged communities with a population of 20,000 or less and that is not a co-permittee for a municipal separate stormwater system NPDES permit issued to a municipality with a population greater than 20,000. The bill's intent is to encourage use of storm water and dry weather runoff as a resource to improve water quality, reduce localized flooding, and increase water supplies for beneficial uses and the environment. Plans should prioritize projects that will assist in attaining water quality outcomes.

2.7.4 FLOOD RISK AND LAND USE PLANNING

A number of state laws were enacted in 2007 regarding flood risk and land use planning. These laws encourage a comprehensive approach to improving flood management by addressing system deficiencies, improving flood risk information, and encouraging links between land use planning and flood management (DWR 2013). Local responsibilities for flood management including adopting National Flood Insurance Rate Maps, conforming to the International Building Code, and enforcing building and land use restrictions.

- AB 70 (2007) Flood Liability 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 requires cities and counties statewide to amend the land use, conservation, safety, and housing elements of their respective general plan to address new flood- related matters.

2.7.5 FOREST AND NATIVE VEGETATION REMOVAL

The federal government has multiple laws, regulations and policies about forest management. These include:

- The Bankhead-Jones Farm Tenant Act — directs the Secretary of Agriculture to develop a program of land conservation and utilization to correct maladjustments in land use and thus assist such things as control of soil erosion, reforestation, preservation of natural resources and protection of fish and wildlife.
- The Endangered Species Act of 1973 — protects animal and plant species currently in danger of extinction (endangered) and those that may become endangered in the foreseeable future (threatened). It provides for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend, both through Federal action and by encouraging the establishment of state programs.
- Forest and Range Renewable Resources Planning — establishes public land policy and guidelines for the management, protection, development, and enhancement of the public lands.
- National Forest Management Act (NFMA) — a Forest Service site with information about *The National Forest Management Act of 1976 (NFMA)*.

State laws, regulations, and policies include:

- California Forest Practice Act – enforced by the State Board of Forestry and Fire Protection to regulate logging on privately-owned lands in California.
- DFW Timberland Conservation Program – helps to conserve natural communities on timberland through environmental review of timber harvesting plans.
- Forest Ecosystem and Harvested Wood Product Carbon Accounting — requires the Board of Forestry and Fire Protection to ensure the rules and regulations governing the harvest of commercial tree species consider the capacity of forests to sequester 5 Million Metric Tons (MMT) of CO2e annually by 2020.
- Lake and Streambed Alteration Program — provides for review of projects that would alter any river, stream or lake and sets conditions to conserve existing fish and wildlife resources.
- North Coast Regional Water Quality Control Board Forest Activities Program – addresses NPS discharges associated with use of forested landscapes including timber harvest, fuels management, vegetation management, salvage logging, road construction, livestock grazing, and recreational use.

2.7.6 AGRICULTURAL LANDS

Federal laws, regulations, and policies regulating agricultural practices include:

- Clean Water Act Section 319 – addresses the need for greater federal leadership to help focus state and local nonpoint source efforts.
- National Pollutant Discharge Elimination System – addresses point source pollution from concentrated animal feeding operations, aquaculture, pesticide use, and biosolid applications.

State laws, regulations, and policies impacting agricultural practices include:

- Agricultural Lands Discharge Program — addresses water quality impacts associated with activities on agricultural lands.

- California's Porter-Cologne Act — covers any discharge activity that could affect the quality of surface water, wetlands, or groundwater.
- Cannabis Cultivation Waste Discharge Regulatory Program – contains enforceable requirements for cultivators to ensure their operations do not impact water resources
- Lake and Streambed Alteration Program — provides for review of projects that would alter any river, stream or lake and sets conditions to conserve existing fish and wildlife resources.
- State Groundwater Management Act — requires governments and water agencies of high and medium priority groundwater basins to halt overdraft and bring groundwater basins into balanced levels of withdrawals and recharge.
- Water Quality Compliance for Dairies & Concentrated Animal Feeding Operations – regulates waste discharge from dairies.

2.7.7 TRANSPORTATION

It is mostly state laws that impact NCRP projects and policies with respect to transportation. These include:

- SB 64 – California Transportation Plan (2015) — reduces greenhouse gas emissions, increases sustainability, and helps prepare the state transportation system to deal with long-term climate change.
- AB 118 – Alternative Fuels and Vehicle Technology Program (2007) — Assembly Bill 118 creates the Alternative and Renewable Fuel and Vehicle Technology Program to provide funding to public projects to develop and deploy innovative technologies that transform California's fuel and vehicle types to help attain the state's climate change policies.
- AB 1092 – Building Standards: Electric Vehicle Charging Infrastructure (2015) — requires the Building Standards Commission to adopt mandatory building standards for the installation of future electric vehicle charging infrastructure for parking spaces in multifamily dwellings and nonresidential development.
- SB 1275 – Charge Ahead California Initiative (2014) — establishes a state goal of one million zero-emission and near-zero-emission vehicles in service by 2020. Establishes the Charge Ahead California Initiative requiring planning and reporting on vehicle incentive programs and increasing access to and benefits from zero-emission vehicles for disadvantaged, low-income, and moderate-income communities and consumers.

2.7.8 RESIDENTIAL AND MUNICIPAL BUILDINGS

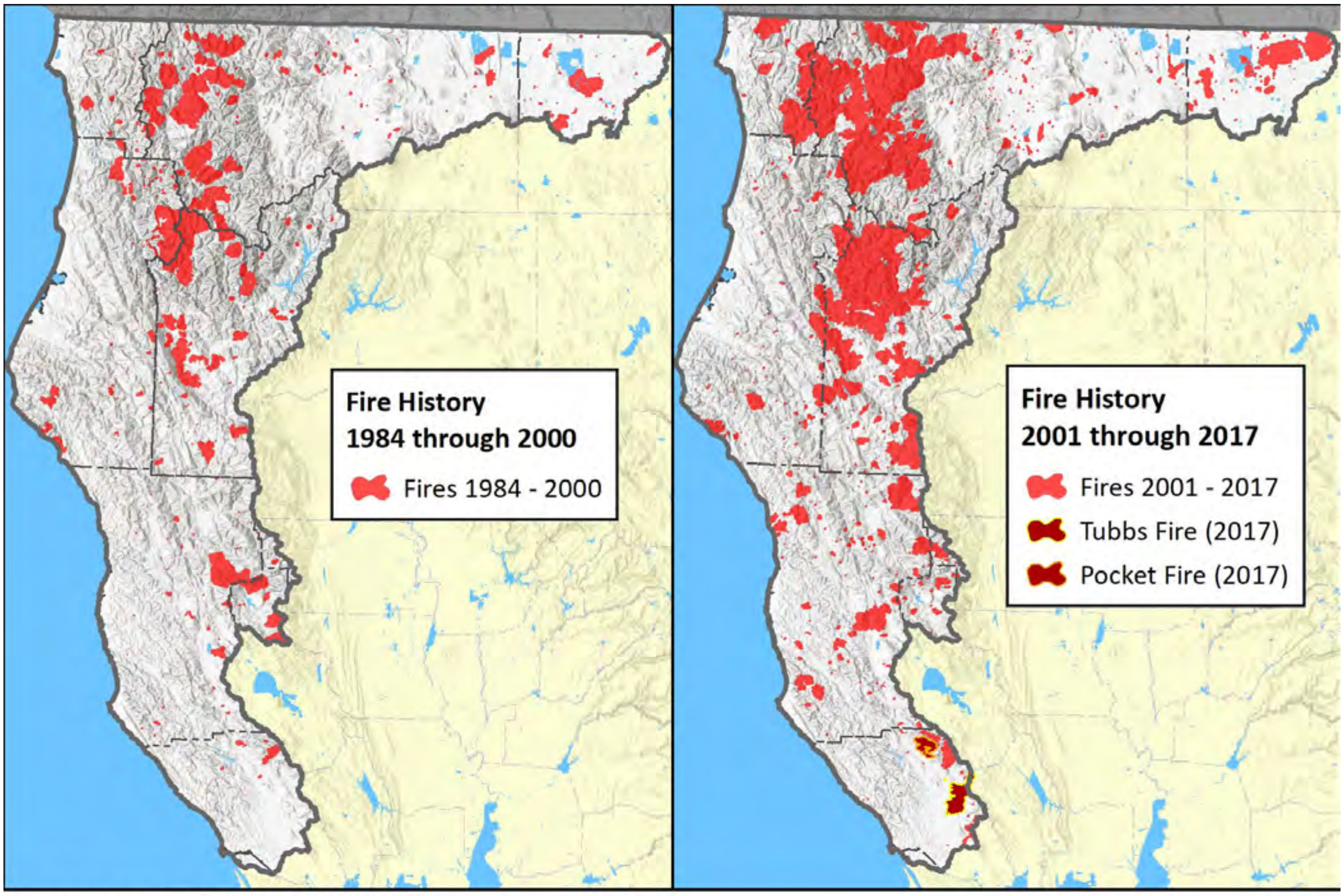
State codes are relevant to NCRP projects; these are listed below.

- California Building Standards Code — a compilation of building standards adopted by state agencies without modification from federal code, building standards modified and adapted to California's ever-changing conditions,, and building standards authorized by the California legislature that have been created and adopted to address concerns specific to California.
- CALGreen — is the first-in-the-nation mandatory green building standards code developed in 2007 in response to AB 32.

2.7.9 WILD FIRE

State regulations and codes are relevant to NCRP projects with respect to wildfire, including:

- Wildland-Urban Interface (WUI) Areas Standards, Regulations, and Information – provides construction information and a directory of WUI products that are compliant with Chapter 7A of the California Building Code and Chapter R327 of the California Residential Code.



Source: CalFire Fire Perimeters v17_1 (2017)

MAP 37 FIRE HISTORY

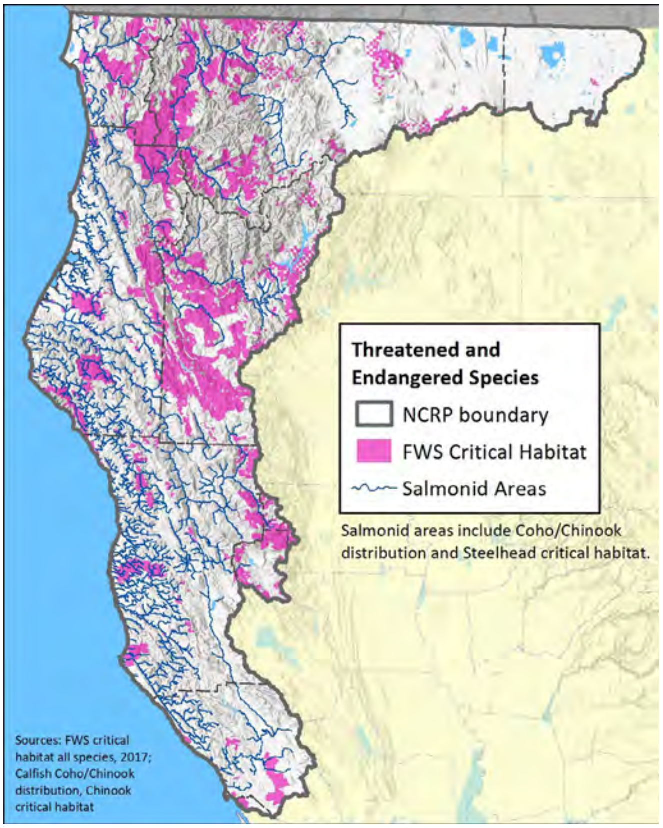
2.8 IMPACTS TO NATURAL CAPITAL

2.8.1 THREATS TO HABITATS, BIODIVERSITY & CORRIDORS

In the face of measurable changes to weather patterns induced by the changing climate, land conservation and habitat restoration are more important than ever to protect biodiversity. Wildlife species will need to migrate to access suitable habitat as habitat shifts occur due to changes in soil moisture, weather events, and temperature increases. The more habitat that is available, the more likely that each wildlife species will be able to successfully locate habitat conducive to its unique forage, shelter, and reproductive needs.

The North Coast region's environmental resources serve as habitat for a large number of plant and animal communities and large corridors of undeveloped land allow for migration, dispersal, and genetic exchange between locations.

The Region contains many species of concern, including thirty federally endangered plant species, four federally endangered fish species (including salmonids), four federally endangered bird species, and seven federally endangered mammals (*see Appendix G, Table 28, Threatened & Endangered Species*). Additionally, the region's mountains, valleys, forests, and grasslands are home to deer (*Odocoileus hemionus*), common garter snake (*Thamnophis sirtalis*), elk (*Cervus elaphus*), Vaux's swift (*Chaetura vauxi*), bear (*Ursus americanus*), southern torrent salamander (*Rhyacotrition vareigatus*), mountain lion (*Puma concolor*) and many other animal species.



MAP 38 THREATENED AND ENDANGERED SPECIES

Approximately 49% of the North Coast Region land is permanently protected by public agencies (e.g. federal, state, local), private entities, or non-profit organizations. The 2014 North Coast IRWMP lists nearly 300 protected areas including parks, preserves, reserves, recreation areas, national/ state forests, private lands, and other sites in the North Coast Region (*see Appendix H, Table 19, NCRP IRWM Plan 2014*). Conservation easements offer one means through which public agencies and non-governmental organizations (NGO) can sell parcels and keep them protected while retaining private or NGO management. Conservation easements comprise approximately 100,000 acres in Sonoma County alone. Functionally, "protection status" for these lands varies, depending on a number of factors, including how lands are managed. Extractive and recreational uses may be permitted on some public and private "protected lands," depending on the specified management status and protections afforded thereby; other protected lands are managed to mimic natural disturbance regimes and maximize biodiversity.

2.8.1.1 LIMITING FACTORS AND CHALLENGES

Land Use Practices

Land use practices that involved removal of riparian vegetation, channelization, dam construction, and other practices that led to channel incision, excessive sedimentation, increased stream temperature, and loss of migratory passage in stream channels led to a steady decline in salmonid populations. Sedimentation, increased water temperature, and chemical and biological pollution can reduce habitat viability and negatively affect at least some stages of the salmonid life cycle. Spawning salmon are known to require adequate surface flows in order to return upstream to their natal streams and clean, appropriately sized gravel in which to spawn; juveniles need intact complex habitat (a matrix of pools, riffles, large woody debris, and riparian vegetation) to provide shelter, food, cool water temperatures, and other factors necessary for survival; and smolts seek intact, unpolluted estuarine habitat to physiologically adjust to the saline environment prior to outmigration to the ocean.

Historically, habitat has been fenced off, native vegetation removed, movement corridors interrupted, and ecological function of many systems was destroyed or severely impacted. For example, buildup of fuels due to fire suppression has led to changes in composition and structure of forest and shrub land ecosystems; accumulated fuel has caused catastrophic canopy fires in systems such as oak woodlands that were formerly more open and frequently experienced ground fires that prevented fuel accumulation. Post-fire, lack of groundcover can lead to increased sedimentation and in extreme cases, landslides, when the rainy season occurs, exacerbating existing instream water quality issues and lengthening recovery time for the burned system.

Agriculture and Resource Extraction

Today, the major land uses in the Region that impact wildlife habitat are resource extraction (e.g. fisheries, timber harvest, and aggregate mining) and agriculture (e.g. vineyards, rangeland, dairies, row crops, and marijuana cultivation). Agricultural lands use significant volumes of water and a large portion of the water supply: irrigated agriculture accounts for about 80% of the developed uses of water supplies in the Region. Additionally, activities associated with agriculture, including grazing, fertilization, and soil disturbance can impact water quality through sedimentation and nutrient loading.

In addition to impacting water quality, agricultural lands also provide forage and habitat for wildlife (NCRWQCB 2011), and it is important to note that agricultural and rangelands protect habitat from urban development and provide connectivity between wildland parcels. A 2002 study of vineyards in Sonoma County found that while large predators were more likely to use native habitat, their numbers and activity levels were next greatest in vineyards adjacent to core habitat, underscoring the importance of the agricultural buffer and suggesting that riparian corridor restoration is important on these lands (Hilty and Merenlender 2004).

Aggregate mining (in-stream and upland types) is the mechanical removal of aggregates (i.e. sand, gravel, and cobble) from the Region's river systems. Aggregates are used to make concrete and asphalt, and as road base/ sub-base and drain rock. Gold mining in streams also occurs. Sediment suspension and changes to channel morphology from aggregate and/ or gold mining has degraded salmonid habitat and impaired water quality.

In recent years, the timber industry has declined as a result of economic issues, changes in international markets, and the expansion of environmental regulations (NCRP 2014). Regulations regarding timber harvest currently moderate sediment and temperature impacts to water bodies, but significant legacy effects from past practices are still present. Failure to manage national forests by thinning and harvesting has caused an unnatural massive buildup of biomass that has reduced water available to streams by canopy interception of snow and evapotranspiration in addition to setting the stage for catastrophic wildfires.

Urban, Suburban, and Exurban Development

Exurban development affects both agricultural and natural lands by fragmenting them as it "leapfrogs" beyond incorporated areas into unincorporated areas. Impacts from all types of residential development include loss of migratory/movement corridors, and stressors on water supply, water quality, air quality, and vegetative community composition in surrounding habitat as native plants are outcompeted by invasive landscape plants and weeds associated with increased human traffic.

Exurban development has been identified as the fastest growing land use in the United States (Wildlife Conservation Society 2018). It is particularly prevalent in areas of high amenity value surrounding protected areas, and while not always visually obtrusive, it is one of the more consumptive development patterns with significant impacts to biodiversity and landscape cohesion due to fragmentation caused by roads and driveway networks as well as the development itself. Studies have shown a significantly reduced survival of native species with a corresponding increase in nonnative species in areas of exurban development. Additionally, exurban development was found to have a larger overall impact on sediment levels in salmonid spawning streams due to the tendency to "leapfrog" into watersheds with intact habitat (Lohse et al. 2008).

Climate Change Impacts

Added to the existing stressors on native habitats and wildlife in the North Coast are projected stressors associated with climate change. These include warmer temperatures, greater hydrologic variability, greater evapotranspiration and the associated increased water demand for landscapes and agricultural crops, variable runoff and groundwater recharge, increased wildfire risk, and shifts in natural vegetation types (Micheli et al. 2018). The shifts in vegetation patterns due to changing abiotic conditions will force wildlife to move to continue to live in habitat conducive to its needs. If such vegetation no longer occurs in protected areas, the wildlife dependent on that habitat may have nowhere to survive.

2.8.1.2 FUTURE OPPORTUNITIES, PLANNING, AND STRATEGY

The North Coast Region is fortunate to contain multiple entities that recognize the threats that land use, current development patterns, and climate change pose to native habitats and wildlife and who are studying how to address these issues. The Pepperwood Preserve in Sonoma County and other Bay Area and regional organizations are sharing their work with local resource managers as data sets and case studies featured on the California Climate Commons, which was established by the multi-jurisdictional California Landscape Conservation Cooperative. The Pepperwood Preserve's Terrestrial Biodiversity Climate Change Collaborative (TBC3) is leading development of empirically-based high-resolution climate-hydrology projections designed to support site-specific conservation solutions.

2.8.2 NON-NATIVE INVASIVE SPECIES

People have long benefitted from the deliberate introduction of plant and animal species from foreign locations. These species have diversified diets and supported cultural development for millennia. However, species that have been introduced from outside ecosystems (i.e. "exotic" species) can invade native systems because they are no longer controlled by their natural predators or pathogens and thus may have a competitive advantage over native species. In some cases [e.g. Giant Reed (*Arundo donax*) in riparian ecosystems, bullfrogs (*Rana catesbeiana*) in freshwater ponds and streams, or yellow star thistle (*Centaurea solstitialis*) in rangelands], the relatively rapid changes posed by invasive species can threaten ecosystem function, trophic structure, agricultural and other working lands, water delivery systems, and flood control infrastructure. With specific respect to integrated water/ land management, invasive species may consume valuable water resources; upset ecological and hydrologic processes; clog water delivery systems; reduce floodplain capacity, weaken flood infrastructure, and increase flood danger; increase wildfire risk; degrade recreational opportunities; destroy productive range and timberlands; change agricultural patterns; degrade salmonid habitat; and disrupt resource-based economies.

There are estimated to be 482 invasive plant species region-wide. Species frequently cited as of particular concern to North Coast stakeholders and local entities are *Arundo donax* (a.k.a. Giant Reed, Wild Cane), *Ludwigia peploides* (a.k.a. Creeping Water Primrose), freshwater zebra (*Dreissena polymorpha*) and quagga (*D. rostriformis*) mussels, warm water fishes, Sudden Oak Death (SOD) (*Phytophthora ramorum*), and agricultural pests such as Glassy-Winged Sharpshooter (*Homalodisca vitripennis*), which is a vector for Pierce's disease, a lethal bacterial infection of grapevines for which there currently is no known cure. The negative effects of some of these invasives (highlighted below) are more pronounced than others.

- *Arundo donax* is robust perennial grass that is native to Asia and widely used locally for horticultural purposes. It grows up to 30 feet tall in dense bamboo-like stands. Arundo favors low-gradient riparian areas, estuaries, and coastal streams. Arundo establishment displaces native plants and associated wildlife species because of the massive stands it forms (Cushman and Gaffney 2010). Establishment may alter hydrologic processes, reduce groundwater availability, contribute sediment to streams, constrict channel flows, and/or exacerbate flooding. Arundo is considered an issue of concern throughout the Region.
- *Ludwigia peploides* is a perennial freshwater aquatic plant native to Florida that forms very dense, virtually impenetrable mats that can grow up to several feet tall. Vegetation mats restrict fishing and boat access; out competes native aquatic plants; and alters aquatic ecosystem function. Ludwigia can be found in rice fields, ditches, ponds, slow moving streams, and along edges of lakes and reservoirs. In the North Coast, Ludwigia is noted as a particular concern in the Laguna de Santa Rosa (Sonoma County) .
- *Dreissena polymorpha* mussels are native to Eastern Europe and Western Asia but they been introduced into aquatic ecosystems and water management systems throughout southern California. They are not yet documented for the Region. Mussels are introduced through ballast water releases by boats and translocation of contaminated boats to new areas. There is great potential for these and other aquatic mollusks (i.e. possibly New Zealand mud snail *Potamopyrgus antipodarum*) to colonize and devastate built infrastructure (e.g. by clogging pipes) if they invade Region water supply reservoirs, and ecosystem function if they are established into habitats.

It is anticipated that climate change effects (e.g. warming temperatures, increasingly variable precipitation) will cause shifts in the range occupied by both native and introduced species: in many instances, this is exhibited as range expansion for the invader, and range reduction for the local species. Landscape disturbances, which often are associated with extreme climate events (e.g. wildfire, flood, drought), can favor or even be facilitated by non-native species which may exhibit greater tolerance of a range of environmental conditions that that of locally adapted species. It is common for invasive species to produce large numbers of seeds or young; to disperse or migrate effectively; and to tolerate extreme conditions so as to colonize disturbed sites well in advance of native species (CNRA 2009).

2.8.2.1 REGULATORY CONTEXT

California food and agriculture regulations, numerous state codes (e.g. California Department of Fish and Wildlife Code, Harbors and Navigation Code, Public Resources Code), and Senate and Assembly legislation are meant to promote invasive species management and control efforts. Assembly Bill 2631 (2004) proposed the creation of the California Invasive Plant Council (Cal-IPC). Cal-IPC works voluntarily with land managers, researchers, policy makers, and concerned citizens to address invasive plant species locally. Additionally, the 2010 303(d) list includes non-native invasive species as a pollutant that impairs waterbodies: in the North Coast, Bodega Harbor HA is listed as impaired by exotic species (crabs), which will necessitate the development of a TMDL.

2.8.2.2 EFFORTS TO ADDRESS THE ISSUE

The only truly effective means of completely managing invasive species impacts is to prevent their establishment and remove them from areas where they are established. From a practical standpoint, preventing all new occurrences of invasive species is virtually impossible: eliminating invasive species from all North Coast ecosystems would likewise be virtually impossible. Instead, the NCRP aims to support targeted efforts to combat the spread of or reduce the expressed impact of local outbreaks of high priority invasive species that do harm to aquatic wildlife, water resources, and/or water management systems. Effective management of established invasive species will require collaborative, cross-jurisdictional efforts focused at the local watershed scale, and may best be integrated as part of existing land and water management efforts underway by counties, municipalities, and Tribes in the Region. Best Management Practices for the prevention and mitigation of invasive species are established and can help guide NCRP local project planning and implementation.

Several organizations in the North Coast are actively working to remove invasive species using a watershed approach. North Coast RCD's provide a valuable source for NCRP interface with private landowners who might be interested in removal of invasive species on their properties. Weed Management Areas are another local resource with potential to help address invasive plants. WMAs are county-based groups composed of diverse stakeholders interested in weed control and focused on mapping, education, and on the ground control projects.

The California Department of Fish & Wildlife Aquatic Invasive Species Program addresses cases of invasive algae, invertebrates, and fishes in streams, bays, wetlands, and coastal areas. There are numerous resources available to help prioritize and implement invasive species programs locally. The USDA Agricultural Resources Library provides a comprehensive "Invasive Species Resources" list with web links to dozens of agency, academic, and private programs, projects, and tools to help North Coast entities to confront invasive species of priority to them, in a manner that is compatible with existing planning and implementation efforts.

2.8.3 AQUATIC ECOSYSTEM DECLINE

Freshwater ecosystems occur throughout the North Coast Region and consist of three types: lotic, lentic, and wetland ecosystems. Lentic ecosystems contain slow moving water (e.g. pools, ponds, and lakes); lotic ecosystems are faster moving (e.g. streams and rivers); and wetlands are ecosystems in which soil is saturated or inundated with water at least part of the year (e.g. freshwater marsh, vernal pools). Closely related to lotic systems and addressed in this section are riparian ecosystems. For the purposes of this section, we define riparian areas as the land area encompassing the river channel and its potential floodplain. The riparian zone is characterized by unique physical attributes that distinguish it from the surrounding landscape. These include river flooding, rich and productive soils, and a relatively shallow near-stream water table — attributes that, when coupled with weather events and fluvial conditions, create a wide variety of growing conditions and subsequent heterogeneity of structural forms (e.g. forests, shrublands, wetlands, meadows, grasslands) that support a greater diversity of wildlife than any other habitat type (Riparian Habitat Joint Venture 2009).

When fully functional, these aquatic-based systems provide vital services to communities in the North Coast, such as water supply, nutrient transport, water quality, fish production, flood attenuation, health benefits, and water-dependent recreational opportunities. Many of these benefits are recognized as having tangible monetary value. The abundant freshwater ecosystems in the Region also provide essential habitat for anadromous fish and other aquatic species as well as a majority of terrestrial wildlife.

The existence and functionality of the region's aquatic ecosystems is fundamentally based on regional water inputs and outputs. From an ecosystem perspective, two main environmental water sources for the North Coast are in snowpack and in precipitation runoff/ groundwater recharge. Major changes are expected in the availability of water for aquatic ecosystems, as both snowpack/ melt and recharge/ runoff are projected to decline and climatic water deficits are projected to increase.

Some of the river systems in the North Coast Region still possess intact fluvial geomorphic processes and the habitats that form in response to them, but many of these systems have been impacted to at least some extent by timber harvest, mining, invasion of non-native plant species, or other stressors. In some locations, natural processes have been impaired by land use changes including channelization, road development, agricultural activities, gravel mining, and dam construction. The implementation of Best Management Practices (BMPs) for forest management, agricultural enterprises, construction activities, and other land uses, and regulations requiring riparian setbacks have lessened negative impacts, and habitat restoration projects by Tribes, RCDs and conservation groups have helped to protect and enhance these stream systems. However, timber harvest, road construction, agricultural activities, urban development, gravel extraction, and other human activities continue to cause habitat degradation. Forest management for timber harvest by both industrial and nonindustrial landowners has become a contentious issue with regard to how logging practices and road building impact watershed resources via sedimentation, and other cumulative effects.

2.8.3.1 EROSION AND SEDIMENTATION

Ten of the 14 hydrologic units in the Region include water bodies impaired by excess sediment (DWR 2013). Sedimentation is a naturally occurring process, and, when it is generated at natural levels, it is an important component in the aquatic environment. Sediment levels are naturally elevated during times of high rainfall and runoff and aquatic organisms possess life history strategies that have adjusted to the natural timing, duration, and levels of sediment. However, land use activities in the North Coast Region have accelerated erosion processes and altered the timing, duration, and amount of sediment delivery to levels significantly outside the natural range. Excess sediment has led to infilling of streams, which adversely impacts drinking water supplies.

Additional problems associated with excess sediment include:

- Decrease in the complexity of aquatic plant communities by decreasing light penetration
- Unnatural aggradation of stream beds which causes increased flooding
- Decrease in the availability of refugia – isolated habitats that retain environmental conditions that were once widespread
- Physical scouring of plants, insects, and other invertebrates from the streambed, thereby reducing food sources for aquatic and terrestrial wildlife
- Transportation of sediment-adsorbed chemicals, such as pesticides, from land to water
- Interference with disinfection of drinking water
- Interference with the delivery of water supplies by added wear on water pumps

2.8.3.2 WATER QUALITY AND QUANTITY

Legacy land use practices continue to impact water quality. Historic timber harvest methods caused extreme sedimentation and loss of canopy cover and agricultural practices led to clearing riparian vegetation, polluted runoff, and draining of wetlands. These, combined with other legacy road and infrastructure construction activities resulted in many aquatic and riparian ecosystems that were once suitable habitat becoming marginal or unusable.

Residential development and urban and suburban areas also have a large impact on nonpoint source pollution and water demand. Low density, exurban residential development is the fastest growing land use in the United States and the zone of exurban development is much larger than the combined footprint of urban and suburban development (Newburn and Berck 2011). It is particularly prevalent in areas of high amenity value surrounding protected areas, a description which covers much of the North Coast Region. Residential development of any type has a large impact on aquatic ecosystems because there is little to no regulation on use of pesticides, fertilizers, or other pollutants such as cleaning supplies, automobile products, or other home and garden products. Improper or excessive use of these environmental contaminants can lead to serious impacts to the Region's waterways that are difficult to diminish or ameliorate.

In addition to land use practices, channel modifications for flood control and water diversions for crop irrigation and drinking water supply have radically changed water quality conditions in many water bodies in the region. Ranney collectors — horizontal wells adjacent to or under the bed of a stream — provide the drinking water for many of the northern communities in the region. These collectors are actually collecting surface water, which decreases the amount of surface water available for other beneficial uses. Reduced natural flows from both Ranney collectors and instream diversions can result in increased temperature, decreased capacity to dilute contaminant concentrations, and decreased dissolved oxygen.

The state's legalization of medical and recreational cannabis has drastically increased cannabis cultivation in the North Coast, especially in the "Emerald Triangle:" Humboldt, Mendocino and Trinity counties. Unregulated (illegal) marijuana grows are ongoing problems in federal and state lands where creeks and streams are diverted, often running dry, and cultivation techniques involving fertilizer, insecticides, rodenticides are improperly conducted, leading to contamination of both waterways and the food chain. In many coastal watersheds throughout the region, significant, localized water diversions via riparian right have impacted listed salmonids region-wide, and affected water supply security for rural water users, communities, and small municipalities. These watersheds are approaching a population threshold where population is large enough to create water supply problems and aquatic ecosystem impacts, but too small to create community-scale water systems.

2.8.3.3 CLIMATE CHANGE IMPACTS

Climate change is expected to exacerbate and compound the challenges facing functional aquatic ecosystems. Increased heat, decreased rainfall, and increased frequency and intensity of precipitation events are expected to add to existing impairments (e.g. increased water temperature, decreased dissolved oxygen, and increased pollutant load) and threaten the survival of aquatic and terrestrial wildlife as well as the continued viability of those dependent on high quality instream water supplies such as farmers, ranchers, and water dependent recreation purveyors. Fire risks are projected to increase across the region, increasing the probability of a "fire within the next 30 years" on average by 40% end of century (Micheli et al. 2018). In Del Norte County, a summer temperature increase of 3° F is projected by 2050, increasing to as much as 6° F by 2100; this temperature is expected to increase the fire risk by 250% by the end of the century (Earth Economics 2018). Following wildfires, watersheds experience increased landslides and sediment loading to streams, diminishing water and habitat quality. Sea level rise is projected to affect low lying coastal areas adjacent to the ocean and streams, especially during extreme high tides, winter storm events and episodes of large ocean swells. This increases potential for saltwater intrusion in coastal groundwater basins; but given the adequate coastal basin recharge that occurs, saltwater intrusion is not generally expected to be problematic in the North Coast (2ND Nature 2013).

The *North Coast Climate Vulnerability Analysis* (2NDNature 2013) found an increased risk of water conflicts between urban, agriculture, and environmental beneficial uses of water due to expected changes in rainfall coupled with increased heat events: this is of concern because the Region has already been struggling with conflicts between water users. For example, the Klamath Project has been extremely controversial; to maintain adequate instream fishery flow to ensure the survival of endangered salmonid populations, water to farms has at times been cut off to prevent harm to the fisheries, resulting in extreme controversy and conflict. Likewise, environmental groups in the Eel River watershed are opposing relicensing of the Potter Valley Project, which diverts the Eel River into the Russian River watershed, providing irrigation water for farmers in the Potter Valley and downstream in the Russian River and also providing some electricity through a hydropower plant. Such controversies will be exacerbated if water availability decreases while demand increases as is projected by most climate models.

2.8.4 SALMONID POPULATION DECLINE

The Region's native, naturally spawning populations of steelhead, Chinook, and Coho salmon have all declined dramatically in the past five decades and all three are listed as threatened or endangered. Coho in particular are considered "very close to extinction," with only 2-3,000 individuals in the Southern Oregon-Northern California Coast (SONCC) ESU (NMFS 2012). Critical habitat has been designated for salmonids in the North Coast (*see Appendix G, Table 31, Critical Habitat of Salmonids in the North Coast Region*).

The decline in salmonid population numbers since the 1940s is considered to be a result of a combination of human-caused and natural factors that occur in fresh water, in estuaries, and in the ocean. These include, but are not limited to:

- Water quality degradation, including sediment, temperature, and chemical contaminants
- Habitat loss and degradation
- Impediments to migratory fish passage
- Reduced stream flows
- Non-native invasive species
- Hatchery fish, which can introduce disease and genetic contamination
- Ocean conditions that negatively impact marine productivity

Two interrelated but distinct types of factors are affecting salmon: those occurring on land and in freshwater, and those occurring at sea. The former may be the subject of and respond positively to management efforts; the latter is, literally, beyond local solutions.

2.8.4.1 WATER & LAND USE IMPACTS TO SALMONIDS

According to National Marine Fisheries Service (NMFS) Office of Protected Resources, water storage, withdrawal, conveyance, and diversions for agriculture, flood control, domestic, and hydropower purposes have greatly reduced or eliminated historically accessible habitat and/or resulted in direct entrainment mortality of juvenile salmonids. Modification of natural flow regimes have resulted in increased water temperatures; changes in fish community structures; and depleted flows necessary for migration, spawning, rearing, and flushing of sediment from spawning gravels; and altered gravel recruitment and transport of large woody debris. Physical features of dams, such as turbines and sluiceways, have resulted in increased mortality of both adult and juvenile salmonids and attempts to mitigate adverse impacts of these structures have to date met with limited success. Historic timber management practices caused extreme sedimentation and loss of canopy cover, which caused streams that were once suitable habitat to become marginal or unusable; these legacy impacts continue to affect North Coast streams. The implementation of Best Management Practices (BMPs) and regulations requiring riparian setbacks have lessened these negative impacts, however, timber harvest, road construction, and related activities continue to cause habitat degradation to a more limited extent. Management of timber lands by both industrial and non-industrial landowners has become a contentious issue with regard to how logging practices and road building impact watershed resources, sedimentation, and cumulative effects (NCRWQCB 2004). Additionally, native cold-water species, such as salmonids, are particularly vulnerable to potential climatic and hydrologic changes (Moyle et al 2013).

2.8.4.2 OCEAN CONDITIONS & MARINE PRODUCTIVITY

In recent decades, scientists have demonstrated that there are (1) recurring, decadal-scale patterns of ocean-atmosphere climate variability in the North Pacific Ocean (Mantua et al. 1997, Zhang et al. 1997), and (2) correlations exist between these oceanic productivity "regimes" and salmon population abundance in the Pacific Northwest and Alaska (Hare et al. 1999, Mueter et al. 2002). There seems to be little doubt that survival rates for salmonids in the marine environment can be strong determinants of observed population abundance trends. The observed and reported increases in some salmon populations and/or fisheries (e.g. 2011/ 2012 Chinook in Klamath River) in recent years may, therefore, be largely a result of more favorable ocean conditions leading to higher juvenile recruitment to North Coast streams. The predicted changes to climate could affect ocean productivity in unpredictable and uncontrollable ways. According to NMFS (2005) "it is reasonable to assume that salmon populations have persisted over time, under pristine conditions, through many such cycles in the past. Less certain is how the populations will fare in periods of poor ocean survival when their freshwater, estuary, and nearshore marine habitats are degraded."

2.8.4.3 REGULATORY CONTEXT

Three salmonid species inhabit the North Coast Region streams, rivers, estuaries, and coastal waters: Steelhead (*O. mykiss irideus*), Chinook (*O. tshawytscha*), and Coho (*O. kisutch*) salmon. Populations of all three species are listed as "Threatened" and/or "Endangered" and thus protected by the US and state Environmental Protection Agencies under the federal and state Endangered Species Acts; the California Environmental Quality Act; California Code of Regulations (Title 14 Natural Resources); Fish and Game Code; state Forest Practice Rules, and elsewhere. Protection of salmonid habitats is particularly addressed in section Fish and Game Code 1600-1616 (Lake and Streambed Alteration Program) and in state Forest Practice Rules (Timberland Conservation Program). Water quality and flow regulations also directly impact salmonids.

SWRCB 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.

2.8.4.4 EFFORTS TO ADDRESS THE ISSUE

The National Marine Fisheries Service is leading salmonid recovery nationally and coordinating efforts statewide, including in the North Coast. NMFS has released a recovery plan for Coho (NOAA 2012) with specific recovery and monitoring recommendations for the Region's watersheds; a multi-species salmonid plan will be released in 2014. NMFS considered a wealth of salmonid- and watershed- related data provided by state agencies (e.g. CDFW) and other available sources, and has recently (2014) distilled them into Recovery Steps that are specific to the stream basins of the North Coast Region. Salmonid recovery efforts are being led at the state level by CDFW, which in 2004 released the Recovery Strategy for Coho Salmon. The Department previously published the Steelhead Restoration and Management Plan (CDFW 1996) and created the California Salmonid Stream Habitat Restoration Manual (CDFW 1994, 1998, 2010), which is used as a guide by restoration practitioners throughout California and will be utilized for the implementation of several NCRP prioritized projects.

Locally, Tribes, watershed groups, and partnerships such as the Karuk, Hoopa, and Yurok Tribes, Five Counties Salmonid Conservation Program (5C), Mattole Restoration Council, and the Shasta-Scott Recovery Team are working cooperatively with regulatory agencies, landowners, and other stakeholders to implement projects that benefit salmonid habitat. Numerous local agencies, water districts, and NGOs contribute to salmonid recovery via a diversity of conservation, management and restoration activities. The NCRP provides a unifying framework for need identification and prioritization of these projects, a forum in which local concerns and state and federal requirements may be exchanged and disseminated, and a regional body for coordination and analysis of monitoring efforts. Recovery of listed salmonids in the Region also includes large-scale watershed-based recovery efforts that have, in some cases, contributed to conflict over agricultural water supply. The Klamath River Basin, for example, has long been a focus of attention by multiple state and federal agencies, Tribes, and stakeholders. The Klamath River Basin Fisheries Task Force (KRBFT) was authorized by Congress in 1986 and is oversaw a 20-year effort to restore salmonid fishery values to the Klamath watershed (NCRWQCB 2005). In April, 2016, the US DOI, Department of Commerce, PacificCorp, and the states of Oregon and California signed an agreement that, following a process administered by the Federal Energy Regulatory Commission is expected to remove four dams on the Klamath River by 2020. Under the agreement, PacificCorp transfers its license to operate the dams to the Klamath River Renewal Corporation, which will oversee dam removal in 2020 (US DOI 2016). The project has been approved in a draft Environmental Impact Report by the California State Water Resources Control Board and has already been approved by the Oregon Department of Environmental Quality (Plaven 2019).

NMFS (2012) estimates that the recovery of just Coho salmon could take 50 to 100 years with costs for implementing the actions estimated at roughly $1.5 billion. However, there are associated benefits: "viable salmonid populations provide ongoing direct and indirect economic benefits as a resource for fishing, recreation, and tourist-related activities. Every dollar spent on Coho salmon recovery will promote local, State, Federal, and Tribal economies, and should be viewed as an investment with both societal (e.g., healthy ecosystems and clean rivers where we and our children can swim and play) and economic returns" (NMFS 2012). Additionally, the salmonid recovery is important to the spiritual and social well-being of local Tribal communities.

2.8.5 IMPAIRED QUALITY OF WATERBODIES

According to the SWRCB, the present water quality within the North Coast Region generally "meets or exceeds" state and regional water quality objectives set forth in Section 3 of the North Coast Basin Plan (NCRWQCB 2011). The Basin Plan defines 27 Beneficial Uses of waters that are protected by the state. The priorities placed on particular "beneficial uses" is perhaps best determined at the local (e.g. county, municipality, Tribal) level.

In most cases the Region's water quality is "sufficient to support, and in some cases, enhance the beneficial uses assigned to water bodies" (NCRWQCB 2018). However, the Basin Plan also estimates there are 20,298 miles (32,667 km) of impaired streams in the Region. Each designation of "impaired" requires development and implementation of a TMDL Plan to reduce pollution loads to acceptable levels. In many cases, impaired waters flow directly into protected areas, including the Marine Managed Areas, Wild and Scenic Rivers, and Critical Habitats of federal and/or state listed species, (*see Section 2.3.4, Protected Areas*).

Drinking and municipal water supplies are directly impacted by the "impaired" quality of regional rivers, streams, lakes, groundwaters, and other waterbodies. This is because, with a few exceptions, the state considers drinking and municipal water supplies to be potentially "all surface and ground waters." Impaired water bodies cannot, by definition, support drinking/municipal uses. Drinking water is of particular concern as it relates directly to public health. Recognizing this, the NCRP has highlighted drinking water quality as a particular concern.

Two types of water pollution sources are commonly defined: Nonpoint Sources (NPS) of pollution include stormwater runoff from industry and urban areas and runoff originating from roads, agriculture, timber harvest, construction sites, channel modification, and gravel mining; and Point Sources of pollution (including bacterial and chemical pollutants such as MTBE, PCE, dioxins, and estrogens, as well as temperature) originate from failing POTWs, large-scale agricultural operations, and industrial facilities. In the North Coast, nonpoint sources currently present a more widespread issue, because point sources are fairly discrete and have responded relatively well to targeted efforts at improvement. Nonpoint sources, particularly sediment from upland and instream erosion, and increased temperatures due to reduced flows and removal of riparian vegetation are more numerous, harder to identify, and are challenging to control.

Inadequate wastewater treatment and aging septic tanks are widespread and common sources of bacteriological contamination. Locally, shellfish harvesting beds in Humboldt Bay have been closed multiple times due to nonpoint source runoff, most often following large rain events. Additionally, as the mariculture industry in Humboldt Bay is being proposed for expansion, questions regarding its legacy of and potential for environmental degradation have come into focus (Sims 2017). Mercury, a legacy pollutant from mining and other industrial activities, concentrates in fish tissue and has been found to be of concern in Lakes Pillsbury, Mendocino, Sonoma, and in the Laguna de Santa Rosa. Fish consumption advisories for mercury have been issued for these waterbodies by the Office of Environmental Health and Hazard Assessment working in coordination with California Department of Public Health – Environmental Health Investigations Branch (see https://oehha.ca.gov/fish/advisories). Additionally, fuel constituents, such as MTBE, chemicals from wood treatment at lumber mills, agricultural (i.e. silvicultural) operations, and residential applications are region-wide water quality issues. Reduced flows in rivers and streams can result in increased temperature and decreased capacity to dilute contaminant concentrations. Decreased precipitation and stream flow patterns (notable, reductions in both) are expected under most climate change scenarios.

Resolution of impaired water quality is hindered by lack of adequate funding, for nearly all North Coast local entities. Funds are needed to develop a Regional Water Quality Monitoring Plan; to conduct comprehensive sub-regional watershed and groundwater assessments; to implement upgrades that reduce POTW permit violations; and to build new facilities where the need exists, but infrastructure does not.

2.8.5.1 REGULATORY CONTEXT

Comprehensive water quality planning is mandated by the Federal Clean Water Act (for navigable waters); California Water Code (for ground and surface waters); and the state's Porter-Cologne Water Quality Control Act. The Clean Water Act requires states adopt water quality standards and authorizes the preparation of wastewater management plans. Under the oversight of the USEPA Region IX, the State and Regional Water Boards have primary responsibility for maintenance of water quality in the North Coast Region, including setting water quality objectives and standards, and designating "beneficial uses" for water. The Porter-Cologne Act devises and adopts water quality control basin plans and authorizes the State Water Board to adopt, review, and revise state water policy.

In 1972 (updated in 1996), the SWRCB adopted a uniform list codifying the various "beneficial uses" for waters of the state to protect water quality and supply to retain maximum benefits for current and future generations of water consumers and stewards. Three additional beneficial uses were added by the SWRCB in May 2017 through resolution 2017-0027 which established three new beneficial use definitions for use by the State and Regional Water Boards in designating Tribal Traditional Culture (CUL), Tribal Subsistence Fishing (T-SUB), and Subsistence Fishing (SUB) beneficial uses to inland surface waters, enclosed bays, or estuaries in the state. Twenty-eight beneficial uses are designated within the North Coast Region, affording protection to its bays, estuaries, minor coastal streams, ocean waters, wetlands, inland surface waters, and groundwaters (NCRWQCB 2011). The North Coast Regional Water Quality Control Board is completing a triennial review of this basin plan which will be competed in 2121.

To address stormwater quality (and supply) issues, the US Congress in 1987 added Section 402(d) to the federal Water Pollution Control Act (a.k.a. Clean Water Act), which requires National Pollution Discharge Elimination System (NPDES) permits from municipalities and industries (including construction sites one acre or larger), to the maximum extent practicable and utilize technologies to achieve water quality improvement (NCRWQCB 2011). The State Water Resources Control Board (SWRCB) and the US Environmental Protection Agency (USEPA) regulate the runoff and treatment of stormwater in industrial, municipal and residential areas of the Region. Cities and other jurisdictions that operate large and medium and small stormwater systems as well as specific industrial activity sites must apply for stormwater permits. The SWRCB has embarked upon a new Storm Water Strategy (STORMS), which seeks to "*lead the evolution of storm water management in California by advancing the perspective that storm water is a valuable resource, supporting policies for collaborative watershed-level storm water management and pollution prevention, removing obstacles to funding, developing resources, and integrating regulatory and non-regulatory interests.*"

In 2004, the NCRWQCB adopted Resolution No. R1-2004-0087, the Total Maximum Daily Load (TMDL) Implementation Policy for Sediment-Impaired Receiving Waters in the North Coast Region, which is applicable to all sediment-impaired watersheds in the Region (NCRWQCB 2004). The goals of the TMDL Implementation Policy are to control sediment waste discharges so that TMDLs are met, sediment water quality objectives are attained, and beneficial uses are no longer adversely affected by sediment.

California Water Code (Section 10920) and Senate Bill x7-6 (2009) require the establishment of statewide groundwater monitoring by locally designated "Monitoring Entities." DWR addresses this requirement through its statewide Groundwater Elevation Monitoring Program (CASGEM). DWR ranks the Region's groundwater basins and sub-basins (Map 17 "Groundwater Basins & Sub-Basins") as "high," "medium," or "low" priority. The current status of the North Coast groundwater basins is described in Sections 2.3.7 Hydrology and Section 2.3.8 Water Quality.

2.8.5.2 EFFORTS TO ADDRESS THE ISSUE

Regional activities focus on continuing to regulate point source discharges, reducing erosion and runoff from confined agricultural and municipal areas, maintaining groundwater cleanup programs, improving public outreach and education, and promoting water reuse and recycling programs. NPS water quality issues are a primary concern and are being addressed through the TMDL process, which is developed and implemented at a watershed scale; the NCRWQCB Water Quality Control Plan for the North Coast Region; and the SWRCB Nonpoint Source Program Strategy and Implementation Plan. The SWRCB has indicated a preference for voluntary compliance with regulations and TMDL implementation, and many groups and programs (e.g. local RCDs, the Gualala River Watershed Council, and Rangeland Water Quality Management Plans) offer landowners technical assistance to address local NPS issues on their properties. A number of NCRP projects include cooperative participation by local landowners in nonpoint source pollution control.

Land cover and land use directly impacts or supports source drinking water quality (DWR and USACE 2012). Forest cover is correlated to drinking water treatment costs: the more forest in a source watershed, the lower the treatment costs (Ernst et al. 2004).

With regard to stormwater runoff, the State Water Resources Control Board (SWRCB) and the US Environmental Protection Agency (EPA) have regulated the runoff and treatment of stormwater in industrial, municipal and residential areas. The effort falls into several distinct categories with the same goals to (1) use stormwater as a resource and to (2) reduce harmful pollutants, fertilizers, debris and other materials carried into storm drains, drainage systems and ultimately the Region's rivers, estuaries, and marine areas. Past efforts to manage stormwater quality and quantity have focused on controlling entry of pollutants into waters, and implementing good management practices; both these strategies remain critical. However, the approach to stormwater has shifted, emphasizing local strategies that aim not only to prevent flood-related problems, but also to provide ecosystem and community benefits (DWR and USACE 2013).

Another effort at water quality improvement is a collaboration of Tribes in the North Coast led by the Cher-Ae-Heights Indian Community of the Trinidad Rancheria (described in DWR 2013). This group was formed to assist local tribes interested in collaborating to develop an environmental assessment and implementation plan for improving ecosystems and water quality in order to meet or exceed federal and State regulations regarding water quality. Tribes currently involved in this collaboration include the Trinidad Rancheria in Trinidad, Blue Lake Rancheria Tribe in Blue Lake, Bear River Tribe in Loleta, and Big Lagoon Rancheria in Arcata. One main function of the cooperation is to assist the members in obtaining grant funding for local water quality infrastructure improvements.

2.8.6 WATER SUPPLY & DEMAND: 20 YEAR PROJECTION

Water available to supply the many beneficial uses defined by the NCRWQCB (2018) includes that which comprises the Region's groundwater basins, rivers, streams, lakes, reservoirs, estuaries, bays, and reclaimed waters. Local water availability is a function of the volume of these sources; applicable regulations that dictate water rights and water distribution; and future conditions that influence long-term supply and demand (e.g. population change, climate change). In some notable cases (e.g. the Klamath Basin), the need to secure water supply availability has led to prolonged, sometimes vehement, disputes between stakeholders.

Instream impoundments in the North Coast Hydrologic Region have the potential to supplement water supplies, but 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.; DWR 2013).

Inter-basin water diversion for agricultural and human use is occurring within the Region (e.g. from the Eel to the Russian River watershed). Water is transferred outside of the region: from the Russian River to supply municipal water for the North San Francisco Bay Area, and from the Trinity River to the Central Valley for agricultural uses. The Eel River diversion at Potter Valley provides power production and incidental supplemental water to the Russian River. However, the associated flow reduction in the Eel River has contributed to reductions in fish spawning habitat and increased water temperatures (CEED 2002). Flows from the Trinity are integral to the ecosystem health of the Lower Klamath River. The Trinity River Division (TRD) of the Central Valley Project (CVP) was completed in 1965 and has received attention from the Secretary of Interior, Bureau of Reclamation, Native American Tribes, and a broad spectrum of stakeholders. On December 29, 2000 the Secretary of the Interior signed the Trinity River Record of Decision (ROD) to require higher releases to the Trinity River from Lewiston Dam. The Westlands Water District and others filed suit to have the Trinity ROD set aside through an injunction. There have been multiple rulings from the Federal Court since that time, however, the ROD remains in effect as of water year 2018 (TRRP undated).

In coastal watersheds throughout the Region, significant, localized water withdrawals via riparian right have impacted listed salmonids and reduced water supply security. This is particularly the case for rural water users, communities, and small municipalities. Some watersheds are approaching a local population threshold where population is high enough to create water supply problems and fisheries impacts, but too small and dispersed to create community-scale water systems. Balancing water demands while maintaining existing and improving degraded salmonid habitat is an important management challenge for the North Coast Region. The use of small-scale diversion and rainwater catchment on a household/farmstead or neighborhood basis has been implemented effectively through the NCRP in the recent past. By searching for innovative solutions and bringing all parties together in a cooperative and collaborative enterprise for the benefit of the entire region, the NCRP provides an important framework for developing and implementing creative, efficient and equitable responses to the water supply and instream flow challenges faced by the region.

Drought is a natural component of California's climate. Particularly severe drought years are documented for 1976-1977, 1987-1992, 2000-2002, 2007-2009, and 2014 – 2017 (NDRP undated). In spring 2019, the governor of California declared an end to a seven-year drought by lifting the drought emergency in nearly all California counties. Prolonged periods of drought can increase ecosystem vulnerability to pests and invasions by non-native species. Reduced precipitation translates to reduced infiltration to groundwater basins and reduced groundwater recharge. Droughts present immediate and long-term challenges to water supply, water quality, food production, economic stability, and ecosystem function. Drought conditions also increase risk of wildfires, which impact water quality through release of sediment and alteration of hydrologic processes.

It is likely that one of the major expressions of global climate change in the North Coast Region will be increasing drought and an associated decrease in water supply and water availability (see *Section 2.11.7 Landscape Scale Drought*). According to the California Natural Resources Agency (2009), more frequent and more intense drought conditions are expected as higher temperatures cause soils and vegetation to lose water; during the past century, shifts in runoff patterns have already diminished the percentage of annual runoff that occurs during April through July. Changes in precipitation, plus higher temperatures, are likely to affect the amount of water in streams, lakes, ponds, and wetlands. More of the precipitation that does occur will fall as rain rather than as snow, and the snow that does fall will melt sooner. The state's snowpack is expected to decline, disappearing entirely at lower elevations. The lower snowpack will deliver less water to many streams during the late spring. Stream flows typically will increase in the winter and spring, and decline in late spring, summer, and fall, changing the morphology of river systems. Changes in storms, runoff, and water temperature may lower the quality as well as the quantity of water in some streams in some months. Ecosystems may change as these conditions decrease the suitability of water-related habitat for some species, and increase its suitability for others (e.g. non-native invasive species). The resulting stress on some species, such as salmon and steelhead, may cause extirpation in some areas.

With respect to water supply reliability, changes in management to capture winter storm surge and store it either underground or above ground poses an opportunity to buffer supplies against unpredictable climatic events. Communities and individuals on a local watershed scale are increasingly turning to water capture – rainwater, stormwater, or diversion of extreme winter flows – to store for use during the dry season. Although these methods have been successfully implemented at the local scale in multiple North Coast watersheds, it is important to understand that this option is not a panacea for drought and periods of low water; it may have unintended environmental impacts if not thoroughly researched and designed to minimize alterations to the natural hydrologic cycle. To successfully prepare for the expected increases in drought length and severity, multiple methods, including water conservation, water use efficiency, and reuse must be more fully explored and utilized.

2.8.6.1 REGULATORY CONTEXT

California Water Code regulates ground and surface water supply in the state. With specific respect to drought preparedness, the Urban Water Management Planning Act (1983, CWC 10610-10656) requires that every urban water supplier that provides water to 3,000 or more customers or more than 3,000 acre-feet annually, should make "every effort" to ensure the appropriate level of reliability in water service sufficient to meet the needs of all customer types during normal, wet, or dry years. The Act introduces Urban Water Management Plans (UWMPs, which local entities across the Region have developed). Water conservation to ensure water supplies to meet growing demands is California's state policy (Water Code Sections 100 & 101). DWR and local jurisdictions partner to ensure that (1) all local jurisdictions adopt a landscape water conservation ordinance and (2) ensure that all fixtures be American Society of Mechanical Engineers (ASME)-certified. The effects of droughts are increasingly being exacerbated by additional regulatory requirements to protect listed fish species, especially with regard to water diversion (CNRA 2009).

SWRCB Resolution No. 77-1 (1977) requires State and Regional Water Boards to encourage water recycling projects using wastewater that would otherwise be discharged to marine or brackish receiving waters or evaporation ponds. The resolution also specifies using recycled water to replace or supplement the use of fresh water or better water quality water, and to preserve, restore, or enhance instream beneficial uses. In subsequent decades, a number of additional regulations have been aimed at encouraging or incentivizing water and/or energy conservation to secure limited or uncertain water supplies. SBx7-7 further requires:

1. Urban Water Management Plans (UWMP) be prepared and adopted by certain urban water suppliers to support their long-term resource planning and ensure adequate water supplies are available to meet existing and future water demands. Every urban water supplier that provides over 3,000 acre-feet of water annually or serves more than 3,000 connections is required as part of the UWMP to assess the reliability of its water sources over a 20-year planning horizon considering normal, dry, and multiple dry years (CWP 2013). DWR reviews updated UWMPs to make sure they have completed the requirements identified in the Urban Water Management Planning (UWMP) Act (Division 6 Part 2.6 of the Water Code §10610 — 10656). Thirteen North Coast urban water suppliers have submitted 2010 urban water management plans to DWR.
2. Agricultural Water Management Plans (AWMP) be prepared and adopted by water suppliers who supply more than 25,000 irrigated acres. All of the North Coast agricultural water suppliers supply fewer than 25,000 irrigated acres; as of August 2013, no AWMPs had been submitted from the North Coast Region.

The state's Sustainable Groundwater Management Act, enacted in 2014, requires local governments and water agencies withdrawing water from high and medium priority basins to halt overdraft and bring basins into balanced levels of withdrawals and recharge. Groundwater Management Plans are required to chart a path to sustainability within 20 years of implementation.

The SWRCB in 2018 rolled out its Strategy to Optimize Resource Management of Storm Water (Storm Water Strategy, STORMS) to "lead the evolution of storm water management in California by advancing that perspective that storm water is a valuable resource, supporting policies for collaborative watershed-level storm water management and pollution prevention, removing obstacles to funding, developing resources, and integrating regulatory and non-regulatory interests." This strategy and associated programs is likely to serve as a planning and project implementation for the NCRP in the future.

The North Coast Instream Flow Policy was adopted by SWRCB 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, and portions of Napa, Mendocino, and Humboldt counties.

The Water Conservation Act (2009 SBx7-7) requires all water suppliers to increase water use efficiency in two sectors, Urban Water Conservation and Agricultural Water Conservation. Under the Act, urban water suppliers to calculate their baseline water use and set 2015 and 2020 water use reduction targets. SBx7-7 supports a 20 percent reduction in the amount of water each person uses per day (i.e. per capita daily use) by the year 2020. The North Coast Hydrologic Region had a population-weighted baseline average water use of 147 gallons per capita per day in 2010. The projected conservation target is 127 gallons per capita daily use. The water conservation law has amended or repealed some sections of the state Water Code and may affect local reporting requirements under the Urban Water Management Planning Act and other government codes (CWP 2013).

The state's Recycled Water Policy (2013) supports increased capture and use of recycled water from municipal wastewater sources that meets the definition in Water Code Section 13050(n): "Recycled water" means water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource." The SWRCB strongly supports recycled water as a safe alternative to potable water for such approved uses.

Severe water shortages have in extreme cases resulted in the declaration of a state of emergency, which allows the governor to direct the SWRCB to suspend certain state water regulations; streamline water transfers; cease or reduce water diversions (including riparian and pre-1914 rights); or take other aggressive means to secure water emergency supplies. The California water rights system is designed to provide for the orderly allocation of water supplies in the event that there is not enough water to satisfy everyone's needs. As a result, every water right holder has a priority, relative to every other water right holder. When there is insufficient water for all, water diversions must be curtailed in order of water right priority. State of drought emergency was declared in 2009 following a 2-year drought, and again in water year 2014, the warmest year and third driest year on record for California.

2.8.6.2 EFFORTS TO ADDRESS THE ISSUE

California's "Climate Adaptation Strategy" (2009) recommends addressing water security/ water availability/drought preparedness with "a portfolio of measures implemented at the local and regional level" in a coordinated manner (i.e. via a process such as the NCRP). These measures may include water conservation, energy conservation, water reclamation and recycling; groundwater storage; conjunctive use; rainwater collection; Low Impact Development (LID) techniques; water efficient landscape ordinances; small surface storage; and climate adaptation planning/ vulnerability identification. The NCRWQCB 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 (DWR 2013).

In 2011, representatives from the State of California and Oregon, USBR, 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 conservation, additional stored water, the use of groundwater and the reduction of diversions (Klamath Basin Coordinating Council 2011).

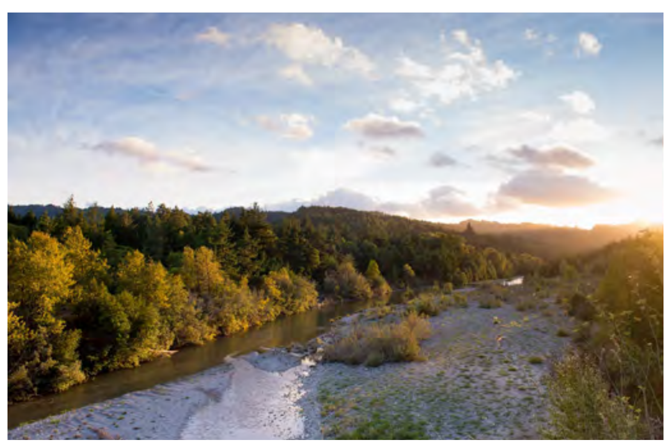
The volume and adequacy of local groundwater supplies represent a major data gap in the Region and the state that the SGMA and CASGEM (California Statewide Groundwater Elevation Monitoring) programs are in the process of filling. In many areas of the North Coast, security of groundwater supplies is of concern, in part because of the difficulty of determining the extent (and quality) of water within groundwater basins. CASGEM requires local entities to assume responsibility for monitoring and reporting groundwater elevations, in order to remain eligible for water grants or loans from the state. Local planning departments in the North Coast Region (e.g. counties and municipalities) are addressing this major challenge by collaborating on groundwater monitoring programs, streamflow improvement plans, and base flow determinations in key rivers.

While groundwater development is being considered by some parts of the Region as a potential future water source, both Sonoma and Modoc counties share a concern over future groundwater development. The Mendocino City Community Services District (CSD), concerned that the groundwater basin that supplies the Town of Mendocino with potable water was being over-drafted, developed a groundwater management plan that puts limits on new well development or the increase in withdrawals of existing wells (Mendocino City CSD undated). Sonoma County has recognized that groundwater is scarce in large areas of the county where intensive rural development and the installation of private wells has led to over drafting. Siskiyou and Modoc counties have voiced concerns over the large number of deep, high output wells that have been recently developed to address current water supply challenges: the long-term consequences of those wells are unknown.

Throughout the region, municipalities, water agencies, Tribes, agricultural producers, and other stakeholders are implementing water conservation measures, water efficiency upgrades, water reuse projects, small-scale water storage, greening of infrastructure and protection and enhancement of recharge areas to combat the effects of water shortages and to ensure water supply reliability. Usually, these projects provide multiple benefits to the communities in which they are implemented. To review the breadth of these projects and obtain an understanding of the many benefits they provide, please refer to the tables and information in Section 4 and Appendix L, NCRP Project Information. These projects represent the effort of communities in the North Coast to respond to the challenges associated with climate change and ongoing issues associated with water quality and water scarcity. The NCRP provides a vital framework for the ongoing success of the North Coast region in meeting the challenges that the next 20 years are sure to bring.

2.8.7 ECONOMIC COSTS FROM DAMAGING NATURAL CAPITAL

As described in Section 2.8, the natural capital of the North Coast – the working lands, watersheds, floodplains, streams, rivers, waterbodies and ecosystems – perform vital ecosystem services for North Coast communities including water supply, water filtration, carbon sequestration, crop pollination, and water infiltration to groundwater aquifers. These services, some of which can be monetized using various economic tools and methods, provide a conservative estimate of between $861 billion and $1.3 trillion in 2014 dollars. Excessive damage from human activities or climate change to these ecosystems and processes would limit the monetary benefit that North Coast natural resources freely provide.



2.9 IMPACTS TO REGIONAL BUILT CAPITAL

The 2009 California Statewide Adaptation Strategy report outlines future climate change impacts to infrastructure. The report asserts "the most significant climate impacts to California's infrastructure are predicted to be from higher temperatures and extreme weather events across the state, reduced and shifting precipitation patterns in Northern California, and sea-level rise. Heavy precipitation and increased runoff during winter months are likely to increase the incidence of floods damaging housing, transportation, wastewater, and energy infrastructure. The largest projected damages will come from sea-level rise threatening large portions of California's coastal transportation, housing, and energy-related infrastructure" (CNRA 2009).

As of today, regional infrastructure already faces challenges. As of 2014, the American Society of Civil Engineers gave Humboldt County a grade of D+ for roads and a grade of C- for bridges (ASCE 2014). Other counties in the region have their share of aging infrastructure. While evaluating projected climate change impacts, an opportunity exists to prioritize projects based on infrastructure already showing signs of deterioration and deficiencies in condition and functionality.

2.9.1 BROADBAND ACCESS AND INFRASTRUCTURE

Telecommunications infrastructure and services are increasingly important for commercial competitiveness and regional economic growth. Additionally, residents increasingly rely on telecommunication for quality of life, education, research, and access to health care and government services. Improved telecommunications infrastructure also supports public safety and emergency services by improving communications and information availability. Additionally, broadband enables online education and work telecommuting opportunities, reducing the need for vehicle trips. The North Coast region, with its rural nature and dispersed population, lags in providing access to reliable telecommunications services when compared with urban centers such as the San Francisco Bay area.

North Coast communities are so widespread that satellite internet (as opposed to phone line or cable connections) is often the most practical mode for those in outlying areas. However, the landscape can interfere with continuous access. Mountainous terrain, proximity to the Pacific Ocean, deep canyons, and weather events can result in sub-standard connection speed and reliability. For mobile internet users, similar connectivity challenges and sparse infrastructure also results in limited or unreliable service for residents and visitors when traveling through or visiting certain parts of the region.

In urban centers, residents and businesses have more options, including stand-alone and bundled services, and multiple delivery channels such as cable, satellite, microwave, fiber optic, and traditional copper telephone service. Dense populations also result in a healthy competitive marketplace, encouraging affordable pricing models. Additionally, all county libraries offer internet access through use of public computers. However, accessing these internet services requires proximity, which is not always readily available to residents of disadvantaged rural communities who may live and work miles away from public facilities.

Lack of adequate access is a recognized issue in the region: The Broadband Alliance of Mendocino County and the North Bay/ North Coast Broadband Consortium are two organizations working towards equitable broadband access.

Not only are there issues with the widespread population and challenging topographic conditions, but there are also issues regarding equitable access to broadband service. In both Mendocino and Sonoma County, a digital divide is identified, where areas with a high population density have broadband access, but other portions of the County, its population, visitors, anchor institutions, government services, and transportation corridors are underserved.

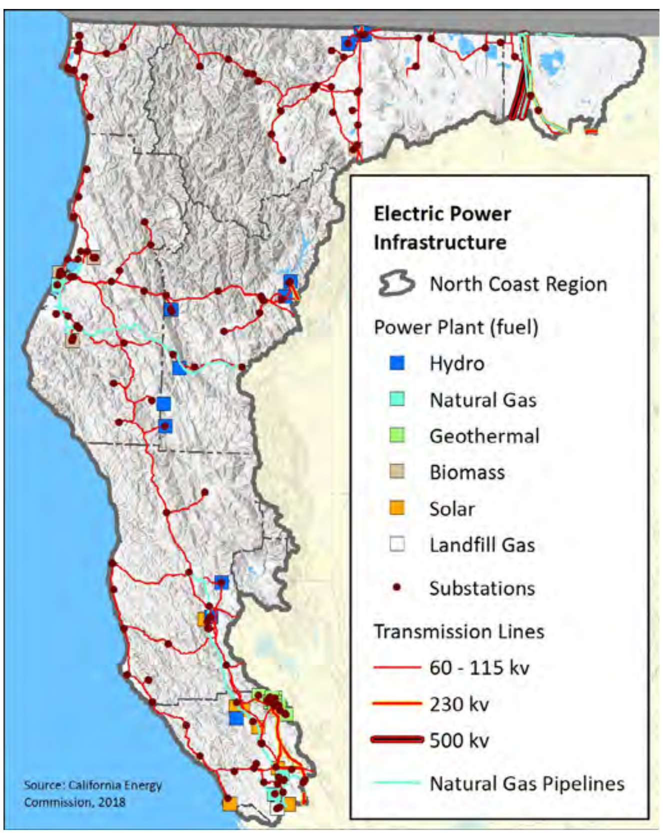
In 2014, a $138 million initiative to extend high-speed Internet capacity to about 150,000 rural Northern California households collapsed after nearly three years of negotiations. This new fiber-optic based network would have connected 16 northern counties and provided the anchor for expansion of fast, affordable service. Also, in 2014 a major outage in August interrupted Internet access for three days for a large part of Mendocino County. This type of outage basically puts health care professionals out of business until service is restored, affecting social health and safety. Additionally, loss of Internet capacity slows business for those using the Internet for sales, file storage, and general communication, potentially affecting the local economy.

In 2017, nearly $47 million was awarded to Inyo Networks, Inc. to construct a Digital 299 Broadband Project that will provide high-capacity backhaul infrastructure and interconnection points to communities along the California State Route 299 corridor in Trinity, Shasta, and Humboldt Counties. In addition to providing much-needed access to broadband, this project provides safety benefits because it will offer service to five community fire stations, two CAL FIRE stations, the Trinity County Sheriff's office, and six medical and health institutions.

2.9.2 ENERGY GENERATION AND CONVEYANCE INFRASTRUCTURE

California Energy Commission believes that California's energy policies will "require substantial increases in the generation of electricity from renewable energy resources. Implementation of these policies will require extensive improvements to California's electric transmission infrastructure" to accommodate for a flexible and responsive network (CEC undated).

Extreme weather events can affect energy demand, impact energy production, and cause potential disruptions to transmission and distribution infrastructure. As outlined by a report from the California Climate Change Center, "potential for disruption of energy supply is particularly high during periods of extreme heat, when energy demand increases (for air conditioning, but also to meet needs such as pumping water for agricultural uses) and energy transmission infrastructure (e.g., transformers) can also be compromised" (California Climate Change Center 2009). When temperatures increase, fossil fuel-burning power plants and transmission lines lose efficiency, which calls for attention to either increase production or improve efficiency (CEC undated). Temperature increases also adversely affect the efficiency of solar panels.



MAP 39 ELECTRIC POWER INFRASTRUCTURE

The North Coast region's renewable energy generation potential can support local energy security and self-sufficiency as well as providing an important contribution to the large state-level effort to transition off of fossil fuels. However, a critical barrier to realizing the potential is in many cases limitation and constraints on the region's electricity transmission and distribution grid. Many sites that could serve as small or medium-size "community-scale" solar projects are limited by the local distribution grid's ability to accept the power, and significant offshore wind energy potential of Humboldt, Del Norte, and Mendocino Counties.

TABLE 8. RENEWABLE ENERGY OPPORTUNITY MATRIX BY COUNTY AND RESOURCE

	Del Norte	Humboldt	Mendocino	Modoc	Siskiyou	Sonoma	Trinity
Biomass	Low	High	High	Medium	High	Medium	High
Geothermal	Low	Low	Medium	High	High	High	Low
Hydro	Medium	Medium	Low	Low	Medium	Low	Medium
Solar	High	High	High	High	High	High	High
Wave	High	High	Medium	Low	Low	Medium	Low
Wind — Onshore	High	High	Medium	Medium	High	Low	Medium
Wind — Offshore	High	High	Medium	Low	Low	Medium	Low

2.9.3 WATER AND WASTEWATER STORAGE AND CONVEYANCE INFRASTRUCTURE

In almost all instances across the North Coast Region, wastewater collection and treatment systems are owned and operated by local agencies (either cities or special districts). There are some instances where wastewater systems were installed to serve a "company town" containing a lumber or paper mill and the wastewater system is owned and operated by the company. Over time, ownership of the utilities serving company towns has transitioned from private to public ownership as property has changed hands. Many rural residents rely on wells and or Onsite Wastewater Treatment Systems (OWTS) such as septic systems for household wastewater disposal. Many public wastewater treatment plants in the North Coast suffer from aging infrastructure and lack of capacity, which will only be further exasperated by climate change.

One of the central threats to water systems resulting from climate change is sea level rise. Water systems in coastal areas face notable risks as sea levels increase the potential for salt water intrusion and for storm surges and high tides to cause inundation of low-lying areas. There are approximately 52 miles of shoreline on Humboldt Bay that form a barrier protecting nearly 10,000 acres of low-lying areas from tidal inundation, an area that contains amounts of water and wastewater systems and lines along with other critical infrastructure.

Humboldt Community Services District's Truesdale municipal water pump station and inter-tie to the City of Eureka water system, with the potential tidal inundation area by 2070 of 3.3 feet (1.0 M) of sea level rise (Trinity Associates 2018).

Water systems will also continue to be threatened by the drought and extreme weather conditions California. High elevation watersheds, such as ones found throughout Trinity County, tend to store more water in the form of snow with percolation into soils. This natural storage is vital to help maintain consistent stream flows in the drier months. In recent years, the region has experienced several very dry years and very low, sometimes negligible, snowpack (NCR&DC and 5C 2017). Wildfires and the associate erosion impacts also pose an increasing risk to water infrastructure.

2.9.4 TRANSPORTATION INFRASTRUCTURE

Throughout the North Coast, communities contend with challenges associated with transportation. The rural nature and widespread geography of North Coast communities facilitated development of roads and highways over non-motorized infrastructure; thus, vehicle transportation is most commonly used for both individual transit and freight transport. However, as concern about GHG emissions and interest in healthy lifestyles and walkable neighborhoods increases, many North Coast communities are planning for and implementing projects that improve public transit and bicycle and pedestrian pathways.

Obtaining sufficient funding for maintenance, repairs, and improvements is a challenge for many North Coast communities. Throughout the region, the condition of some roadways is compromised due to this funding deficit. Additionally, private roads, which have historically been lacking sufficient maintenance, are in various states of repair.

All counties in the North Coast have developed Transportation Plans and many communities have developed Bicycle and Pedestrian Plans. Some also possess airport, rail, and harbor plans. The challenge facing the region is to operate and develop these systems into the future so that they coalesce into a safe, efficient, integrated intermodal system that serves the mobility needs of people and freight while fostering economic growth and development.

The impacts of climate change pose increasing risks to the region's transportation infrastructure. Sea level rise threatens costal roadways in the region along with the associated increases in erosion, as well as the potential impacts from more extreme weather events such as increased risks of flooding. The Humboldt Bay Area Plan Sea Level Rise Vulnerability Assessment identified approximately 38 miles of surface roads vulnerable to tidal inundation by 1.5 meters of sea level rise because of diked shoreline breaching or overtopping, and backwater flooding effects from stormwater runoff (Trinity Associates 2018).

2.9.5 RESIDENTIAL AND MUNICIPAL BUILDINGS

Coastal areas in northern California experience the coolest climate in California with the most heating degree days according to PG&E's guide to California climate zones. Cool, wet winters and cool summers with frequent fog and strong winds make it a climate requiring a lot of heat for comfort with peak demand in the winter, especially in Humboldt and Mendocino coastal areas. Farther inland, as well as in Siskiyou County, many microclimates exist in the varied geography affected by proximity to the ocean and elevations. Due to this climate, heating days dominate building needs, but some cooling is needed in the summer (PG&E 2006).

With an expected increase in the number and intensity of heating degree and cooling degree days (Cal-Adapt.org), a need exists for buildings to focus on energy management and building maintenance, especially given the region's dependency on heat for comfort.

Increased risk of wildfire is a critical threat to the region's building stock, as evidenced by the devastating 2017 Sonoma County Tubbs fire, which was the most destructive wildfire in California ever recorded, destroying 5,643 structures.

2.9.6 RELATIONSHIPS AMONG BUILT INFRASTRUCTURE SECTORS

According to the California Air Resources Board, in the face of rising temperatures, six economic sectors — water, energy, transportation, tourism and recreation, agriculture, and public health— would together incur tens of billions per year in direct costs, even higher indirect costs, and expose trillions of dollars of assets to collateral risk (CARB 2010).

To reduce greenhouse gas emissions, there is a clear push for reducing dependency on oil and natural gas by electrifying transportation and heating in homes. Energy efficiency of systems and appliances becomes increasingly important as electrification increases demand. With transportation being a key source of regional GHG emission it is particularly important to address the electrification of transpiration and the need to develop regional electric vehicle charging infrastructure. The electrification of heating and transportation also increases dependence on transmissions and distribution systems, furthering the need for systems that can cope with grid power interruptions.

There is a strong connection between water supply and conveyance with energy use. At its core, the water-energy nexus stems from the fact that there is both limited supply and high demand for energy and water. Climate change has forced the water-energy nexus into the forefront (*North Coast Climate Mitigation, Adaptation, and Energy Independence Report* (NCCMAEI)).

2.9.7 ECONOMIC AND COMMUNITY IMPACTS FROM FAILING BUILT INFRASTRUCTURE

Infrastructure for electricity, transportation, and communication is critical for everyday life and especially for those in rural and hard-to-reach areas. Mitigation funds remain scarce and often directly compete with funds to tackle decaying national infrastructure and increased disaster response costs stemming from climate change (RCEA 2017). Not only is infrastructure already aging, the rugged terrain and dispersed populations in the North Coast Region add an extra challenge to communities who are trying to mitigate their contributions towards climate change. Logistical and technical feasibility of mitigation projects remain challenges, however funding remains the largest hurdle.

Impacts from climate change, specifically wildfires and sea level rise, are not only broad environmental issues but also pose direct, major threats to the safety, quality of life, and economy of the people of the NCRP region. Counties should continue mitigating their contributions to greenhouse gas emissions, while also planning to adapt to the consequences of climate change that the region is already starting to experience.

2.10 FLOOD PROTECTION & FLOOD MANAGEMENT

2.10.1 FLOOD HISTORY

The floods of 1955 and 1964 were called "the disaster of the century" and a "1,000 year event" respectively (McGlaughlin, 2014). We are still living with impacts of those events, from flooding in urban areas to the significant devastation of blown out timber road networks and the domino effect that has had on our regional ecosystems and communities. Since 1960 there have been more than twice as many severe snow and ice storms in the U.S. than occurred in the 60 years prior, and over the past century "the amount of rain falling in the heaviest downpours has increased approximately 20% on average (Thomas and Peterson 2009)." Annual precipitation is greater in this Region than in any other part of the state and floods are a fairly regular phenomenon. Damaging floods occur relatively frequently in the Region, with particularly destructive floods documented in December 1955, December 1964, February 1986, spring 1995, and January 1997 and 2006. In the North Coast, more than 30,000 people (5% Region population) and $3 billion in assets lie within the 100-year flood zone. Some 40,000 people and over $4 billion in assets are exposed to the 500-year flood event (North Coast IRWMP 2014). As recently as the winter of 2019, California and the North Coast region experienced significant flood events (Goff 2017, Sulek 2019). Significant risk to communities and infrastructure are already a factor under current conditions, and flooding is projected to increase in most places (FEMA undated).

Transportation routes and low-lying communities along all major waterways are vulnerable to flooding (Houston, 2017). Low lying communities, especially those in low lying coastal areas close to estuaries or at the confluence of major waterways are at particular risk. Rivers that flow directly into the ocean along the North Coast include the Russian, Eel, Mattole, Van Duzen, Mad, Klamath, and Smith Rivers. Many communities on these waterways have experienced a history of flooding. Major tributaries of these rivers, including the Trinity River (which drains into the Klamath), also have significant potential to present flood risks to communities, transportation, and other vital built infrastructure.

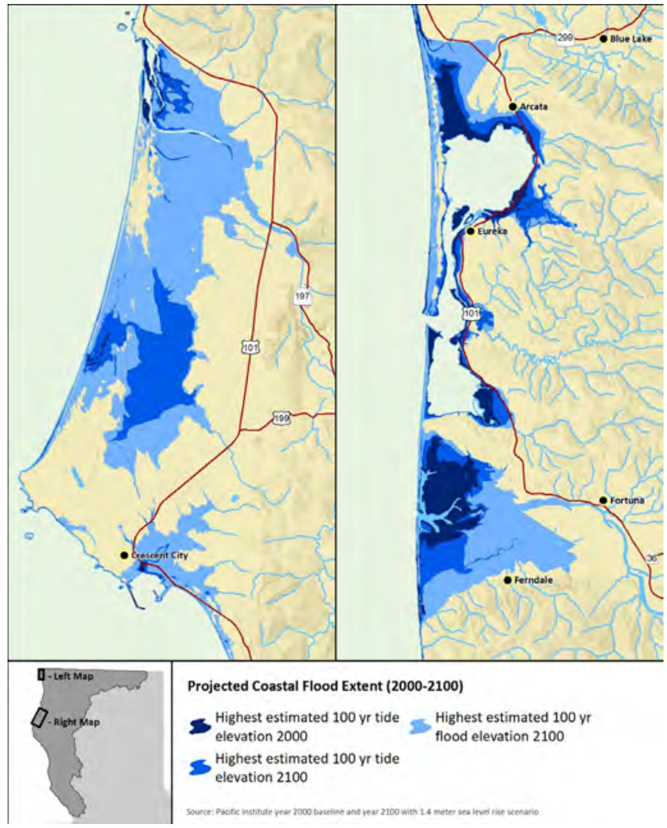
Flood events in the Region have the potential to cause widespread damage to personal property, infrastructure, and human health. According to DWR (2013) resources vulnerable to flood risk in the North Coast Region include:

- 30,000 people exposed to flood risk (5 per% cent of population) in a 100-year floodplain with 40,000 people (6 % of population) exposed in a 500-year floodplain
- $3 billion worth of structures (8 %) exposed in a 100-year floodplain with $4 billion (10 %) exposed in a 500-year floodplain
- $80 million of crop value exposed in a 100-year floodplain (108,000 acres or 25 % of crop acreage). Within a 500-year floodplain in the North Coast region, $90 million in crop value from 112,000 acres (26 % of crop land) is exposed
- 5,748 acres of Tribal lands are at risk in the 500-year floodplain

2.10.2 LIMITING FACTORS AND CHALLENGES

Sea level rise contributes to flooding in select coastal portions of the Region, particularly in Del Norte and Humboldt counties. Sea level has risen along the California coast by several inches in the previous decade and models predict sea levels rising significantly this century. Rising sea level will affect roads, utilities, wastewater treatment plants, agricultural lands, outfalls and stormwater facilities and systems as well as large wetland areas in addition to towns and cities. Higher sea levels can inundate low- lying coastal areas, accelerate erosion of bluffs, beaches, and other coastal features; flood areas near the mouths of rivers and streams; increase the potential for levee failures; alter estuarine and aquatic habitats; and stimulate the intrusion of saltwater into estuaries and freshwater aquifers. When storms, winds, and high tides cause storm surges, increases in sea level that appear inconsequential at other times may lead to substantial damage to shorefront properties and infrastructure, and increase the probability of injury and death. Where land is rising due to tectonic lift, the rate of sea level rise may or may not be exceeded by the rate of coastal uplift. For example, at Humboldt Bay's North Spit, sea level is rising by 18.6 inches per century (4.73 millimeters per year), the highest rate in California. At Crescent City, 80 miles north, sea level is dropping relative to the coastline by 2.5 inches per century. The shoreline at Humboldt Bay is subsiding, whereas Crescent City's coastline is rising (DWR 2013).

MAP 40 SEA LEVEL RISE IN ARCATA BAY, CRESCENT CITY, AND ENVIRONS



MAP 41 PROJECTED COASTAL FLOOD EXTENT (2000-2100)

Tsunamis are an infrequent but severe source of coastal flooding. The North Coast was struck by a tsunami in March 1964 as a result of an earthquake in Prince William Sound, Alaska. The resulting 20-foot wave hit Crescent City (Del Norte County). It damaged 289 homes and businesses; 11 people were killed; and 3 were never found. Damages were estimated at $16 million in 1964 dollars (CWP 2013). Crescent City was struck by another tsunami in March 2011. Generated off the coast of Japan, the wave struck Crescent City with an 8.1-foot wave, destroying much of the harbor and resulting in one death near Klamath. There was also major damage to docks and boats at Noyo Harbor. Estimated damage in the Region was $24 million (CWP 2013).

Flooding is likely to become more frequent and severe under climate change scenarios, as more precipitation is delivered by intense storms, and as storms drop more of their precipitation as rain rather than snow. Runoff in the October–March period has been increasing along with peak flood levels, as well as the variability among floods. Storms and snowmelt may thus coincide and produce higher winter runoff from the landward side, while to the west, accelerating sea-level rise is expected to produce higher storm surges during precipitation events. In relatively developed coastal floodplains, storm related coastal flooding might coincide with high tides and stormwater runoff, creating particularly severe flooding.

The California Water Plan (DWR 2013) provides a snapshot of the communities, structures, crops, infrastructure, and sensitive species exposed to flooding in the Region.

Significant development already exists in some at risk areas; resources required to respond during an emergency will be stretched thin where large amounts of development/built infrastructure exist inside a projected flood-risk area. Many routes are already compromised during current weather events. The current inundation zones in recently updated flood maps from FEMA include significant portions of Highway 101. The Russian River is one of the most flood-prone rivers in California, routinely overflowing during wet years and impacting local as well as major transportation routes (WEF 2018). Flood exposure also occurs along the coastline, Eel River, Elk River, Scott River, around Crescent City Harbor, and Humboldt Bay (DWR 2013).

Depending on the proximity of infrastructure to at risk areas, disruption of transportation routes, drinking water supply, wastewater facilities (and risk of overflow), and communications facilities could occur with direct impact on evacuation/strategic retreat activities, communication, and eventual relocation efforts.

There is potential political resistance to planning for the future; given the many current challenges associated with limited funding and prioritization of myriad infrastructure, social services and other community needs, it can be challenging for local elected officials and leaders to prioritize future risk planning.

2.10.2.1 FUTURE OPPORTUNITIES, PLANNING, AND STRATEGY

The region should conduct and infrastructure analysis of at-risk waterways and coastal areas to ensure reliability of baseline services and/ or needed relocation, plus potential environmental and non-vital infrastructure impacts if changes in land use and relocation efforts do not occur. Although most communities/counties have emergency plans developed, the level of analysis regarding relationship between potential events is unclear. Renewed communication with emergency service providers and teams with regard to these strategies would be beneficial. Additionally, coastal urban areas and river corridor communities could aggregate their planning efforts and share strategies to increase efficacy and efficiency. Although the specific long-term impacts of increased severity and frequency of flooding events are as of yet unknown, communities and tourism related businesses should be prepared for a changing coastline and adapt their efforts accordingly.

The DWR report "California's Flood Future: Recommendations for Managing the State's Flood Risk" provides a powerful tool local jurisdictions may consult as they make their own flood management plans. The NCRWQCB is supportive of efforts to address the 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 (DWR 2013). Current research offers new tools to help managers assess the risks presented to local flood management from climate change and to address the flood-control constraints future climate may present (e.g. Brekke et al 2009). The Region's flood management systems (e.g. basins or reservoirs for collection and storage; dams for release of excess and to maintain minimum flows) were designed in the last century to strike a balance between water storage for dry months and flood protection in winter and spring, when heavy storms, snowmelt, and runoff can cause extensive flooding. Trinity Dam, for example, has been identified at critically high risk for failure and downstream flooding in the event of a "probable maximum flood" in part due to the lack of an emergency spillway (Jacobs 2017). As precipitation patterns become increasingly variable and unpredictable, it becomes more challenging for water managers to respond, particularly if they continue to base their operations on past climate and regulatory conditions.

Municipalities and other local jurisdictions in the Region are investigating or implementing Low Impact Design (LID) projects as a technique to manage stormwaters and reduce the severity of flooding locally. LID is a sustainable practice that benefits water supply and contributes to water quality protection. Unlike traditional stormwater management, which collects and conveys stormwater runoff through storm drains, pipes, or other conveyances to a centralized stormwater facility, LID takes a different approach. The LID approach involves using site design and stormwater management to maintain the site's pre-development runoff rates and volumes. Several entities in the NCRP have recognized the utility of LID projects to achieve floodway protection simultaneously with habitat protection and improvement.

An effective flood management program will likely include combinations of on-site measures (e.g. LID techniques, flow-control basins), in-stream measures (e.g. stream habitat restoration), floodplain and riparian zone actions (e.g. wetland restoration, setbacks), and off-site measures. Off-site measures may include compensatory mitigation measures at upstream locations that are designed to help restore and manage flow and sediment yield in the watershed (Stein et al. 2012).

Finding solutions to reduce residual flood risk in California is a complex task that will require a mix of both old and new tools and approaches to flood management and funding, evolution of existing planning processes and policies, sustained action, and commitment from agencies at all levels to achieve the desired result of public safety, environmental stewardship, and financial stability in the state. To accomplish these goals, the public, policymakers, and agencies at all levels (local, state, federal) must work together to address the flood risk; evolve toward integrated water management; and bring flood managers into the IRWM process as full partners with other water management agencies (DWR 2013). Achieving effective flood management further will require that hydromodification management strategies operate across programs beyond those typically regulated by NPDES/MS4 requirements. The state's new STORMS program is one step in this direction: it calls for optimizing the resource use of storm water, one component of which is flood prevention and mitigation. Successful strategies will need to be developed, coordinated, and implemented through land-use planning, habitat management and restoration, and regulatory programs such as STORMS. Substantial resources will be necessary to realize these goals; therefore, opportunities for joint funding and leveraging of resources should be vigorously pursued from the onset. The NCRP is well-position to implement a cooperative approach that will lend cohesion to and reduce potential conflicts from the current fragmented efforts among regions and jurisdictions. Such an integrated watershed-based approach will likely take one or more permit cycles (i.e., at least ten years) to fully implement (Stein et al. 2012).

To ensure that measures to protect or relocate resources and begin limitation on building in at-risk areas, communities should consider ways to incentivize sustainable land use planning and integrated flood management by exploring potential mitigation funding, or other creative ways to drive the process. Planners should incorporate 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. The general principles of integrated management include adaptation planning to embrace sustainability while considering equitable distribution and apportionment of costs and benefits of adaptation measures, especially with regard to disadvantaged communities (DWR 2013).

2.11 CLIMATE CHANGE VULNERABILITY & UNCERTAINTY

Interviews with North Coast planning entities reveal concerns about a variety of climate-related vulnerabilities that already are recognized locally: identified vulnerabilities include sea level rise (28%), followed by agriculture, fire, and flood (11% each). Science-based research specific to California confirms the state's ecosystems, households, businesses, farms, and communities are vulnerable to numerous impacts of climate change. This vulnerability is especially apparent as changes in climate are predicted to affect the quantity, quality and spatial distribution of California's water resources. There is widespread agreement among scientists about climate observations:

1. Climate change is partially the result of human activities that emit heat trapping carbon dioxide, methane, and other greenhouse gases (GHGs) into the atmosphere. Past emissions will continue to influence climate and additional GHG emissions will accelerate these changes.
2. California has experienced loss of life and severe economic damage, as well as ecological, social, and cultural disruption from storms, drought, wildfires, and other weather–related extremes.
3. Climate change impacts are expected to intensify weather and climate events in severity, duration, and variability.

Despite lack of agreement in the region about the pace, causes, and solutions to anthropogenic climate change, there is unanimous shared concern in the NCRP about severe climate-related phenomena and associated water management implications. NCRP stakeholders and local planners consistently identify two water- and climate-related challenges as priority for the NCRP. These are (1) flooding/stormwater management and (2) drought/water availability, and the adequacy of infrastructure to deal with both.

The results of the North Coast's *Climate Change Vulnerability Assessment* suggest the following relative vulnerability of sectors (both human-built and naturally-occurring) to climate-energy-water impacts (*see Appendix J, NCRP Climate Change Vulnerability Assessment*).

"Natural" Sector Vulnerability

- **Riparian: High [highest]**
- Coastal: Moderate-High
- Forests: Moderate-High
- Rangelands: Moderate

"Built" Sector Vulnerability

- Agriculture: Moderate-High
- Fisheries: Moderate-High (both "natural" and "built" elements)
- Forestry: Moderate-High
- Recreation: Moderate-High
- Urban/ Infrastructure: Moderate-High
- Water Supply & Demand: Low-**Moderate**
- **Energy Capacity & Demand: Low [lowest]**

The sectors that are identified as relatively vulnerable at a particular location warrant further analysis and consideration in local water, energy, and climate planning and decision-making (DWR USEPA 2011). The NCRP is actively addressing priority vulnerabilities through existing Goals and Objectives (*Section 1.1 NCRP Goals and Objectives).*

2.11.1 EFFECTS OF CLIMATIC & HYDROLOGIC CHANGES ON WATER MANAGEMENT

The North Coast currently faces challenges in meeting the water-related demands of an increasing population and increasingly regulated natural resources. In California, the observed trend toward increased hydrologic variability and more frequent severe weather events (Weare 2009) is expected to intensify in the 21st century. The climate vulnerability assessment conducted for the North Coast Region predicts that more variable precipitation will create more inter-annual variability in stream flow, with potentially more frequent droughts and flood years with increases of greater than 50% more high and low values for annual discharge (Micheli et al. 2018). According to the California Natural Resources Agency (2009), the state "can expect to experience more frequent and larger floods and deeper droughts. Rising sea level will increase salinity in near-coastal groundwater supplies." However, according to one study, California's water supply and management system appears physically capable of adapting to significant changes in climate and population, albeit at a significant cost, requiring major changes in operation of groundwater storage capacity, water transfers, and adoption of new technologies (Tanaka et al. 2006). Listed below are some expected impacts to regional water management systems during the 21st century.

Water Management Impacts Due to Increased Temperatures

- Reduced water supply from snowpack accumulation – in the North Coast, the observed geographic extent of snow cover on April 1st has decreased by 10% over the recent period (1981-2010) relative to the historical average (1951-1980) and the geographic extent of April 1st snow cover is projected to shrink from approximately 60% to 30% of the project area by mid-century, and to just 11% of the project area by end-century.
- Earlier snowmelt runoff leaving less stored for dry months – for the North Coast, the average "snow water equivalent" on April 1st, a proxy for snow depth over these areas is projected to decline from approximately 10" of water (1951–1980) to just 1" by end-century.
- Reduced water quality due to increased water temperature – North Coast summer season temperatures are projected to increase on the order of 3 – 5 °F by mid-century (2040-2069) and 6–9 °F degrees by end-century (2070-2099).
- Increased evaporation/evapotranspiration rates from plants, soils, and waterbodies – in the North Coast, climatic water deficits in soils are projected to increase by approximately 10–19% by mid-century.
- Moisture deficits in non-irrigated agriculture, landscaping, and natural system – the majority of the area of the North Coast is projected to experience water deficit conditions.
- Increased agricultural irrigation demand to avoid crop losses and due to a longer growing season
- Increased urban water use, at the possible expense of agriculture water

Water Management Impacts Due to Precipitation Changes

- Reduced surface and groundwater supply due to decreased precipitation
- Increased proportion of precipitation falling as rain instead of snow
- Increased intensity of rainfall events with more frequent and/or more severe flooding
- Increased frequency and persistence of droughts
- Reduced water quality due to higher water temperature, lower flow, and more concentrated sediment load

Water Management Impacts Due to Sea Level Rise

- Increased stress on coastal levees and other flood management infrastructure
- Increased saltwater intrusion into estuaries, bays, and coastal groundwater sources; drought and groundwater extraction will exacerbate saltwater intrusion because they reduce pressure from freshwater resources that otherwise

supports the balance of coastal groundwater basins by keeping the saltwater out

- Reduced surface and ground water quality due to saltwater intrusion
- Increased freshwater releases from upstream reservoirs to hold back salinity intrusion, reducing freshwater supplies
- Reduced freshwater supplies due to salt water intrusion into coastal aquifers
- Reduced viability of coastal agriculture due to increased soil salinity

New analyses using fine-resolution hydrologic and climatic datasets suggest that, in this century, all North Coast counties and watershed basins (WMAs) will experience (1) increased temperature, (2) reduced precipitation, and (3) rising seas (Thorne et al. 2012a), all of which may exacerbate flooding and drought (Purkey et al 2008). The magnitude of change will vary widely across the Region; however, the direction of change is clear. This will have widespread and direct effects on the viability of the Region's natural and built systems and sectors.

The *Climate Change Vulnerability Analysis (CCVA)*, assessed the region's overall vulnerability with respect to reduced spring snowpack and water supply storage, increased risk of water use conflicts, and increased dependence on groundwater supply during summer is moderate (*see Appendix J, NCRP Climate Change Vulnerability Assessment*). Although reduced snowpack is expected, the majority of watersheds in the region are rain fed. While a snowpack loss of 73 to 90% (estimated in the PCM model in the Sierras) may stress aquatic ecosystems with lower base flows in summer months, much water supply in the region is met with groundwater sources and groundwater fed springs. Major water supply projects in the region include the U.S. Bureau of Reclamation Klamath Project, the U.S. Army Corps of Engineers Russian River Project, the Humboldt Bay Municipal Water District Ruth Reservoir, and the U.S. Bureau of Reclamation Trinity Lake Reservoir. The Klamath Project has been controversial because to maintain adequate instream fishery flow to ensure the survival of endangered salmonid populations, coordination between many jurisdictions is necessary. Water to farms has at times been cut off to prevent harm to the fisheries, resulting in controversy, and in some cases, violence. Currently, surplus surface water is exported out of the region for use elsewhere in the state, but reduced snowpack storage may tax existing resources and require changes to satisfy all existing water supply needs in the region. Most basins within the region depend on groundwater or groundwater fed springs indicating exposure to this impact. Current resources are adequate to meet current and projected needs indicating resilience to changes and a high adaptive capacity.

The CCVA considers the region's overall vulnerability to increased seawater intrusion to coastal groundwater aquifers low. Rising sea level will increase the potential for seawater intrusion indicating exposure to this impact for coastal communities. Given the adequate groundwater basin recharge that occurs, saltwater intrusion is not generally a problem in North Coast groundwater basins.

2.11.2 EFFECTS OF CLIMATIC & HYDROLOGIC CHANGES ON SECTORS

The potential effects of climate change on three representative North Coast sectors (fisheries, agriculture, and energy) are introduced below. See Appendix J, NCRP Climate Change Vulnerability Assessment for more information and maps, including an overview of the specific impacts and climate drivers to all 11 "natural" and "built" sectors comprising the Region's water management infrastructure. The report also provides a preliminary listing of the 11 sectors, ranked by vulnerability (a combination of sensitivity and adaptive capacity). For a related assessment of vulnerabilities identified by and for Tribal communities, please refer to https://cig.uw.edu/our-work/decision-support/building-tribal-capacity-for-climate-change-vulnerability-assessment/

2.11.2.1 FISHERIES

Freshwater fishes are highly vulnerable to climate change (Moyle et al. 2013). Species requiring cold water (e.g. all salmonids, particularly Coho salmon) are most vulnerable. Changes in global climate have altered and continue to alter local hydrologic conditions. These hydrologic changes are accelerating the declines observed in many fish species, especially in regions (like much of the North Coast) that experience arid or Mediterranean conditions (Moyle et al 2011, Moyle et al 2012). Under present climate change scenarios, most native fishes in the Region would experience population declines and restricted distribution. These impacts are not limited to freshwater environments, of course: coastal and marine systems are also expected to experience major changes, with negative effects expected for marine organisms and habitats (Harley et al. 2006). As they require both freshwater and marine habitats, salmonids will likely experience stresses in both environments.

2.11.2.2 AGRICULTURE

Vineyard establishment and management have significant implications for terrestrial and freshwater conservation, which may be significantly impacted by climate change. Climate impacts to vineyards are relevant to the entire

North Coast and to NCRP planning because they may be illustrative of conservation implications of shifts in other agricultural crops (Hannah et al. 2013). Mediterranean climate regions are most suitable for viticulture, but at the same time have very high levels of biological diversity, endemism (species occurring nowhere else), and habitat loss. Potential impacts of climate change on historical patterns of viticulture suitability are predicted to be "substantial" by 2050 (Hannah et al. 2013). Climate change has the potential to drive changes in viticulture that will impact the Region's ecosystems and threaten native habitats: damage to freshwater habitats is generally highest where water is already scarce (Vorosmarty et al. 2010). Changes in viticulture practices could affect land use (e.g. establishment of vineyards at higher elevations, leading to conversion of upland areas) and/or water use (e.g. increased water use for irrigation and crop protection, leading to freshwater conservation conflicts). Damage to freshwater habitats is generally highest where water is already scarce (Vorosmarty et al. 2010).

It is possible that some types of crops grown in certain areas could benefit from projected climate and hydrologic changes, but this would be the exception rather than the rule. Additionally, farmers may be able to convert their crops to different cultivars or other types of crops that are better adapted to projected conditions. The California Energy Commission's California Climate Change center provides more information about the effects of climate on California agriculture (Jackson et al. 2012). The NCRP report "Climate Change and Agriculture in the North Coast of California" provides information specific to the North Coast Region (described below).

Saltwater intrusion into coastal aquifers can also impact agriculture, especially in watersheds where ditches and canals were built to drain coastal lands to minimize flooding damage. These ditches and canals could complicate the problem by acting as conduits for saltwater and funneling it inland with storm surges. Salt water also alters soil chemistry and mobilizes nutrients which can contribute to nutrient loading in adjacent water bodies.

2.11.2.3 ENERGY INFRASTRUCTURE

According to the California Climate Adaptation Strategy (CNRA 2009), the "largest projected damages" to energy infrastructure are expected from sea level rise inundating low lying coastal areas. Flooding of inland infrastructure is also a concern. Other potential challenges for energy infrastructure development in the 21st century are listed below.

Due to Warmer Temperatures

- Changes to energy production potential (e.g. hydropower)
- Changes to transmission capabilities
- Reduced transmission efficiency
- Increased energy demand for cooling
- Increased risk of brown outs and black outs

Due to Altered Precipitation Patterns

- Changes to energy production potential (e.g. hydropower)
- Reduced summer flows requiring increased water releases, reducing reservoir volume and hydropower potential
- Increased flood damage to transmission lines, from storm runoff and snowmelt

Due to Sea Level Rise

- Increased need for fortification from coastal surges or relocation of built infrastructure
- Increased economic cost for required fortification, relocation, and system upgrades

2.11.3 DISTRIBUTION AND MAGNITUDE OF CLIMATIC & HYDROLOGIC CHANGES

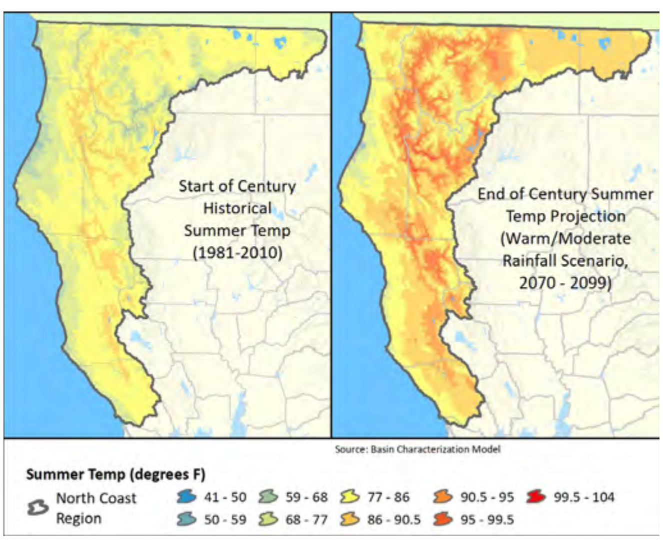
The geographic, climatic, and hydrologic variability among and between the North Coast planning area watersheds is vast. Therefore, it is unwise to extrapolate statewide or even region wide climate predictions down to the local level (*see Appendix J, Table 42, Projected Changes to Climate & Hydrology of North Coast Counties and Table 43, Projected Changes to Climate & Hydrology of North Coast WMAs*).

The fine-scale spatial distribution and magnitude of the predicted changes in precipitation, temperature, and other climatic and hydrologic variables across the North Coast Region is illustrated in the USGS/Pepperwood Preserve technical report, *Climate and Natural Resources Analysis and Planning for the North Coast Resource Partnership* (Micheli et al. 2018). Highlights of key findings by analysis area are summarized below. Projected ranges represent values for "business as usual" emissions across three scenarios including low, moderate, and high precipitation.

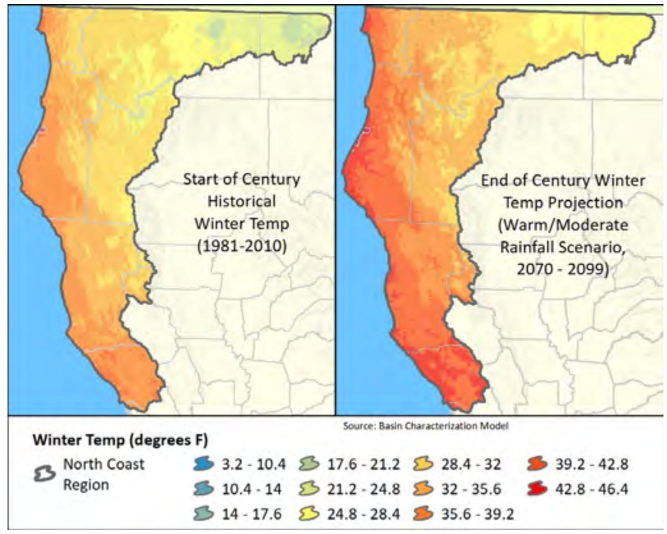
Historical and Projected Climate and Hydrology

- Summer season temperatures are projected to increase on the order of 3–5 °F by mid-century (2040-2069) and 6–9 °F degrees by end-century (2070-2099).
- Winter season temperatures are expected to increase on the order of 5–7 °F by mid-century and 8–11 °F by end-century.

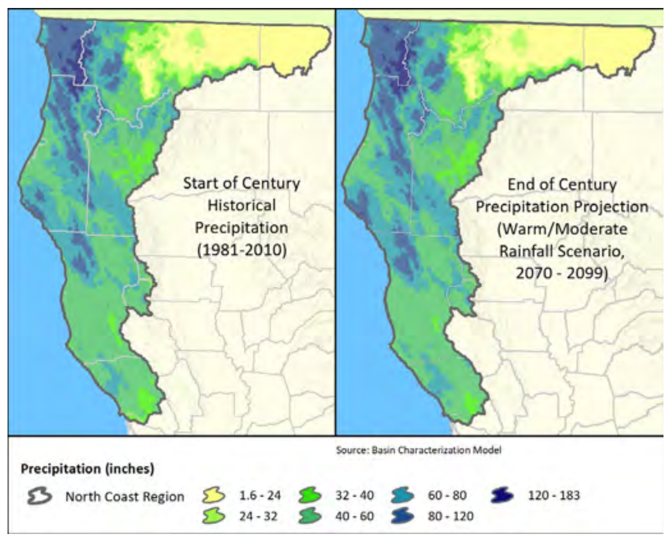
- Warmer temperatures are projected to increase rates of modeled actual evapo-transpiration on the order of 4–11% by mid-century and 11–13 % by end-century.
- Increased rainfall variability combined with increased rates are projected to increase climatic water deficits in soils, a measure of drought stress, by approximately 10–19% by mid-century and 16–32% by end-century.
- End-century projected water deficits represent an effective loss of 3–6” of rainfall equivalent from soils by the end of the dry season relative to today’s conditions.
- The majority of the area of the North Coast is projected to experience water deficit conditions (drought stress on soils) exceeding a standard measures historical variability (1 standard deviation) by end-century.
- The observed geographic extent of snow cover on April 1st has decreased by 10% over the recent period (1981-2010) relative to the historical average (1951-1980).
- The geographic extent of April 1st snow cover is projected to shrink from approximately 60% to 30% of the project area by mid-century, and to just 11% of the project area by end-century.
- The average “snow water equivalent” on April 1 st, a proxy for snow depth over these areas is projected to decline from approximately 10” of water (1951–1980) to just 1” by end-century.



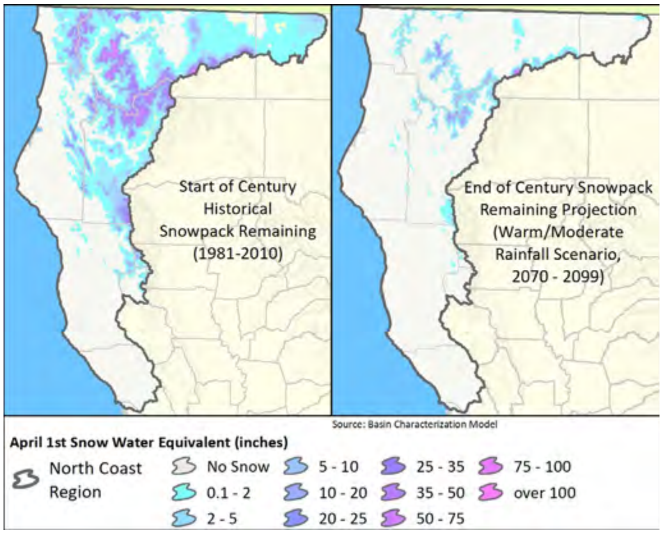
MAP 42 PROJECTED SUMMER TEMPERATURES



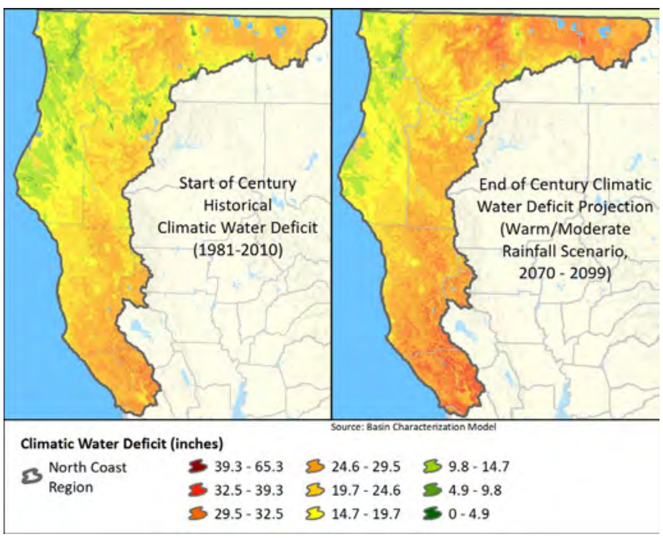
MAP 43 PROJECTED WINTER TEMPERATURES



MAP 44 PROJECTED PRECIPITATION



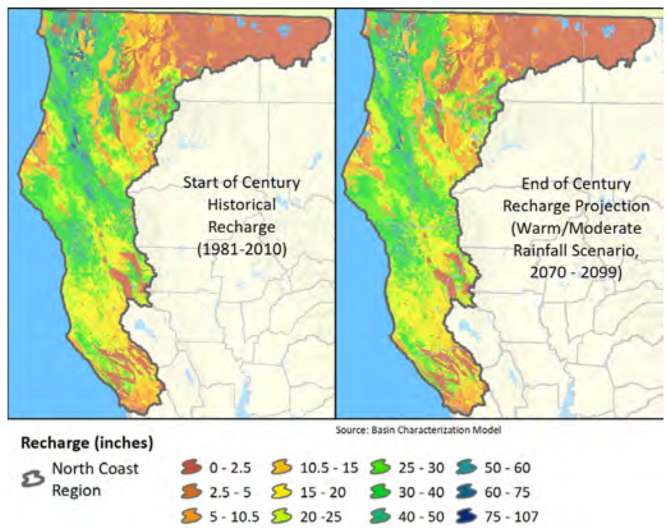
MAP 45 PROJECTED SNOWPACK (WARM/MODERATE RAINFALL SCENARIO)



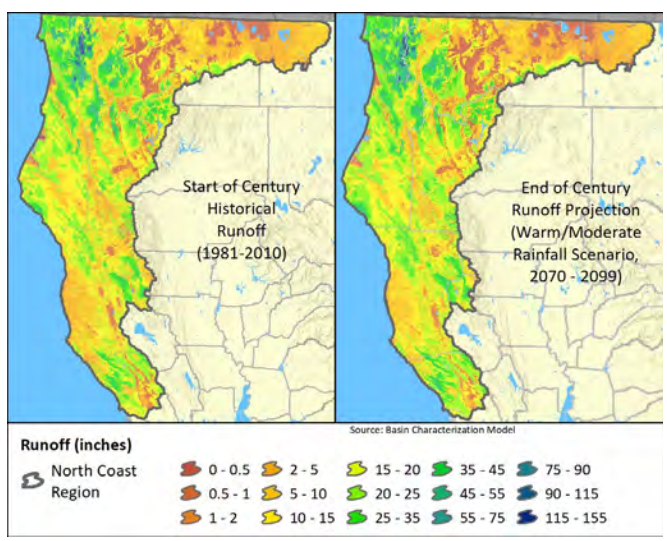
MAP 46 CLIMATIC WATER DEFICIT

Watershed Runoff and Stream Flow

- A water supply indicator comprised of recharge plus runoff can be used to provide an overview of potential impacts of climate change. A comparison of this indicator for the 1920-2009 period to the projected conditions for 2010-2099 suggests that a high rainfall scenario (with on the order of 20% greater rainfall than the baseline) would result in only 4% more water supply, while the low rainfall scenario could result in 13% less available water.
- Watershed resilience can be estimated in part by comparing the relative dominance of runoff or recharge on hydrology, with runoff-dominated watersheds hypothesized to be more vulnerable in terms of water supply to more variability in projected future conditions.
- Cumulative stream flow volumes for three study basins (Russian River, Eel River, and Redwood Creek) show the potential impact of low versus high rainfall scenarios ranging from -25 % to +40% of reference values for annual cumulative discharge under 90 year projections.
- More variable precipitation is projected to create more inter-annual variability in stream flow, with potentially more frequent droughts and flood years with increases of greater than 50% more high *and* low values for annual discharge.
- The moderate rainfall scenario, although similar in long term rainfall averages to historical conditions, also features more low and high stream flow years: thus all projections evaluated suggest great inter-annual variability in available stream flow.



MAP 47 PROJECTED RECHARGE



MAP 48 PROJECTED RUNOFF

Groundwater Resources

- Average recharge is projected to decrease under moderate and low rainfall scenarios due to rainfall variability combined with increased evaporative demand. In-situ regional recharge is projected to decrease by approximately 20% by end-century under low rainfall scenarios.
- Where available, groundwater recharge is estimated to be a less variable supply of water from year-to-year than watershed runoff under projected futures.
- Under low rainfall scenarios, rainfall is projected to become a more significant fraction of total potential water supply.
- Comparisons of spatial variability in historical recharge rates can be used to assess the relative vulnerability of groundwater basins in the North Coast, and to inform recharge protection strategies.

Forest Ecology

- Approximately 65% of the region's natural vegetation is currently estimated to be prone to climatic stress: by end-century, this is projected to grow to approximately 85% of the project area.
- There is uncertainty about how native vegetation may respond to unprecedented combinations of temperature and rainfall in California.
- The projected extents of stress on vegetation are similar for both high and low rainfall scenarios, since high rainfall scenarios generate novel climates for California vegetation in this region, which absent data, are considered stress-inducing.
- There are likely to be vegetation species climate "winners" and "losers," with future conditions likely favoring drought-adapted species, which may promote expansion of chaparral and shrublands at the expense of woody species.
- Long-term monitoring of native forest vegetation is needed to better inform models with an improved understanding of mechanisms and trajectories of potential change.

Fire Risks

- With projected climate change the fire risk, as measured by the 30 year average in the probability of burning in a given year averaged across the NCRP increases from 10% historically to 15% by the end of century under both examined scenarios.
- Critical data gaps in fire modeling include the short historical record available to calibrate models and the challenges of incorporating ignition risks attributable to urban development expanding into wild land regions.

2.11.4 PLANNING FOR UNCERTAINTY

According to the California Natural Resources Agency (2009), "The climate patterns that these [water and flood management] systems were based upon are different now and may continue to change at an accelerated pace. These changes collectively result in significant uncertainty and peril to water supplies and quality, ecosystems, and flood protection." Most data and models indicate that climate change is occurring relatively gradually and will continue to do so. There is a chance, though, that significant changes will occur far more rapidly. For the North Coast, the two greatest uncertainties in localized climate-hydrology projections are 1) how fast projected changes will occur due to uncertainties in future rates of greenhouse gas emissions and 2) whether rainfall trends will increase or decrease overall (Micheli et al. 2018). Prudent planning for climate change should explicitly account for the possibility that abrupt changes will occur, perhaps with catastrophic consequences. Physical, process-based watershed models (featuring well-mapped topography, geology, and soils) can estimate the response of watersheds as a function of seasonal temperature and seasonal rainfall projections. However, there is inherent and undeniable uncertainty involved in documenting, forecasting, and interpreting climatic and hydrologic data.

There will be no single "one-size-fits-all" solution to climate changes; solutions will need to be tailored to local conditions (climatic, financial, and ideological, for a start). A recommended approach to "uncertainty" in climate change planning, as for other situations that lack full resolution of data, is to: (1) respond directly to confident projections (and identify less confident projections as data gaps); (2) utilize an adaptive management approach that calls for frequent input and refinement of processes; (3) allow flexibility with a range of potential response actions that suit local conditions; (4) implement long-term monitoring; (5) prioritize ecosystem adaptability in restoration efforts; and (6) continually update and refine analyses using data specific to the Region and of the finest resolution possible (Thorne et al. 2012a). Adaptive management planning in the context of climate change and other stressors should consider the following principles (Micheli et al. 2018):

North Coast Adaptive Management & Planning Considerations:

- Given the hydrologic effects of projected increased temperatures across all climate models, water conservation and long-term plans for water security are increasingly important under projected futures.

- Protecting high value recharge zones will be critical to enhancing water security by maximizing subsurface storage in aquifers, a relatively resilient form of natural water storage, where available.
- Effective watershed protection strategies can utilize maps of historical watershed behavior (rather than utilizing models of projected future conditions) for planning purposes, since the location of key watershed structural elements, such as recharge zones, are relatively fixed facets of the landscape.
- Communities need to innovate ways to capture winter precipitation, storm water runoff, and peak flows for use during dry seasons and to recycle wastewater streams.
- Land stewards should aim to increase soil moisture holding capacity of soils where feasible through vegetation management, soil amendments, and approaches to sequestering carbon.
- Long-term vegetation monitoring sites, coordinated with local weather and water data stations, are needed to measure stress and/or mortality, in locations identified with high vegetation vulnerabilities.
- Managers should expand collaborative approaches to landscape-level vegetation management and treatments capable of reducing accumulated fuel loads and associated fire risks.
- Communities should develop plans for post-fire management that address strategies for native vegetation resilience and mitigation of potential impacts on watershed runoff and water quality.
- Climate adaptive strategies should be integrated into all aspects of hazard mitigation planning, including responses to drought, flood, earthquake and fire.

Resiliency to climate volatility and natural disasters starts with planning, and local planning departments, health departments, and emergency managers should work to incorporate risks associated with projected climate change impacts into existing emergency preparedness plans and/or develop new plans as needed. While some impacts, such as wildfires and floods, have likely already been addressed in existing local hazard mitigation plans, risks should be re-evaluated and plans periodically updated in light of evolving climate models and trends (CEMA and CNRA, 2012).

Numerous municipalities, counties, Tribes and other local jurisdictions in the Region are looking towards development and implementation of climate action plans and GHG inventories to accommodate climate change adaptation and mitigation programs. When asked about local resources that will be vulnerable to climate change impacts in the next 50 to 100 years, coastal interviewees responded that sea level rise; impacts to agriculture, especially related to crop phenology changes; increased risk of forest fires and their environmental consequences; flooding events due to greater storm intensity; ocean ecosystem changes; drought; salmonid populations; and water quality impacts would be most susceptible.

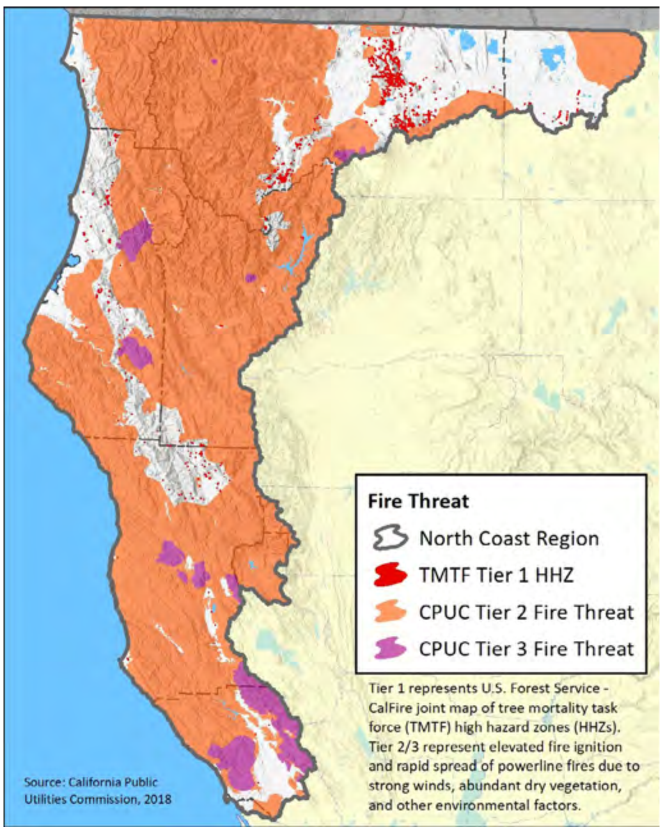
Communities can increase resiliency for climate volatility and natural disasters through the development of social and community support networks. Each community should consider building collaborative relationships with neighboring communities and forming regional partnerships to promote development of complementary adaptation strategies and cohesive regional approaches. Many climate change impacts and disasters extend beyond jurisdictional boundaries, and these issues are best addressed in collaboration with neighboring jurisdictions to ensure complementary actions and conservation of limited resources (CEMA and CNRA, 2012). Especially with respect to disaster resiliency, neighboring communities should develop coordinated first response actions that kick in during emergency situations to best allocate limited resources and avoid redundant actions (CEMA and CNRA, 2012).

In addition to academic institutions and state agencies, efforts by county, municipal, Tribal, and other local entities can contribute significantly to knowledge about North Coast resources and issues. Local collaborations in the Region are resulting in successful and informative ventures with direct applications to the NCRP. Regionally, counties and municipalities have placed emphasis on the need to conduct site-specific adaptation and emergency response planning, particularly with respect to sea level rise, storm surges, and extreme precipitation events that will result in coastal and inland flooding, causing damage to critical, low-lying or shoreline infrastructure.

To ensure public buy-in to climate adaptation measures, a robust public outreach program is necessary. As with most aspects of climate adaptation and disaster resiliency strategies, the most effective strategies are tailored to fit local conditions, constraints, and opportunities. Local government outreach for climate change resiliency and disaster preparedness should begin with identification of the most vulnerable populations. This can be accomplished by incorporating social and community engagement into local health departments and prioritizing adaptation efforts where vulnerabilities are highest and the need for safety and resilience is greatest (CEMA and CNRA, 2012).

Finally, as with all planning and implementation efforts, monitoring results is crucial to determining success and adjusting management for optimal efficacy. Whenever possible, communities should establish an ongoing monitoring program to track local and regional climate change impacts and adaptation strategy effectiveness. Climate change impacts vary spatially and uncertainties and contextual considerations make accurate prediction of impacts difficult. Adaptation strategies should be adjusted based on effectiveness of a strategy and adequacy of the strategy to address projected changes. Monitoring will provide the data necessary to adjust course as necessary.

Monitoring can be labor and cost intensive, so indicators should be chosen carefully. The most severe impacts should be identified by each community along with indicators that will measure effectiveness of adaptation actions as well as continued assessment of the expected impact.



MAP 49 FIRE THREAT

2.11.4.1 REGULATORY CONTEXT

In 2006, California's legislature passed Assembly Bill 32 (AB 32), the Global Warming Solutions Act, which mandates the California Air Resources Board achieve significant reductions by 2020 in greenhouse gas emissions from stationary (i.e. not vehicular) sources such as power stations and refineries. AB 32 also establishes a carbon trading market (i.e. "cap-and-trade") to stimulate financial incentives to reduce emissions. The Sustainable Communities and Climate Protection Act of 2008 (Sustainable Communities Act, SB 375, Chapter 728, Statutes of 2008) further supports the State's climate action goals to reduce emissions through coordinated transportation and land use planning

2.11.4.2 EFFORTS TO ADDRESS THE ISSUE

The State of California has taken the lead nationally and globally in developing actions and policies to reduce the emission of GHGs in an effort to slow changes to climate and to reduce the risk of abrupt threshold changes that would have catastrophic effects. The NCRP recognizes that "reducing emissions" may be achieved by focusing on energy conservation, water conservation, local energy production, and green jobs creation, all of which result in energy savings and GHG emission reductions and thus contribute to state goals.

The NCRP is investigating how observed and projected climate change impacts are expected to affect Northern California waters, communities, and economies, including identifying and assessing potential responses to these impacts. NCRP-commissioned reports investigate climate change implications in depth:

- *Climate Change – Issues and Initiatives* provides an overview of expected changes to weather and climate in Northern California, as well as response initiatives including Assembly Bill 32 (AB 32), Executive Order S-3-05, and the Western Climate Initiative.
- *Climate Change and Agriculture in the North Coast of California* identifies project-level agricultural BMPs that will reduce GHG emissions and increase soil carbon sequestration and economic incentives and policy specific to agriculture.
- *Climate Change Vulnerability Assessment (CCVA) for the North Coast Region* outlines a process framework for identifying and ranking the vulnerability to projected climate change impacts of the Regions built ("gray") and natural systems, and proposes an initial list of vulnerabilities to guide development of local and regional strategies to adapt to impacts and/ or mitigate GHG emissions. A CCVA developed separately from the NCRP effort, addresses climate concerns specific to Tribes.
- *Energy Independence, Emissions Reduction, Job Creation, and Climate Adaptation Initiative* describes the NCRP-preferred approach of addressing state and regional "climate change" needs with a promising program aimed at aggressively promoting local green energy independence and job creation.
- *Climate and Natural Resource Analyses and Planning for the North Coast Resource Partnership* provides analysis and planning support for climate change

adaptation, forest ecology and watershed hydrology, and groundwater analyses and planning.

- *Biomass Energy in the North Coast Region: An Assessment and Strategy for Ecologically and Socially Compatible Development* presents a strategy for how the region might advance biomass utilization strategies, with particular focus on biomass-to-energy projects, that are compatible with protecting and enhancing water resources, terrestrial habitat conditions, forest health and resilience and climate objectives while also improving the economic stability of the region and advancing the overall environmental and energy supply goals of California as a whole.
- *Climate Mitigation Report for the North Coast Region of California* presents a suite of integrated strategies aimed to improve the region's inefficient or failing infrastructure, to increase its resilience and reduce emissions; and reduce GHG emissions from major energy sources, as well as non-energy sectors.
- *Carbon Inventory Estimates for the North Coast Resource Partnership* presents an inventory estimate of carbon stocks in landcover classes throughout the study area.
- *NCRP Integrated Strategic Plan: Memo for Technical Area 1 – Climate Change Mitigation, GHG Emissions Reduction and Energy Independence* Report provides an overview of the energy picture for the seven counties that comprise the North Coast Resources Partnership (NCRP).
- *Greenhouse Gas Emissions Assessment Roadmap for the North Coast Resource Partnership Region* establishes a set of key criteria, and utilizes it to develop a GHG emissions accounting roadmap for the NCRP region.
- *North Coast Regional Climate Adaptation Report* is an effort to provide insight into the projected effects of climate change on the region so that North Coast communities can better prepare for and respond to life in a changing world.

2.11.5 SEA LEVEL RISE

Rising sea levels threaten thousands of California coastal residents and billions of dollars' worth of coastal property with increased risk of flooding, storm damage, shoreline erosion, saltwater intrusion, and wetland loss (NRC, 2012; CNRA, 2009; IPCC, 2007). Consequently, California's coastal communities will need to build greater resilience to sea level rise by minimizing potential vulnerabilities and adapting to new sea level conditions. When considering different adaptation strategies to implement, there will likely be tradeoffs between preservation of coastal ecosystems that need to migrate landward to survive inundation and the protection of existing development and property rights.

It is important to note that changes in sea level are not consistent around the globe, or even along the California coast for that matter. This is due to several factors, including changes in land elevation, atmospheric pressure, and ocean circulation (IPCC 2013). As a result, sea level might be observed rising in one location while falling in another. For this reason, scientists track both changes in sea level and land elevation to determine relative sea level change, or the change in sea level relative to the land around it (NRC 2012). It is the rate of relative sea level change that is of most importance to communities potentially affected by coastal flooding, including those in the North Coast.

In Crescent City, for instance, the land is being uplifted via plate tectonics faster than sea level is currently rising, such that relative sea level has been falling by about 0.4 inch (0.97 mm) per year (Northern Hydrology & Engineering 2015). At the same time, just 80 miles south of Crescent City, in and around Humboldt Bay, the land is subsiding due to plate tectonics, so relative sea level is rising faster there than anywhere else in California, at an average rate of 0.1 to 0.23 inch (2.5 to 5.8 mm) per year (Patton et. al. 2014, Northern Hydrology & Engineering 2015, Russell and Griggs 2012). As a result, by the end of the century, sea levels in Humboldt Bay are expected to be 19 to 68 inches (49 to 174 cm) higher than they are today (Northern Hydrology & Engineering, 2015). This is clearly an issue for the communities in and around Humboldt Bay, and the cities of Eureka and Arcata, at 39 feet (12 m) and 23 feet (7 m) above sea level respectively, and the County of Humboldt have already begun planning for the effects of sea level rise on the region (Laird 2015, Laird 2016, Humboldt County 2014). Coastal areas of Mendocino, Del Norte, and Humboldt counties are expected to experience about an 18% increase in land vulnerable to a 100-year flood, while a 14% increase in land at risk of a 100-year flood is predicted around Bodega Bay on the southern Sonoma coast (NCRP 2014, Reza Environmental 2016).

Planned retreat, also called strategic retreat, managed realignment, managed retreat, set back, or de-embankment, entails establishing thresholds to trigger removal and relocation of development threatened by rising sea levels. As part of this process, actively maintained defenses against storm surge and sea level rise will most likely need to be adjusted over time, typically further inland and to higher ground, in response to encroaching waters.

Planning for strategic retreat entails first identifying vulnerable properties and structures and then developing incentives, such as regulatory, tax, and market-based tools, to encourage and achieve realignment. These options, as identified by NOAA (Eastern Research Group, 2013), are listed below and described in more detail in the *North Coast Regional Climate Adaptation Report*.

- Transfer of Development Rights
- Zoning and Development Standards
- Purchase of Development Rights
- Rolling Easements
- Fee-Simple Acquisitions
- Preservation of Open Space
- Infrastructure Relocation
- Options for saltwater intrusion adaptation include:
- Diversify options for water supply and expand current sources
- Aquifer recharge by freshwater injection
- Increase treatment capabilities to contend with significant reductions in groundwater quality
- Installation of low-head dams across tidal estuaries to impede the upstream movement of the salt water-freshwater boundary in tidal estuaries
- Model and monitor groundwater conditions
- Monitor surface water conditions including discharge, snowmelt, reservoir or stream level, upstream runoff, streamflow, instream temperature and overall water quality to incorporate into models of projected supply or receiving water quality

2.11.6 FLOODING AND VOLATILE WEATHER

A recent report by the Ocean Protection Council indicates that as climate change accelerates over the course of the century and the rate of freshwater input from the major ice sheets increases, sea levels are expected to rise faster along the California coast than elsewhere in the United States (Griggs et al., 2017). Further, as sea levels rise, the rate at which the region's dunes and coastal bluffs are eroded is expected to accelerate (NRC 2010, RCPA 2016, Russell and Griggs 2012).

Along with sea level rise comes projected flooding of low lying coastal areas. This has the potential to redefine the coastline and impact the lives of many of those who live by it. Without proactive adaptive planning, low lying homes, businesses, and infrastructure can become badly damaged or destroyed, resulting in severe structural and economic losses, displacement of individuals, and the potential release of contaminants into the environment. Low-lying roads that are not decommissioned and rerouted in anticipation of sea level rise may become impassable, impacting the flow of goods and people and delaying emergency response times. The ocean's slow advance inland can also cause streams to "back up" resulting in worse flooding upriver from the coast. Moreover, when coastal flooding is combined with extreme high tides and/or storm surge (i.e., an increase in sea level during large storm events), the extent of flood impacts can be made substantially worse.

Also, at risk due to increased weather volatility are the region's dams. Trinity Dam has been identified as particularly vulnerable to extreme flooding events because it has no emergency spillway and the spillway is does have is insufficient for a major flood. In the case of failure, about 3,500 people downstream would be at risk. The dam is owned and operated by the Bureau of Reclamation, which in 2000, reported that the dam cannot safely pass the probable maximum flood (PMF). The PMF is the largest precipitation event that could conceivably occur, making it an extremely rare event, but ever more likely in the face of climate change, which is causing more intense storms, more rain instead of snow and faster snowpack melting, putting increasing strains on the regions dam infrastructure. The Bureau of Reclamation has winter operations restrictions to ensure there's enough room in the reservoir to accommodate peak inflows and flood events, but the calculations for peak inflows and flood events were developed 41 years ago and should be updated with more current information (Jacobs 2017).

To better understand the potential for future flooding in the North Coast, Lisa Micheli, Celeste Dodge, and Lorraine Flint modelled changes in flood frequency for three North Coast drainages under different rainfall and temperature scenarios using annual flows that exceed the 90th percentile per decade as an indicator of flood (see *Table 9*). According to their findings, the frequency of flooding is expected to increase in all three drainages under moderate and high rainfall scenarios and decrease under a low rainfall scenario. While it is not surprising that increased precipitation under a "warm, high rainfall" scenario is likely to generate more frequent flooding, the degree to which flood frequency could increase is significant. Further, because the "warm, moderate rainfall" scenario used in the model is based on 30-year precipitation averages comparable to baseline and recent conditions, the data suggest flood frequency in the North Coast is likely to increase based on warming alone.

TABLE 9. PROJECTED ANNUAL DISCHARGE EXTREMES FOR EEL RIVER, REDWOOD CREEK, AND RUSSIAN RIVER: HIGH RUNOFF FREQUENCY

Basin	Historical Record (Time Period Varies)	Hot, Low Rainfall (2010-2099)	Warm, Moderate Rainfall (2010-2099)	Warm, High Rainfall (2010-2099)
	Annual Cumulative Discharge Exceedances of the 90th Percentile per Decade			
Eel River	5	1	12	28
Redwood Creek	10	5	19	29
Russian River	8	2	9	29

(Micheli et al., 2016)

The usual approach using structural/ built management measures is now thought to provide less effective protection from floods, compared to use of natural infrastructure systems (e.g. a continuous riparian buffer of native vegetation) (Horner 2002). The further reduction in natural hydrologic functioning via the construction of additional hardened flood control channels is not viewed, in most cases, as supportive of water quality goals (DWR and USACE 2013).

2.11.7 LANDSCAPE SCALE DROUGHT

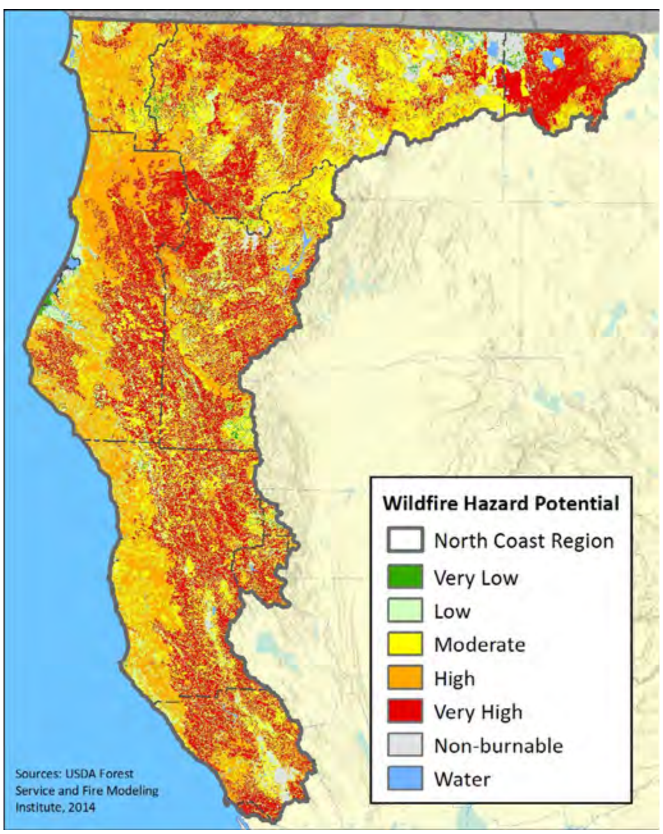
It is the forecast of drought that generates more concern in this country and around the globe than any other climate change impact (Pew Research Center, 2017). That may be because unlike rising seas or volatile weather, the impacts of drought on the landscape are so apparent and can be incredibly far reaching. Not only do droughts make water levels in lakes, reservoirs, streams, and groundwater basins drop, sometimes significantly, they can create food shortages, spur wildfires, throttle economies, and drastically alter the living environment and people's lives (NOAA 2017). As temperatures in the North Coast continue to rise throughout the 21st century (Micheli et al. 2018, NOAA 2016, Cayan et al. 2009), they are expected to influence the frequency and severity of droughts in several ways, such as extended dry seasons, decreased snowpack, earlier snowmelt, increased evapotranspiration, greater variability in runoff and recharge, and increased water demand (Micheli et. al. 2018, Cayan et al. 2009).

Although nobody knows for certain how much more often droughts will occur, the climate change vulnerability assessment prepared for the region indicates that drought frequency in the North Coast could increase approximately 50% by the end of the century (2NDNATURE, 2013). While this is hardly encouraging, other forecasts are even less optimistic. For example, Micheli, Dodge, and Flint evaluated the same North Coast drainages for drought frequency that they assessed for changes in flood frequency, this time modelling annual flows that fall below the 10th percentile per decade, and found that the frequency of very low annual flows (i.e., drought) could potentially double in two of the three drainages by the end of the century with no change in precipitation.

But it is not simply the incidence of drought-like conditions that matters when it comes to understanding how this could affect the region. This is because some droughts are not as severe or long lasting as others, and it is the strain on the environment and agriculture created by drought that is so potentially detrimental. For this reason, Micheli, Dodge, and Flint also modelled climatic water deficit (CWD), or the amount potential evapotranspiration exceeds available spoil moisture, for several watersheds in the region. Because CWD integrates the combined effects of rainfall, air temperature, topography, and soil structure to estimate where and by how much water demand will exceed availability, it serves as an excellent measure of drought stress.

2.11.8 INCREASED FIRE RISK

Although there are several factors that affect the size and frequency of wildfires, the progressively warmer temperatures and associated drought stress projected for the region are expected to contribute to an increase in wildfire size and frequency that climate models predict will worsen over time (Krawchuck and Moritz 2012, Yoon et al. 2015). Micheli, Dodge, and Flint note that the probability of fire over a 30-year period is expected to increase across the region on average by 40% by the end of the century (Micheli et al. 2018). Given that 15 of California's 20 largest wildfires over an 85-year period have occurred since 2000 and 13 of the top 20 most destructive fires have occurred since 2007 (CAL FIRE 2019 a & b), it's not surprising that some scientists believe that the combined effects of increased heat and drought are already contributing to larger and more frequent wildfires in California (Krawchuck and Moritz 2012, Yoon et al. 2015). Interestingly, however, a 2012 study of the Klamath, Mendocino, Shasta-Trinity, and Six Rivers National Forests found that, although wildfire size and frequency have been trending upward, the severity of wildfires has not been (Miller et al. 2012). This lead the study's authors to conclude that, under appropriate conditions, fire could be more extensively used in the region to achieve management objectives.



Wildfire Hazard Potential

2.11.9 BIODIVERSITY IMPACTS

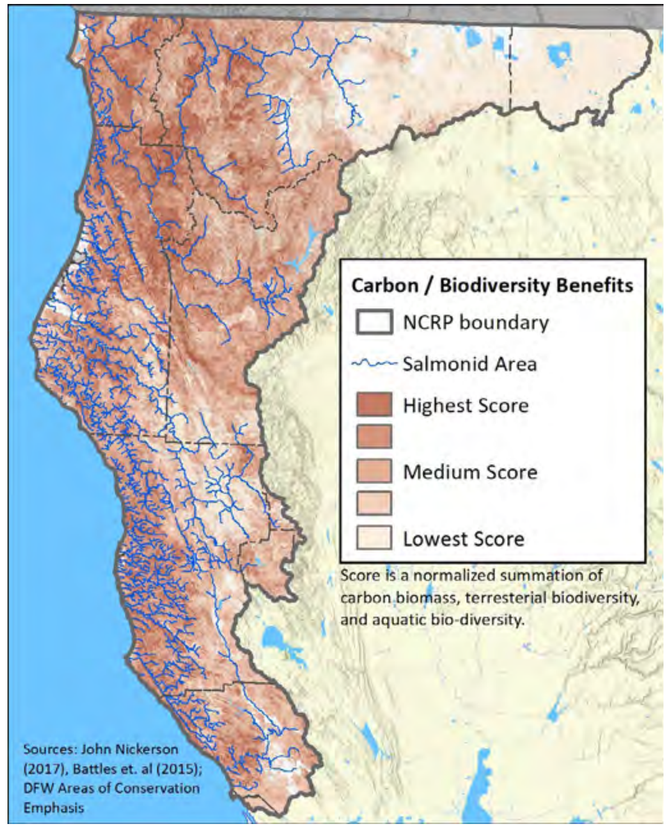
Along with those physical impacts on the environment discussed above, climate change is expected to affect the region's living environment as well. Whether as a result of thermal stress; increased drought and fire activity; the spread of pathogens and invasive species; greater variability in stream flows; habitat loss; changes in phenology; or ocean acidification, climate change is expected to influence the distribution and abundance of North Coast species in several ways (2NDNATURE 2013, Barr et al. 2010). In general, however, as existing habitats shift in response to changing environmental conditions and become less suitable for the species they currently support, species are expected to either migrate toward more favorable conditions, adapt to the new conditions, or die (CNRA 2009).

For example, as the chronic stress of decreased soil moisture and more frequent droughts continues to build, trees that are currently under duress will be more likely to perish and others may become increasingly strained and vulnerable to attack from damaging insects and pathogens (Das et al. 2013). Even long-lived species that have adapted to life an increasingly drier climate like the coast redwood (*Sequoia semperivens*) could be impacted. In fact, because climate change could potentially result in decreased frequency of California's coastal fog, redwood habitats may be at risk of further contraction (Johnstone and Dawson 2010). Moreover, when tree loss is combined with an increase in wildfires capable of opening large areas of habitat for colonization, as well as the migration of other species toward more favorable conditions, the range and composition of North Coast forests is likely to shift (CNRA, 2009). In addition, because invasive species are generally able to thrive under a wider range of conditions than native species, their competitive advantage, and therefore presence in North Coast habitats, could become even greater in the coming years (CNRA 2009).

With these changes in natural community composition, relationships between species will also be affected. Moreover, as the timing of natural events (e.g. flowering, insect emergence, and bird migration) shift in response to increasingly warmer temperatures, interactions among co-evolved species could become disrupted, placing species at risk (CNRA 2009).

For those species that are specialists, are currently vulnerable to environmental stressors, and/or that have limited populations (e.g., the region's 86 special-status plant and animal species), climate change is likely to create an even greater risk of regional extirpation, or in the case of species endemic to the North Coast, potential extinction (CNRA 2009, Burge et al. 2016). This includes denizens of the region's aquatic habitats, like salmon and steelhead, that require cold, clean, oxygenated water to survive and reproduce. Already facing multiple challenges to their survival, these anadromous species could face further reductions in range and abundance due to the warmer water temperatures and more variable stream flows that are predicted (Moyle et al. 2012, CNRA 2009). In addition, for those alpine species that live near the upper limits of available habitat, such as whitebark pine (*Pinus albicaulis*) and American pika (*Ochotona princeps*), there is already little habitat left for them to migrate toward (Barr et al. 2010). Indeed, studies suggest that both of these species are already disappearing from the western United States as a result of climate change (Beever et al. 2016, Aitken et al. 2008).

Marine species are also at risk. In addition to the effects of elevated ocean temperatures, which could allow some marine diseases to spread, such as the one that causes withering syndrome in abalone (Rogers-Bennett et al. 2011), researchers have found that the higher concentrations of CO2 in the atmosphere are making marine waters more acidic. This ocean acidification, which is projected to worsen over time as CO2 levels continue to increase (NOAA 2017b), can adversely impact the ability of marine species to develop shells and exoskeletons. For instance, research conducted by Jason Miller of the Northwest Fisheries Science Center has found that small changes in pH, consistent with projected CO2 induced ocean acidification, results in higher mortality and delayed larval development in Dungeness crabs (*Metacarcinus magister*), a commercially important species in the North Coast (Miller et al. 2016). Other marine species that play a role in the region's economy, such as Kumamoto and Pacific oysters, are also already experiencing declines along the Pacific coast due to ocean acidification (Chan et al. 2016).



MAP 50 CARBON/BIODIVERSITY BENEFITS

2.11.10 HUMAN HEALTH IMPACTS

With predictions for more frequent wildfires and extreme heat events, degraded air and water quality, and increased abundance of pests and pathogens in the coming years, climate change has the potential to impact the health of North Coast residents as well as the environment (CNRA 2009). Further, because climate change is expected to result in contaminated water supplies and higher food costs, it also has the potential to impair access to the most basic of necessities for the most vulnerable members of society.

2.11.10.1 WILDFIRES AND EXTREME HEAT EVENTS

Wildfires not only impair air quality over large geographic areas with toxic particulate matter found in smoke, but they can obviously also result in life-threatening burns and the loss of life for those directly affected by it. Moreover, when residential, commercial, and industrial properties are impacted, wildfires can leave behind a mess of dangerous debris in their wake. In 2017, when some of the most destructive wildfires in the state's history ravaged Sonoma, Napa, Mendocino, and Yuba counties, over 180 persons were injured, 44 lives were lost, the Bay Area population of roughly 7 million people were blanketed in smoke, and EPA cleanup crews were tasked with removing hazardous waste from nearly 7,000 fire-damaged properties in Sonoma and Napa counties alone (US News& World Report 2017, The Press Democrat 2017, USEPA 2017).

When it comes to forecasts for extreme heat, heat-related illnesses are always a concern; without the ability to stay cool and adequately hydrated during periods of prolonged heat exposure, health impacts that begin with fatigue and cramping can quickly escalate to heat stroke and death (HAW CAT 2013). Although exposure to extreme heat can affect everyone, health risks are greater for vulnerable members of society.

Geographic location also plays a critical role in one's exposure to, tolerance of, and general preparedness for extreme heat. For example, a hot day inland away from the moderating influence of the ocean can be significantly warmer than a "hot" day on the coast. Therefore, it makes sense that inland residents are much more likely to be exposed to temperatures that can cause thermal stress in the body. However, at the same time, coastal residents are generally less acclimatized to higher temperatures, less likely to recognize the signs of heat-related illness, and are less likely to be living in homes equipped with air conditioning because it is so rarely needed. In fact, during the 2006 California heat wave, there was a greater increase in trips to the hospital for heat-related illnesses within coastal counties versus inland counties (Gershunuv et al. 2011).

North Coast communities with highly-modified urban landscapes may also be disproportionately affected during periods of extreme heat; urban landscapes also tend to have higher concentrations of dark, thermally absorptive surfaces, such as roads, rooftops, parking lots, and buildings. Furthermore, after absorbing the sun's heat throughout the day, the asphalt and concrete that are so frequently used in urban development continue to radiate heat long after sundown, such that nighttime temperatures are generally warmer in cities. In fact, this phenomenon, known as urban heat island effect, can result in temperatures in cities that are as much as 10°F warmer than in surrounding areas (CDC undated).

2.11.10.2 AIR AND WATER QUALITY

The impact of climate change on air quality is not limited to irritants and potentially carcinogenic contaminants contained in smoke from wildfires; with projections for warmer temperatures and higher concentrations of CO2, plants are expected to grow more vigorously and produce more pollen, or in the case of fungus, it may result in the release of more spores (Wayne et al. 2002, CNRA 2009). This increase in allergens is expected to induce and/or worsen allergies, asthma, and other chronic pulmonary conditions. Heat also facilitates the formation of ground-level ozone and other air contaminants that cause inflammation of the airways, diminished lung function, and other human health impacts. Because these pollutants are byproducts of power generation, industrial emissions, and motor vehicle exhaust, however, concentrations are expected to be higher in the region's urban centers and along major transportation corridors than in the North Coast's many rural communities (CNRA 2009, HAW CAT 2013).

During late summer, when flows on North Coast streams are low and temperatures are high, toxic algal blooms can develop that can sicken and/or kill humans and other animals exposed to the toxins. These blooms, which have been observed on the Mattole, South Fork Eel, Trinity, Van Duzen, Klamath, and other North Coast streams, are expected to occur more frequently due to the higher temperatures and more frequent drought-like conditions that are forecast for the region (The Times-Standard 2013, The Times-Standard 2017, CNRA 2009).

2.11.10.3 PESTS AND PATHOGENS

There is also a connection between climate change and infectious disease (IPCC 2013). In some instances, it is the transmissibility of pathogens that can increase with warmer temperatures. In other cases, it is the abundance and range of vectors that carry disease that can shift in response to temperature. For example, with warmer winter temperatures, there will be fewer freezing nights in the North Coast, allowing certain pests, like ticks, fleas, rodents, and mosquitoes, to survive through the winter and grow more abundant. Moreover, with the changing environmental conditions that are forecast, pathogens that are currently absent from the North Coast could become increasingly common (CNRA 2009).

2.11.10.4 CONTAMINATED WATER SUPPLIES AND HIGHER FOOD COSTS

Climate change also threatens access to safe drinking water; because of the warming climate, coastal aquifers are expected to face an elevated risk of contamination from saltwater intrusion due to increased pumping of groundwater (USGS 2017) and in response to sea level rise (Werner and Simmons 2009). In addition, with the forecast for more frequent heavy storms, nutrients, pesticides, and other contaminants are much more likely to be flushed from the land into nearby streams, lakes, and reservoirs, with potentially catastrophic impacts on the region's water quality. When these inputs of excessive nutrients, bacteria, and other contaminants occur, water quality is significantly impaired and blooms of toxic algae, like the ones briefly discussed above, are more likely develop. Moreover, after the blooms of algae die, dissolved oxygen in the impaired waterbody can become depleted by the decomposition process, resulting in potentially large fish kills, the loss of other aquatic life, and further impacts to water quality.

Along with potential impacts to water quality, climate change also threatens food security through diminished crop yields, impacted fisheries, decreased livestock productivity, and the higher resultant food costs (CNRA 2009, Chavez et al. 2017). For example, at the same time more frequent extreme heat events and diminished water supplies are expected to decrease agricultural productivity, fewer freezing nights could result in more abundant pests and higher use of pesticides (CNRA 2009). The increased food costs will be particularly difficult for the most vulnerable members of society who already struggle to afford healthy food choices for themselves and their families (Morello-Frosch et al. 2009, CNRA 2009).

2.11.11 DISPROPORTIONATE IMPACTS ON ECONOMICALLY DISADVANTAGED COMMUNITIES

In addition to the greater challenges that economically disadvantaged communities in the North Coast already face due to their rural location and more limited financial resources, DACs are also likely to experience disproportionate impacts of climate change.

For example, low-income individuals and families will not only struggle to afford the higher food prices discussed above, but they will also be more likely to be harmed by the increasingly frequent extreme weather events such as heat waves forecast for the region. This is due in part to the many fixed-income elderly in the North Coast that, because of their age, are less able to thermoregulate to avoid overheating. Moreover, these economically disadvantaged seniors are also more likely to have pre-existing health conditions that are exacerbated by the heat, such as pulmonary and cardiac disease. However, it's not just the low-income elderly that will face elevated risks. Because the poor are more likely to be employed in occupations that require physical exertion and/or exposure to the environment, such as agriculture, forestry, and construction, even healthy working-age individuals will face disproportionate heat-related health impacts. In addition, for those with very limited financial resources, the cost of air conditioning and its operation can be prohibitive. The same is true for automobiles, with low-income individuals being less likely, on average, to have reliable transportation for accessing cooling centers and/or escaping to locations where temperatures are less oppressive. Finally, low-income individuals are less likely to have access to health care should they become sickened by the heat, and they are also more likely to have asthma and other chronic conditions made worse by the heat (Morello-Frosch et al. 2009, CNRA 2009).

With all seven counties represented in the NCRP defined, at least in part, as economically disadvantaged per the State of California definition (NCRP, 2014), impacts on the region and its resilience to the effects of climate change may prove all the more challenging.

2.12 GHG EMISSIONS & REDUCTION OPPORTUNITIES

According to the Public Policy Institute of California, "Global emissions of greenhouse gases (GHGs) are raising air and water temperatures and sea levels, with serious consequences for California. The state has recently experienced record-high temperatures, and warming is expected to continue over the century" (PPIC 2017). Extreme weather events are increasing and costlier than ever: recent droughts and floods have damaged local infrastructure and rural economies, and the region's wildfires are becoming increasingly devastating, with the 2017 Tubbs fire in Sonoma County was California's most destructive and third most deadly wildfire in recorded history.

In response to evident and escalating consequences of GHG emissions, the state has mandated aggressive mitigation. Mitigation of climate change (as opposed to adaptation to the impacts of climate change) is "intervention to reduce the human impact on the climate system; it includes strategies to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sinks [sequestration]" (CNRA 2018). Statewide mitigation policies and programs have put California on track to meet its 2020 target; increasing the pace of GHG reductions will ensure aspirational targets for 2030, 2050, and beyond are achievable if every sector, in every part of the state, and every community is involved.

Climate change challenges everyone, but impacts "are often disproportionately borne by the state's most vulnerable and disadvantaged populations (CARB 2017)." Relative to the rest of California, the North Coast hydrologic region is rural, politically underrepresented, and economically disadvantaged. It also is incredibly rich in natural resources, including renewables, and natural/ working lands, including forests and farms. There is compelling local incentive and potential for the region to reduce GHG emissions outputs, increase carbon sequestration inputs, and engage and empower communities – all while growing the economy and revitalizing infrastructure.

The NCRP has commissioned development of a regional renewable energy analysis and GHG accounting framework: *North Coast Resource Partnership Integrated Strategic Plan: Climate Change Mitigation, GHG Emissions Reduction and Energy Independence*, Redwood Coast Energy Authority and *Greenhouse Gas Emissions*

Assessment Roadmap for the North Coast Regional Partnership, from the Schatz Energy Lab, and the information below is excerpted and adapted from them.

Regional Energy Profile

- *Consumption:* Sonoma, with its larger population, has the highest energy consumption. However, it also has the lowest electricity consumption per capita. Only three counties (Humboldt, Mendocino and Sonoma) have significant natural gas service. The remaining counties rely on propane, fuel oil, wood and electricity to meet space heating, water heating, and cooking needs.
- *Generation:* The region generates more electricity than it consumes, with Sonoma generating the majority from geothermal power. Other sources throughout the region include hydroelectric, natural gas, biomass, and solar. Almost all natural gas is imported from outside the region, and all gasoline and diesel fuels are imported.
- *Sustainability*: An assessment of the region's potential for generating renewable energy (by county and by sector) indicates significant opportunities throughout the region and across sectors. Development of these opportunities is a key recommendation of the Climate Mitigation Report (Redwood Coast Energy Authority and Woods Biological Services 2018).

2.12.1 ENERGY SECTOR

The energy-related greenhouse emissions in the region appear to be dominated by the transportation sector. However, incomplete data are currently available and further work is needed in this area. Heating fuel emissions are significant and electricity use accounts for a relatively small portion of energy sector emissions. Due to its larger population, Sonoma has the highest level of CO2 emissions in the electricity and natural gas sectors. In contrast, The Trinity County PUD, which provides electricity to the majority of Trinity County, gets all its electricity from hydropower, so the CO2 emissions associated with electricity consumption in Trinity County are close to zero. Transportation accounts for over half the emissions in all cases. This is not atypical, especially for rural areas where emissions from industry are relatively low and per-capita vehicle miles traveled is relatively high. For comparison, the transportation sector accounted for 37% of total CO2e emission for the State of California in 2014 (CARB 2014).

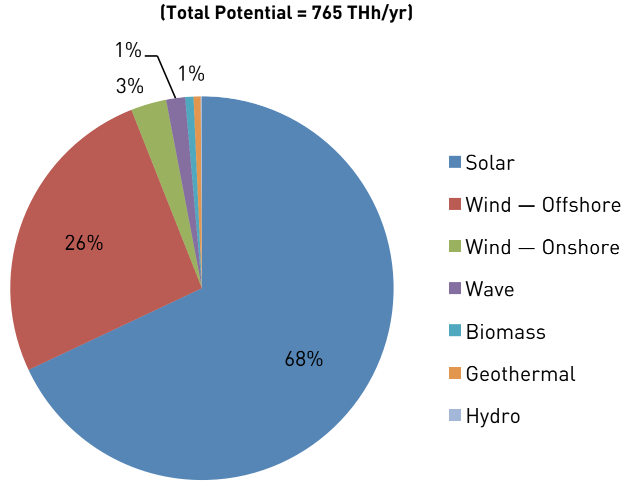
Energy efficiency is key to reducing GHG emissions in the NCRP region. California has been at the leading edge of energy efficiency efforts and thus there is a long history of efficiency programs throughout California and the NCRP region. In California the investor owned utilities are required to collect and spend funds from ratepayers for efficiency programs.

The NCRP region is a renewable resource rich region. Developable renewable resources include biomass, geothermal, hydroelectric, solar, wave, and wind power. However, these resources are not uniformly distributed throughout the region. For example, coastal counties in the region tend to be rich in wave and wind energy, while inland counties have a greater solar resource. Other resources, like geothermal and biomass power, are distributed based on unique geological and ecological characteristics. Chart shows the estimated technical potential for renewable electricity generation in the NCRP region broken out by resource. Solar and off-shore wind dominate the region with over 94% of the total technical potential. Onshore wind, wave, biomass and geothermal resources make up most of the remainder. Note that the dominance of solar photovoltaic (PV) power and wind power is consistent with the breakdown shown in NREL studies for the State of California (Brown, A. et al. 2016, Lopez, A. et al. 2012).

There are challenges and opportunities associated with the development of regional renewable resources. The topics covered include: 1) the intermittent nature of some prominent renewable resources and the value of energy storage and demand response, 2) the need for adequate transmission infrastructure, 3) the challenges and opportunities associated with distributed generation, 4) the opportunity for microgrids and combined heat and power, and 5) power plant ownership. These are discussed in depth in the *North Coast Resource Partnership Integrated Strategic Plan: Climate Change Mitigation, GHG Emissions Reduction and Energy Independence*.

Chart 1. North Coast Renewable Electricity Generation Potential by Resource

(Total Potential = 765 THh/yr)



Biomass refers to renewable organic materials, such as wood and wood waste, agricultural crops and waste, and municipal wastes that can be used as a source of energy to produce heat, electricity or biofuels. Biomass energy generation can be accomplished through use of agricultural by-products such as prunings, field crop residues, food and fiber processing residues, and animal manures; forestry by-products such as logging slash, mill residues, and forest thinning/fuel reduction/management residues; and municipal by-products such as solid waste in the form of organics, landfill gas, biosolids from wastewater treatment, and sewage digester gas. Three North Coast counties, Humboldt, Mendocino, and Siskiyou, are considered to have high biomass technical potential; Humboldt County has three existing biomass facilities and Siskiyou has one (Table 10, Biomass Facilities in the North Coast Region).

TABLE 10. BIOMASS FACILITIES IN THE NORTH COAST REGION

	FAIRHAVEN	SCOTIA	BLUE LAKE	WEED
County	Humboldt	Humboldt	Humboldt	Siskiyou
Plant Type	Biomass to Energy	Combined Heat and Power	Biomass to Energy	Combined Heat and Power
Nameplate Capacity (Mw)	19 Mw	34 Mw	14 Mw	12 MW
Operational Mw	18 Mw	28 Mw	12.5 Mw	?
Main Power Customer	PG&E	Mill and town of Scotia	San Diego Gas & Electric	Proposed PPA is cancelled and/or in dispute
Owner	DG Fairhaven Power	Greenleaf Power, LLC	Blue Lake Power, LLC	Roseburg Forest Products
Address	97 Bay Street Samoa, CA 95564	Sacramento, CA	200 Taylor Way Blue Lake, CA	Weed, CA
Phone	(707) 445-5434	(916)-259-0930		(530) 938-2721
Fax	(707) 445-2551			
Contact	Bob Marino, General Manager	Rob Crummet, Fuel Buyer	Glenn Zane	Arne Hultgren, Manager
Feedstock Source	The plant uses over 250,000 tons of various forms of wood waste from local sawmills annually.	The plant uses mill residuals and other available biomass to provide heat and power to the Town of Scotia and the adjacent saw mill.	This plant uses mill residuals and non-merchantable hardwoods and other waste from timber stand improvement and other timber operations	Veneer plant. Waste material from plant and additional feedstock. The plant is an expansion of current cogeneration capacity at the Weed facility.

(from The Watershed Center, February 2017)

Accessing underground geologic heat reservoirs can generate geothermal energy. Geothermal potential within the NCRP counties is concentrated chiefly in Sonoma County, Siskiyou County, Modoc County, and Mendocino County. Sonoma County currently utilizes much of its geothermal resource with the existing facility at The Geysers. Additional expansion of geothermal power in other parts of the region is most likely in Siskiyou and Modoc counties, although resource exploration will be necessary to determine the true power potential.

Hydropower utilizes the energy in flowing water to spin a turbine and generate electricity. The potential energy available for conversion is a function of the elevation change between intake and turbine and the flow rate. Hydropower technology is fully mature and has been utilized to generate electrical power for over 100 years. Traditional hydropower has involved the construction of dams to impound water and harness it's power. Unfortunately, the construction of dams can pose adverse impacts to river ecosystems. In the NCRP region most existing facilities are less than 100 MW in capacity, however, there is a substantial amount of new hydropower potential in Del Norte, Humboldt, Siskiyou and Trinity Counties. Environmental impacts, however make it unlikely that these opportunities are feasible unless greater understanding of the watersheds makes it possible in some situations to build new run-of-river systems with minimal impact. In this type of system, water is taken out at one location, run through a turbine, and returned at a lower location in the stream, which may be possible in streams with natural blockages to fish passage.

According to a solar fact sheet available from Sandia National Laboratory (Tsao 2006), sunlight has by far the highest theoretical potential of the earth's renewable energy sources. In fact, enough solar energy strikes the earth's surface every few hours to satisfy a year's worth of worldwide energy consumption. The solar radiation that strikes the earth can be converted into useful energy via a number of technology pathways. These include active solar thermal systems, passive solar thermal design, concentrating solar thermal electric systems, and solar photovoltaic technology. Solar photovoltaic (PV) technology is unique in that it is very modular. It can be the size of your thumbnail and used to power a wrist watch, or it can fill square miles of desert land and power over 100,000 homes. Solar PV is a very mature technology that has come down in price dramatically over the last 10-15 years. The solar resource potential for the NCRP region is tremendous. As shown in Table 11 solar clearly offers the greatest total potential across all the resources examined (68% of the total estimated renewable resource potential). This is due in large part to the fact that the sun essentially shines everywhere. Modoc and Siskiyou have by far the greatest solar resource potential in the NCRP region, with Mendocino and Sonoma trailing as distant 3rd and 4th place rankings, followed by Humboldt and Trinity.

Wave Energy Converters (WECs) utilize ocean waves to produce power. While the technology is not mature and has yet to see any major installations, wave energy has the potential to provide around-the-clock power to coastal communities. The wave resource in northern California shows great potential. That has led to multiple wave energy projects being proposed for the coastal counties in the NCRP region. Unfortunately, these projects have all been dropped due to the immaturity of the technology, unfavorable project costs, and extensive infrastructure needs. Wave energy in the region is not likely to be limited by resource availability, but instead by cost, supporting infrastructure, competing stakeholder needs, regulatory complexity, and public acceptance. Access to a deep-water port is necessary, and this makes Humboldt Bay the most feasible location for wave energy demonstration and deployment in the region.

Wind power is a very mature technology that has been used effectively at a large commercial scale in the U.S. for more than a decade. While there are some very good wind sites onshore, the best wind resource is found offshore. There are a few potentially favorable onshore wind power areas in the region; these include: 1) an area on the border of Sonoma and Mendocino Counties near the coast, 2) the Cape Mendocino coastal ridgelines in Humboldt County, 3) an area running roughly from east to west in southeastern Siskiyou County that runs adjacent to Mount Shasta, and 4) a few potential locations in Modoc County. The offshore wind resource is generally strong off both Humboldt and Mendocino Counties, with Cape Mendocino exhibiting the strongest resource in the region.

TABLE 11. RENEWABLE ELECTRICITY GENERATION POTENTIAL AND ELECTRICITY CONSUMPTION TOTALS FOR THE NORTH COAST REGION

	DEL NORTE	HUMBOLDT	MENDOCINO	MODOC	SISKIYOU	SONOMA	TRINITY	TOTAL	RESOURCE % OF TOTAL
2014 Electricity Consumption (GWh)	203	839	563	168	482	2,943	118	5,314	
Renewable Electricity Generation Technical Potential (GWh/yr)									
Biomass	168	1,369	1,291	443	1,137	556	748	5,711	0.7%
Geothermal	—	—	430	860	1,505	1,505	-	4,300	0.6%
Hydro (Total)	100	184	50	42	339	48	223	986	0.1%
Hydro — Unpowered Dams	0	13.1	13.1	13.1	45.85	45.85	0	131	
Hydro—New run-of-river (> 1 MW)	100	171	37	14	289	-	223	835	
Hydro—in-Conduit	—	—	—	14	3.7	2	-	20	
Solar	8,452	36,580	61,196	205,753	123,752	53,006	30,461	519,200	68.0%
Wave	1,916	3,455	3,303			3,560		12,233	1.6%
Wind—Onshore	2,212	4,222	2,132	3,176	8,575	958	1,428	22,703	3.0%
Wind—Offshore	35,683	51,101	57,269			55,947		200,000	26.0%
Total	48,532	96,911	125,669	210,274	135,308	115,579	32,860	765,133	
County % of Total	6%	13%	16%	27%	18%	15%	4%		

Information sources:
Biomass: CA Biomass Collaborative (2015)
Geothermal: Williams, C. et al. (2008)
Hydro: Hadjerioua, B. et al. (2012), Navigant Consulting, Inc. (2006), Kane, M. (2005)
Solar: Simons, G. and J. McCabe (2005), Lopez, A. et al. (2012)
Wave: Kane, M. (2008)
Wind: Yen-Nakafuji, D. (2005), Dvorak, M. et al. (2010)

2.12.1.1 Fuel Use Reduction

Under the right circumstances, fuel switching in the heating sector can save money and reduce greenhouse gas emissions. The most economically viable opportunity is to convert propane or fuel oil users over to electric heat pumps. Data should be collected to help determine the potential size of this market and to assess the opportunity in more detail. If the market is of sufficient size and the economic and GHG reduction opportunity is compelling enough, serious consideration should be given to creating a promotional program. However, the key obstacle is identifying the owner and implementer of such program. While an electric utility provider would typically handle such a program, it may be difficult to convince PG&E or PP&L to develop such a program. However, a municipal utility could easily take it on, or if a CCA were serving the entire NCRP region they could offer such a program.

California Energy Commission defines distributed generation projects as "20 megawatts or smaller- including both self-generation and projects that do not directly serve a home or business and are interconnected 'in front of the meter' to generate energy to be sold to load-serving entities or on the wholesale market. Self-generation is defined as distributed generation systems installed at a utility customer's facility, business, or home. These systems serve primarily on-site load or export excess power back to the grid through net-energy metering" (CEC).

Parts of the North Coast Region are divided by numerous mountainous regions and extensive river systems.

This rugged terrain requires distributed assets, especially distributed generation, which would allow autonomous operation in more isolated communities in case of damaged central generation or transmission lines. In many North Coast Region areas there are very limited transmission line connections to the larger statewide electric grid. Focusing on smaller, distributed sources of renewable energy generation, coupled with other microgrid technology components allows for adaptation in emergency situations while also decreasing everyday dependence on fossil fuels that provide electricity to the central grid.

2.12.2 FOREST AND NATIVE VEGETATION

Approximately 3.5 billion hectares, or almost 70% of the Region is forested (Nickerson 2017). As detailed in Section 2.3.12 Land Use, managed forests approach their maximum contribution to mitigating GHGs when stocking levels support healthy trees that are resilient to wildfire and pests and the healthiest trees are grown to a mature condition before harvesting (Nickerson 2017). Forests in the region store almost 4 gigatons of CO_2e, or 90% of the carbon within the study area.

In the past few decades, the timber industry has declined as a result of economic issues, changes in international markets, and the expansion of environmental regulations to protect resources and ecological function. Increased regulations have also created new opportunities for foresters in the Region with respect to the carbon sequestration and the Cap-And-Trade Program. Natural and working lands are a key sector in the State's climate change strategy (ARB 2017, CalFire et al. 2017). Storing carbon in trees, other vegetation, soils, and aquatic sediment is recognized as an effective way to remove carbon dioxide from the atmosphere (ARB 2017).

2.12.3 AGRICULTURAL LANDS

Although not a geographically-large part of the Region's area (herbaceous rangeland covers 7.26 %; cultivated agriculture covers about 3.57%), agriculture looms large in the Region's identity: the southern part of the Region, "Wine Country," is known for its vineyards and fine wines, fresh organic vegetables, and artisanal cheeses while further north along the coast are dairies, ornamental flowers, and bulb production. Pasture, orchards, alfalfa, grain, and potato production accounts for much of the major inland agricultural enterprises. The Region is also home to the "Emerald Triangle," portions of Trinity, Humboldt, and Mendocino counties where conditions are favorable for cannabis cultivation, which was legalized in California in 2018.

Agricultural GHG emissions have not been analyzed for the North Coast region; however, California cropland and dairies are a primary emission source of N_2O, methane and other GHGs. Agriculture contributes over 50% of the state total N_2O emission inventory (CARB 2019). Research is currently ongoing to explore alternative management options to cut N_2O and overall GHG emissions from California cropland. Research specific to agricultural emissions on the North Coast is necessary to fill this data gap.

Orchards (<1%), row crops (<1%), and grasslands (4%) comprise about 6% of the carbon sequestered in the North Coast. Soil sequestration techniques, such as compost addition, while providing multiple benefits of improving water holding capacity, increased nutrient availability, and improved soil structure, are not a significant source of sequestration for the region, although they may locally mitigate for farm practices that emit GHGs.

2.12.4 TRANSPORTATION

Transportation (gas, diesel) emissions accounts for over half of emissions when considering regional energy use. A key strategy identified for the North Coast is to convert energy use in the transportation sector to electricity while simultaneously "greening the electric grid. Additional options include promoting energy efficiency and switching to renewable and low-carbon fuels (Climate Mitigation Report for the North Coast Region of California). Commercially available alternative transportation fuels include biodiesel, electricity, ethanol, hydrogen, natural gas, renewable natural gas, propane, and renewable diesel. Renewable diesel is a "second generation" diesel fuel made entirely from plant and waste oils like biodiesel, but without the gelling or engine performance issues of first-generation biofuels. The alternative fueling infrastructure in the NCRP region, as of December 2016, includes: electric vehicle charging stations (147), propane fueling stations (17), biodiesel fuel pumps (4), and hydrogen fueling stations (1) (DOE 2016).

Increased use of public transportation is another option, although with the widely dispersed populations in the North Coast, this presents a particular challenge. However, concern about GHG emissions and interest in healthy lifestyles and walkable neighborhoods increases, many North Coast communities are planning for and implementing projects that improve public transit and bicycle and pedestrian pathways.

All counties in the North Coast have developed Transportation Plans and many communities have developed Bicycle and Pedestrian Plans. Some also possess airport, rail, and harbor plans. The challenge facing the region is to operate and develop these systems into the future so that they coalesce into a safe, efficient, integrated intermodal system that serves the mobility needs of people and freight while fostering economic growth and development.

2.12.5 RESIDENTIAL AND MUNICIPAL BUILDINGS

As stated by the California Legislature in AB 32, "building-related emissions are the second largest category of emissions of greenhouse gases in California, accounting for 25 percent of all emissions of greenhouse gases. Direct emissions from combustion of fossil fuels in buildings, primarily for space and water heating, accounts for 10 percent of all emissions of greenhouse gases in California. Decarbonizing California's buildings is essential to achieve the state's greenhouse gas emission reduction goals at the lowest possible cost" (California Legislative Information 2018).

In 2014 Redwood Coast Energy Authority conducted a 2005 greenhouse gas inventory for Humboldt County revealing 20 percent of the county's emissions were related to residential and commercial energy use (Humboldt County General Plan 2017). Reinforcing the trend, Sonoma County's 2010 GHG inventory data shows building emissions accounting for 36 percent of countywide greenhouse gas emissions (Sonoma County Regional Climate Action Plan 2016).

Energy efficiency is key to reducing GHG emissions in the NCRP region. Deep energy efficiency retrofit programs should look holistically at building energy use and should be based on actual measured energy savings. There are currently many energy efficiency programs that operate in the NCRP region; however there is still untapped potential to enhance and expand these programs. This can include a focus on "integrated demand-side management" which goes beyond technology retrofits and includes demand response and load shifting strategies to support the cost-effective and efficient operation both at the facility level as well as for the management of the overall utility grid.

2.12.5.1 Geo-Exchange

A geo-exchange system is a central heating and/or air-cooling system that actively pumps heat to or from the shallow ground several meters deep, where temperatures remain moderate all year. One barrier to employing geo-exchange is high up-front cost, but the difference can be made up in energy cost savings in three to ten years. Sonoma Water initiated a study to characterize and analyze impacts of geothermal resources on hydrogeological resources in a small region of Sonoma Valley, just south of the North Coast Region in Sonoma County. The analysis found that a heat capacity of up to 230° F are available at depths greater than 0.8 miles, however, extraction may only be achieved using low flow rates (less than 95 gal/hr) because higher flows could negatively impact existing uses.[11]

2.12.5.2 Micro-Cogeneration

Cogeneration is the principle of capturing and using the waste heat emitted by heat engines powering other energy applications. Micro-cogeneration, also called micro combined heat and power (microCHP), is an extension of cogeneration to the scale of the home or small building and is used to heat water or spaces and produce electricity. Micro-cogeneration systems use conventional (natural gas) or alternative (biomass or fuel cells) fuels to power engines and turbines so a system's operation is only as "green" as its power supply.

11 Geothermal Resource Analysis available on Sonoma Water Energy & Sustainability Projects web page: https://www.sonomawater.org/energy-sustainability-projects

2.12.6 WATER TRANSMISSION

Due to pumping, treating, and heating, water systems are energy intensive. California's water system accounts for nearly 10 percent of the state's greenhouse gas emissions. Most energy consumed by California's water sector goes to residential use (42%), however water supply, conveyance, and treatment accounts for 12% of energy consumed by the water sector (PPIC 2016). Significant differences in energy used to convey water in Northern and Southern California call for a closer look at local data. According to the California Energy Commission, "on average, water conveyance requires more than 50 times the energy for Southern California than it does for Northern California" since the water must travel hundreds of miles and, in some cases, pumped over mountain ranges before reaching the destination (California Energy Commission 2005).

Compiling and analyzing detailed regional data would provide a better understanding of County and community-level water-related GHG emissions due to the variability of local conditions as well as local emissions-reduction efforts. For example, the Sonoma County Water Agency is one of the largest energy users in the county, but has undertaken aggressive renewable energy and emissions-reduction strategies, including sourcing 100% of its electricity from renewable and carbon free sources, which have resulted in the Sonoma Regional Climate Protection Authority reporting a 96% decrease from in county-wide emissions from water conveyance between 2010 and 2015 (SCWA and RCPA 2018).

The intricate link between energy use and water supply, distribution, and conservation is commonly referred to as the water-energy nexus. This nexus requires an integrated cross-discipline approach to water-climate-energy security. Given the tight relationship between water and energy, the relationship between local energy generation and local economic development, and the nexus between GHG emissions and watershed management, the North Coast must logically integrate energy considerations into its programmatic regional approach to water resources planning and management (*North Coast Climate Mitigation, Adaptation, and Energy Independence Report (NCCMAEI)*).

2.12.7 WILD FIRE

With the region's forests serving as important carbon storage sinks, wildfires can conversely cause significant releases of CO_2 back into the atmosphere along with other GHGs and particulate matter. Fire is a natural and important element in the ecosystems of the region, but the intensity, size and characteristics of fires influences both their GHG emissions impacts as well the human and natural impacts.

There has been significant effort to identify the ability for forest treatments to influence the severity of wildfire through various treatment methods. A good brief overview of efforts to date regarding fuel treatment-wildfire-carbon dynamics can be found in the introduction of (Chiono et al. 2015). In general, it is possible to protect live carbon stocks using fuel treatments that produce lower density stand structures that are dominated by large fire-resistant species (Hurteau and North 2009). Emissions from wildfires can be reduced because of forest treatments, but it is not guaranteed that this will sufficiently offset the emissions associated with treatment activities. For example, according to one study the severity of very large wildfires (~10,000 hectares) must be reduced to offset the emissions from treatments employing prescribed burning (Chiono et al. 2015). Some of the additional important variables that impact wildfire emissions estimates include existing stand structure, forest type, treatment type, stand management type, spatial distribution of treatments relative to each other (Ganz 2007), fire weather conditions, and landscape-scale variables such as long-term wildfire probability and impacts from diseases and pests.

Because of the complexity of fuel treatment-wildfire-carbon dynamics it is difficult to generate a blanket number that represents potential emissions impacts. However, a study conducted in Trinity River Watershed Management Area estimated that if it could be assumed that thinning practices reduced wildfire severity from "high" to "low", then 15 tonnes of stored CO_2 per acre (12,500 tonnes total for the Trinity study) could potentially be retained through avoided fire-caused mortality (NCRC&DC and 5C 2017). Many forested communities, including those in the North Coast Region, are already removing significant biomass from forested areas on both public and privately-owned lands. Some of this removal is part of current timber harvest activity, and a large part is for fuels reduction to assist in limiting the occurrence of regional large-scale catastrophic wildfires.

In addition to using California's forests for carbon sequestration, the Air Resources Board (2017), in response to ARB32, the California Global Warming Solutions Act, recommends use of forest biomass to advance statewide objectives for renewable energy and fuels (see *Section 2.12.1 Energy Sector*). Biomass energy project designed to support forest restoration and management priorities have the potential to support overall net reductions in GHG emission. In a study conducted by the USFS Rocky Mountain Research Station, a comparison of CO_2 emissions of pile burning, natural gas, and bioenergy concluded that biomass energy projects, with defined implementation, can result in over-all reduced emissions (TWC 2017). However, transporting forest biomass material to traditional centralized plants can be difficult and costly. There are ongoing efforts to explore strategies to process forest fuels to make transport more feasible as well as to develop smaller, community scale technologies that can utilize the material closer to the source to reduce the need for long-distance transportation. Further research is needed to draw conclusions specific to forest-derived woody biomass as a fuel for electricity generation.

2.12.8 OTHER

Landfills can emit significant amounts of methane into the atmosphere. The landfilling of organic materials leads to the anaerobic breakdown of these materials into landfill gas. Landfill gas is primarily composed of methane, which is 72-84 times more potent than carbon dioxide (CARB 2018). A 2010 GHG inventory for the City of Ukiah in Mendocino County revealed that 21% of greenhouse gas emissions in the city were from the city landfill (City of Ukiah Climate Action Plan 2014).

The North Coast Region has undertaken multiple strategies to decrease emissions from landfills. In Sonoma County, the Landfill Gas Power Plant produces up to 5MW electricity using gas collected from 150 collection wells in its landfill. The landfill gas is transported through four miles of pipeline to the landfill gas-to-electricity facility and to the landfill gas-to-vehicle fuel pilot project. The compressed natural gas produced is used to fuel select vehicles in the Sonoma County fleet (County of Sonoma undated). Humboldt Waste Management Authority collects green waste and 85% is composted at Mad River Compost Facility in Arcata, while the remainder is used as fuel to produce energy at local biomass facilities (HWMA).

Livestock is another significant source of GHG emissions. For example, even as the most-populous county in the region, Sonoma County's 2015 GHG Inventory found that 10% of County's emissions were from livestock and fertilizer – more than the emission from solid waste, off-road transportation, and water and wastewater sectors combined. Animal waste digesters are strategy to capture the release of methane, however, dairies in Sonoma County are mostly pasture-based and waste is spread over the landscape, which is not conducive to the feasible use of animal waste digesters. This strategy would only be useful in those areas where livestock are frequently confined; in these cases, waste can be collected and transferred into the digester on a regular basis. Biogas is created when animal waste decomposes, and as stated by the Environmental Protection Agency, "capturing biogas from cattle, hog, and poultry farms can reduce greenhouse gas emissions and recovering the methane from the biogas can provide a cost-effective source of renewable energy" (EPA).

The North Coast Region should continue exploring innovative ways to capture the release of greenhouse gases from landfills and agriculture.

2.13 REGIONAL SOCIOECONOMIC CHALLENGES

Despite historically economically challenged communities and a series of boom and bust economic cycles, the communities of the North Coast Region continue to approach their future with a remarkable level of tenacity and optimism. The NCRP is recognized statewide for its ability to organize and leverage this energy — and uses this momentum to help to support and guide the Region towards a more resilient future. Creating, nurturing, and retaining human capital and talent in the North Coast Region is a critical factor in current and future success of local communities and the region. Human capital and talent – the social resources of the Region – are as important to its future as its natural and built infrastructure. Identifying, empowering, and tapping into existing social capital is vital to leverage and multiply human potential to continue on a path towards a resilient and viable North Coast Region.

2.13.1 LIMITING FACTORS AND CHALLENGES

2.13.1.1 Disparities between Region and State

As a Region, the North Coast is older, less affluent, less racially diverse, and less educated than the California average. Although these factors represent significant challenges, there are also many shared values, such as an appreciation for the Region's astounding natural beauty and widespread support of its agricultural heritage, that compensate. Additionally, for over a decade, the NCRP has proven that individuals and communities with widely different lifestyles and/ or beliefs are able to find common ground; through the Integrated Regional Water Management process, the Region has made great gains in creating a shared vision for the North Coast.

2.13.1.2 Changing Economic Conditions

Over the past 100 years, the North Coast evolved from mainly extractive activities (fur, gold, timber, agriculture) to more stewardship-based and service-oriented activities (outdoor recreation, education, sustainable forestry) today. At every step along the way, natural capital assets have been foundational to these economic sectors with human innovation and strong institutions also playing an important role. From computer technology to cattle genetics, that dynamism continues. While extractive industries remain, they can now be augmented and influenced by changing market values and opportunities that improve local economic health while also ensuring the long-term health of local natural resources and the communities that are dependent upon them. Moving forward, the North Coast economy of the 21st century is poised to further advance value-added goods and services. The diverse economy and ecology that exists across the Region requires an economic vision for the future that takes advantage of the value provided across every economic sector (Earth Economics 2018).

2.13.1.3 Limited Job Opportunities and Regional Loss of Human Capital

Retention (and re-attraction) of talent is a challenge for the region. As noted in the NCRP Plan (NCRP 2014), in Modoc and Siskiyou Counties "younger non-migrant residents continue to leave the area." The present lack and modest projected increases of population age 25 and younger is indicative of locations that are unable to provide living wage jobs that retain local youth (CA DOF 2017b). Although there are a few nascent initiatives underway (e.g. in community groups and churches) and the Region continues to do well in educating its population through high school, the Region does not capitalize on that investment to secure these graduates returning. This is due in large part to the lack of wage parity and paucity of employment opportunities. Additionally, in a number of interviews, the lack of access to high speed internet is identified as a significant deterrent for younger workers who might want to stay in the region, but expect the ability to work remotely. The dearth of young professionals, and their families also impacts succession planning in both private and public sectors, resulting in an aging population of entrepreneurs, elected officials, and administrative staff. Also, falling school enrollment with resulting budget and capacity implications is a challenge for many of the more rural school districts.

2.13.1.4 Aging Population and Succession Planning Needs

The state's estimated median age has increased slightly from 33 to 36, while the median ages in the six main counties in the North Coast Region are estimated to approach the mid-40s (CA DOF 2017a). While the Region's overall birthrate continues to decline, estimates point toward an increasingly aging Region population. Increasingly, retirees are settling in the North Coast as they value the area's rural quality of life and high standard of living. Modoc, Trinity, and Siskiyou Counties have the largest proportion of residents age 65 and over (25%, 23%, and 21% respectively) (Pederson 2018). This may lead to an increase in the demand for health-related services and related construction of retirement, healthcare, and other facilities in these remote areas.

Especially in the more rural areas of the region, the lack of younger populations, the continued exodus of high school graduates, and wage competition from communities outside of the Region all lead to the aging of organizations, elected bodies, and private sector leadership. For some public organizations this means board members are continuing to serve well into their 80's and, many of these elderly leaders have unparalleled levels of knowledge and institutional memory that is extremely valuable. Unfortunately, without the use of/skill for electronic archiving or transferring this knowledge to new leadership, it disappears when the leader ends their tenure.

2.13.1.5 Potential Loss of Infrastructure, Knowledge, and Talent

The North Coast region, during the transition from a resource extraction based history to a more sustainable and diversified economic portfolio, risks the potential loss of existing talent and infrastructure. As an example, traditional timber industry knowledge, human talent, and infrastructure will still be needed in a climate adaptive/forest restoration scenario. It is important to ensure that the current assets that could help with a future industry are not lost as a result of economic dips occurring within that transition period. Future activities and opportunities are likely to be more expensive and time consuming if new facilities and talent need to be developed from the ground up (Morris et al. 2017).

2.13.2 FUTURE OPPORTUNITIES, PLANNING, AND STRATEGY

2.13.2.1 Regional Knowledge and Talent Development

With the recent merging of the Northwest and Northeastern California Small Business Development Center (SBDC) Offices, there is an opportunity to work with this and similar organizations to enhance region-wide knowledge, workforce training, and other programming.

2.13.2.2 Vocational Training Programs to Fill Specific Technical Sector Gaps

Although the Region does have some highlights in vocational and technical training (e.g., the College of the Redwoods and College of the Siskiyous both received accolades for programming in 2017), there remains a significant opportunity to improve other North Coast programs.

2.13.2.3 Leveraging Previously "Exported" Human Capital and Related Networks

In spite of the current demographic challenges of the region, there are networks of people elsewhere that have some type of connection (family, education, recreation) to the Region and may be willing to participate in a defined North Coast assistance program. Alumni and fans of the Region include leaders in tech, forestry, renewable energy, recreation, and the entertainment industry, among others.

3 NCRP STRATEGIES

Following are strategies specific to the North Coast Region developed by the North Coast Resource Partnership (NCRP) in its most recent planning document: *Healthy Watersheds, Vital Communities, Thriving Economies: Actionable Strategies for California's North Coast Region* and companion documents developed through a planning grant with the Strategic Growth Council (funded in 2015). The existing conditions of and basis for these strategies are laid out in Section 2. North Coast Region.

3.1 NATURAL & WORKING LANDS MANAGEMENT STRATEGIES

3.1.1 NATURAL RESOURCES

3.1.1.1 FUNCTIONAL FRESHWATER ECOSYSTEMS

Reduce Non-Climate Stressors

- Protect functional aquatic ecosystems from habitat loss, invasive species, and pollution, via land conservation, habitat restoration and public-private partnerships (CDFA 2013, DWR 2013, NCRP 2014, DFW 2016a,
- Prioritize aquatic systems providing habitat for known threatened, endangered, and special status species and native salmonids.
- Protect high value recharge zones and maximize subsurface storage in aquifers (DWR 2013, NCRP 2014, Micheli et al. 2016)

Plan for Projected Climate Change Impacts

- Make use of available climate and hydrology projections to determine optimal aquatic ecosystems for restoration, enhancement, and protection (Micheli et al. 2016)
- Seek vegetation management tools and treatments capable of reducing accumulated fuel loads and associated fire risks (Micheli et al. 2016)
- Develop plans for post-fire management that address strategies for native vegetation resilience and mitigation of impacts on watershed runoff (Micheli et al. 2016)
- Diversify local water supplies (CDFA 2013, DWR 2013, OPR 2018)
    - » Find innovative ways to capture winter precipitation, storm water runoff, and peak flows for use during dry seasons and recycle wastewater streams (Micheli et al. 2016)
- Adopt wetland and riparian area protection policies (DFW 2016a)
- Improve conservation planning alignment on policies and regulations between government agencies (DFW 2016a)

Evaluate and Improve Agricultural Lands and Forest Health Stewardship, and other Land Use Activities

- Broaden watershed focus by integrating working groups; engage Tribal groups and landowners in projects to understand land values to benefit water quality (DFW 2016a)
- Focus on agricultural and forest health stewardship activities (DWR 2013, DFW 2016a, DFW 2016b)
    - » Consider alternative irrigation and water efficiency techniques to conserve water and energy (DWR 2013, OPR 2018)
    - » Increase soil moisture holding capacity of soils where feasible through vegetation management or soil amendments. (CDFA et al. 2016, Micheli et al. 2016, OPR 2018a)
    - » Consider cultivation of plant and tree species likely to be suited for projected environmental conditions with an emphasis on native species that support local wildlife (CDFA 2013)
- Encourage low-impact development (CDFA 2013, DFW 2016a)
- Develop easement strategies with multiple objectives (DFW 2016a)

3.1.1.2 NATIVE HABITAT & WILDLIFE CORRIDORS

Promote Legislation and Policy

- Promote legislation and policies that incorporate climate change planning into conservation lands planning, acquisition, and design (OPR 2018b).

Utilize Data-Based Planning and Management

- Modify existing conservation and open space management priorities to buffer species from the effects of climate change (Micheli et al. 2016).
- Several sources for climate and hydrology projections for conservation lands are available. Land managers are encouraged to use proven data and tools to determine optimal lands for protection (Micheli et al. 2016).
- Identify multi-benefit conservation values that include other land use priorities for management purpose (DFW 2018b)

Implement Comprehensive Monitoring

- Expand and improve monitoring programs to better understand ecosystem dynamics (DFW 2016b).
- Consider vegetation monitoring for stress and mortality, particularly during drought events, in locations identified with high vegetation vulnerabilities (Micheli et al. 2016).
- Tailor program to specific local/regional setting and define potential threats as specifically as possible to ensure usefulness of data collected (OPR 2018b).
- Collect and collate data about wildlife corridor use (e.g., roadkill, radio tracking, genetics) in and around agricultural areas to ascertain management and other protection measures to ensure or enhance such uses (CDFW 2016e)

Practice Adaptive Management

- Reduce non-climate stressors, such as habitat loss, invasive species, and pollution, by continuing current management practices, such as habitat restoration and invasive species removal. Less-stressed systems will be more resilient to climate change impacts (DFW 2016b, OPR 2018b).
- Keep abreast of current research in climate adaptation and management techniques to preserve native habitat and wildlife corridors (Micheli et al. 2016)
    - » Prioritize preservation of landscape units with high topographic heterogeneity to allow for climate shifts over shorter distances, increasing the likelihood of overlap between current climate and future climate within a landscape unity and therefore increasing the likelihood of successful species migration and survival within that unit (Heller et al. 2015).
- Assist landowners to develop wildlife friendly practices on their working lands that can be sustained and co-exist with agricultural operations; the Wildlife Conservation Board accepts grant applications for habitat restoration projects on a continuous basis (WCB 2018).

Foster Innovation

The list of potential management actions to anticipate, respond to, slow, or facilitate climate-driven ecosystem change is rapidly expanding. Examples include (Micheli et al. 2016):

- Ensure genetically appropriate seed collection, propagation and ecological restoration that takes into consideration projected shifts in conditions due to climate change
- Species translocations
- Reevaluation of invasive species risks
- Re-creation of historical water flows (DFW 2016a)
- Facilitated ecosystem transformations

3.1.1.3 NEAR SHORE MARINE AREAS PROTECTION

Improve Water Quality Inputs

Mitigation of the water quality issues impacting North Coast Region freshwater aquatic ecosystems will directly improve the quality of waters draining into near-shore marine areas.

Plan and Implement Strategic Retreat

Strategic retreat (also called planned retreat, managed realignment, managed retreat, set back, and de-embankment) entails establishing thresholds to trigger removal and relocation of development threatened by rising sea levels. As part of this process, actively maintained defenses against storm surge and sea level rise will most likely need to be adjusted over time, typically further inland and to higher ground, in response to encroaching waters. Planning for strategic retreat entails first identifying vulnerable properties and structures and then developing incentives, such as regulatory, tax, and market-based tools, to encourage and achieve realignment. Strategic retreat options include the following (Reza and Tinsman 2018):

- Refined assessments of assets at risk

- Preservation and enhancement of coastal wetlands
- Transfer of development rights
- Purchase of development rights
- Zoning and development standards
- Rolling easements
- Fee-simple acquisitions
- Preservation of Open Space
- Infrastructure relocation

Conservation Activities

- Support Community MPA Collaboratives to ensure that local and regional expertise informs management decisions (DFW 2016d)
- Facilitate the distribution of publications to local communities and partners about MPA regulations, resources, and monitoring results (DFW 2016d) — be proactive in presenting science-based information to the general public and engage the community frequently with opportunities to ask questions and participate as volunteers in data collection, invasive species removal, and native species planting (Judge et al. 2017)
- Encourage marine resource assessments and monitoring on areas/ species, such as rocky intertidal, marine birds, marine mammals and eelgrass (DFW 2016d)
- Engage partners on the ground in data collection both on their own land (for buy in) and on their partners' land (to increase understanding of landscape level processes)
- Encourage coastal monitoring consistent with the State's Wetland and Riparian Area Monitoring Plan (DFW 2016d)
- Improve fish passage through use of estuary enhancement data (DFW 2016d)
- Consider development of a list of marine restoration options such as eelgrass, native oyster and salt marsh restoration, land purchases for habitat restoration to buffer from sea level rise, and other activities that would directly benefit MPAs and marine resources in general (DFW 2016d)
- Consider wildlife needs in management of water and floods in estuaries and wetlands (DFW 2016d)

3.1.1.4 FOREST HEALTH

Practice Adaptive Management

- Careful management can maintain economic value, watershed function, and biodiversity (DFW 2016e, OPR 2018c).
- A monitoring program that is tailored to regional needs allows for responsive management of these systems and enables identification of areas where insects and disease, invasive species, and/ or tree mortality levels are high or increasing (Micheli et al. 2016).
- Manage forests for climate adaptation by considering potential climate effects, the spatial scale of response, timing and prioritization of adaptation efforts.
- Consider forests at the landscape scale to aid in prioritizing site and stand level actions to reduce threats to forest health and forest-based economies (Micheli et al. 2014).
- Manage forest composition by altering management regimes are altered to favor species that have characteristics suited to projected environmental conditions.
    - » There is uncertainty about how native vegetation may respond to changing climate conditions; long-term monitoring is need to better inform models with an improved understanding of mechanisms and trajectories of potential change (Micheli et al. 2014)

  - Results from model simulations could inform planting choices to maximize timber harvest, carbon sequestration, and drought tolerance (Micheli et al. 2014)
  - Development of mixed-species forests decreases risks associated with pest outbreaks and promotes greater genetic diversity and resilience (CalFire et al. 2017)
- Use tools such as C-CAT to provide analytical support for investments in landscapes from the State's Greenhouse Gas Reduction Fund through California's cap-and-trade program (TNC & SCAPOSD 2016)

Manage Forest Density for Forest Health, Wildfire Risk Reduction, Energy Production & Carbon Sequestration

- Practice density management; to increase summer water yield, thin stands between 4,000 and 6,000 feet in elevation on northwest to east facing slopes (5C 2017)
- Forest managers should seek vegetation management tools and treatments capable of reducing accumulated fuel loads and associated fire risks (Micheli et al. 2016).
- Fuel load reduction can also provide a significant stream of biomass, which may be useful to a regional effort to develop biomass energy systems (DFW 2016e, Morris et al. 2017, Woods 2018)
  - When evaluating potential for biomass energy systems, scale is vital: the average biomass feedstock haul mile distance vs. the amount of total energy expended reached a threshold of diminishing returns at around 60 miles; the authors recommend 45 miles. To meet the goal of both reducing emissions and lowering energy use overall, a smaller geographic sphere of influence should be considered (Morris et al. 2017).
- "Managing forests in California to be healthy, resilient net sinks of carbon is a vital part of California's climate change policy (CalFire 2017)." The California Forest Carbon Plan calls for increasing the pace and scale of forest and watershed improvements on nonfederal forest lands, fuels reduction, invasive species removal, road improvements, prevention of forest land conversions through easements, acquisitions and land use planning, biomass utilization, and continued research and data management, including development and dissemination of tools to assist landowners.
  - Carbon offsets offer a mechanism for private landowners to receive market-based incentives for maintaining and enhancing forest health. The California Air Resources Board issues carbon offset credits to projects meeting requirements in its Cap-and-Trade Regulation (ARB 2017).
- Post-fire management plans should be developed to address strategies for native vegetation resilience and mitigation of impacts on watershed runoff (Micheli et al. 2016).

Align Governance Priorities

- Managers of both public and private forests should expand collaborative approaches to landscape-level vegetation management and treatments (Micheli et al. 2014). With the vast majority of the forested lands in the Region being managed by federal agencies, alignment among agencies and collaboration with local communities is essential for successful implementation of these strategies (DFW 2016e).
- The policy and strategy recommendations above enact and help to accomplish the objectives of the State's climate change program, including increasing the use of renewable electricity (state goal of 50%), protecting and managing natural and working lands, and providing a strong natural resource foundation for a successful Cap-and-Trade program (CAB 2017).
  - Assistance and collaboration from state agencies in aligning these efforts can help ensure the effectiveness of these efforts and serve as a model for other regions of California and the United States.
- Work with partners to improve landowner access to entry into the Air Resources Board's carbon market as well as voluntary carbon markets that are currently cost-prohibitive for many forestland owners (CAB 2017).
- Work with the California Board of Forestry and Fire Protection and the California Air Resources Board, forest professionals, and stakeholders to change policies that can hinder sustainable forest management and have led to a decline in forestry labor as well as resulted in unhealthy forests and increased wildfire risks.

3.1.2 AGRICULTURE

- Improve Agricultural Lands Stewardship: The NCRP report *Climate Change and Agriculture in the North Coast of California* (Roberts 2009) identifies project-level agricultural BMPs that will reduce GHG emissions and increase soil carbon sequestration and economic incentives and policy specific to agriculture. These include:
  - Carbon farming, implementing practices that are known to improve the rate at which CO2 is removed from the atmosphere and converted to plant material and soil organic matter, with co-benefits including increased water holding capacity and nutrient availability (CAN 2015, CDFA et al. 2016, Woods 2018) (https://www.marincarbonproject.org/carbon-farming).
  - Organic farming operations provide multiple opportunities to reduce agricultural GHG emissions and sequester carbon; a twelve year study in California showed a 36% increase in carbon sequestration with the use of organic practices such as green manures and animal manures despite increased tillage compared to the conventional system (CAN 2015).
  - Farmscaping describes a broad range of agricultural practices that incorporate perennial and annual flora into agricultural production to benefit both farm productivity and the environment; these practices include hedgerows along farm margins, riparian buffer zones and winter cover crops (CAN 2015).
  - Methane digesters and on-farm electrical generation (ARB 2017) (https://www.epa.gov/anaerobic-digestion/farm-digester-projects). In an analysis conducted specifically for the North Coast Region, The Watershed Research and Training Center found that together with forest products, agricultural based biomass resources could support the development and operation of appropriately scaled biomass energy systems (Morris et al 2017). (http://www.northcoastresourcepartnership.org/resources/)
  - Switch to alternative irrigation techniques to use less water and less energy; in some cases conversion to alternative irrigation techniques can be funded as offsite mitigation of GHG emissions as part of a project's CEQA review. Local jurisdictions can support alternative irrigation techniques through partial or full coverage of cost and/ or technical support (CAN 2015, Reza and Tinsman 2018).
  - California Climate and Agriculture Network (CalCAN) Cap-and-Trade. CalCAN's goal is to secure revenue to incentivize agricultural practices that mitigate climate change (DFW 2016 c, ARB 2017)(http://calclimateag.org/cap-and-trade/).
  - Soil Best Management Practices (DFW 2016c, ARB 2017) (http://agwaterstewards.org/practices/soil_management/).
  - Habitat Restoration (DFW 2016c) (https://wcb.ca.gov/programs/agricultural-lands).
  - Surface storage: rainwater catchment for agricultural uses has increased in the North Coast in the past decade as water balance analyses have shown that the Region receives adequate rainfall to support all beneficial uses of water, but that the timing of the rainfall is out of step with water demand, which is high for all beneficial uses during the summer dry season. The North Coast Regional Water Quality Control Board is supportive of efforts to provide off-channel storage for summer agricultural use as an alternative to summer instream withdrawals to protect salmonid populations (NCRWQCB 2011) and California's

Healthy Soils Action Plan (CDFA et al. 2016) promotes on-farm water storage for soil health.

» Diversify crop choices and take advantage of local microclimates to enhance resilience to changing climatic conditions (OPR 2018d).

» Diversify potential sources of farm income, including value-added products, agricultural tourism, roadside stands, organic farming and farmers' markets (Reza and Tinsman 2018).

- Evaluate, identify and map locations within the Region that have ideal characteristics for soil carbon sequestration and water infiltration to improve soil health, food production and resilience to climate change impacts and drought (CDFA et al. 2017).
- Policy and economics as incentives: local governments can institute new ordinances, zoning laws, pricing policies, and land use practices that support agriculture and limit conversions of wildlands, incentivize carbon sequestration, generate energy from biogas, improve agricultural water efficiency, and use conservation easements to protect agricultural operations and land.

3.1.3 TRADITIONAL ECOLOGICAL KNOWLEDGE

To include or apply Traditional Ecological Knowledge in a project or management plan, partnership and collaboration with the Tribe(s) from the territory of the project or management plan is necessary. The NCRP, however, is aware that the majority of the Tribes in the region continue to be guided by Traditional Ecological Knowledge for regional resource stewardship and to inform climate change decisions. NCRP Tribal Representatives and the Tribal Engagement Coordinator continue to work with Tribes in the North Coast to implement and provide support of *NCRP Goal 1, Objective 3 — Integrate Traditional Ecological Knowledge in collaboration with Tribes to incorporate these practices into North Coast Projects and Plans* (see *Section 1.1 NCRP Goals and Objectives*).

3.1.4 FLOOD ATTENUATION USING NATURAL SYSTEMS

- Wetlands and riparian areas are particularly effective, efficient flood management systems, reducing flood damage by storing flood water, reducing flood height, and slowing flood velocity. They typically occur as natural buffers between uplands and adjacent water bodies and act as natural filters of nonpoint source pollutants, including sediment, nutrients, pathogens, and metals, to waterbodies, such as rivers, streams, lakes, and coastal waters.
- It is important to preserve and restore damage to wetlands and riparian areas because these areas can play a significant role in managing adverse water quality impacts that often are associated with flood/ stormwater events.
- Preserved, viable wetlands (fresh and saltwater) and riparian areas help decrease the need to build and maintain costly stormwater and flood protection facilities.

3.1.5 OUTREACH AND ENGAGEMENT

3.1.5.1 ANALYZE REGIONAL TRAINING, LEADERSHIP AND RECRUITMENT PROGRAMS

- Engage regional SBDC and other organizations in conversations about identified gaps and needs in relation to the Priority Actions for other areas of this document.
- Engage private sector regarding the need for, and viability of, a regional intern program.
- Engage public sector organizations in civics leadership and sector governance and policy knowledge development (energy, natural resources, communications, transportation).
- Together with the California Board of Forestry and Fire Protection explore the development of programs to expose students to careers in forestry management.
- Inventory the current offerings from local colleges and universities and integrate those into the three points above.
- Invite and engage current leadership in serving as mentors and training their replacements.

3.1.5.2 SOURCE HIGH VISIBILITY REGIONAL ALUMNI AND SUPPORTERS

- Identify and contact high-visibility alumni and supporters of the Region to bring their resources,

- expertise and visibility to assist long term in supporting specific programs, goals, and initiatives.
- Integrate these contacts into regional training, leadership, and recruitment programs listed above, as appropriate.

3.1.5.3 ANALYZE A "RECRUIT BACK" STRATEGY TO RE-ATTRACT TALENT DEVELOPED IN THE REGION

Similar to recruitment strategies for rural health care, develop student loan repayment programs and other incentives to bring back locally developed talent after they have completed their formal educations. Additionally, in job recruitment efforts, engage the alumni list mentioned above to assist with "recruit-back" strategies.

3.1.5.4 IDENTIFY, ENGAGE, AND SUPPORT CURRENT EMERGENT LEADERS

Support and assist the current leadership to strengthen their commitment and demonstrate to future leaders that they will be stepping into supportive businesses, jobs, and elected positions.

3.2 BUILT INFRASTRUCTURE STRATEGY

3.2.1 BROADBAND ACCESS AND INFRASTRUCTURE

3.2.1.1 SUPPORT AND ENHANCE EFFORTS OF CURRENT RURAL BROADBAND ADVOCATES

While there are already solid teams in place advocating at the state level for infrastructure expansion, there is a need to support, enhance and strengthen efforts to obtain equitable access to broadband throughout the Region. Humboldt and Del Norte counties can serve as successful examples: Humboldt achieved Internet route diversity in 2011 and Del Norte in 2014; both counties forged and maintained coalitions of public and private interests to leverage funding opportunities that improved reliability and Internet data capacity for their communities (Hight 2014, Woods 2018).

3.2.1.2 WORK REGIONALLY TO ENCOURAGE USE AND EFFICACY

Development of tools and training, similar to other outreach efforts of the NCRP, such as the Water and Wastewater Service Provide Outreach and Support Program, can enhance usage and efficacy of broadband infrastructure as it continues to expand within the Region.

3.2.1.3 INCLUDE COMMUNICATIONS INFRASTRUCTURE WITHIN FUTURE ENERGY RISK ASSESSMENTS

Communications infrastructure is one of many essential public service assets potentially at risk during emergency events such as energy interruptions and natural disasters (Boudreau et al. 2016). Redundancy in communications infrastructure is vital to ensure public safety during such events.

3.2.1.4 PLAN FOR TIERED COMMUNICATIONS STRATEGIES DURING EMERGENCIES

There is increasing risk to power and communications infrastructure in light of more frequent and intense storms, fires, predicted through climate modeling and other natural disasters, such as earthquakes and tsunamis. Local communities should develop/update a tiered communications strategy to respond during local emergency situations.

3.2.1.5 ASSESS THE NEED FOR PUBLIC ENTITY MICRO-NETWORKS

Even with the expansion of fiber optic lines in more areas of the region, private sector vendors are not always incentivized to provide viable access to remote, more dispersed populations. As with the expansion of the electric power grid, public sector support and capacity may be a viable option within the Region (Gonzalez 2018). Because the model is somewhat similar, there may be opportunities to co-locate these networks with distributed power micro-grids, with multiple benefits achieved through such combinations (Woods 2018). A report by Earth Economics (2018) suggests that wood biomass, along with wind-power and hydro-electric generation, could present an opportunity for multiple benefits when combined with data centers that provide essential information technology needs, such as wireless and optic fibers for high speed internet access.

3.2.2 ENERGY GENERATION AND CONVEYANCE INFRASTRUCTURE

3.2.2.1 USE A PLANNED RETREAT/ GREEN INFRASTRUCTURE APPROACH TO ADAPT TO SEA LEVEL RISE AS FEASIBLE

Planning for strategic retreat entails first identifying vulnerable properties and structures and then developing incentives, such as regulatory, tax, and market-based tools, to encourage and achieve realignment (Reza and Tinsman 2018).

3.2.2.2 CONDUCT RISK ASSESSMENTS FOR AT-RISK WATERWAYS AND COASTAL AREAS

Areas that should undergo risk assessments include:

- Infrastructure at risk (private and public)
- Viability of transportation routes for evacuation/planned retreat
- Potential number of evacuees and impacts on local housing
- Risk to communications infrastructure and redundancy planning
- Environmental impacts from damaged/ inundated infrastructure

3.2.2.3 INCENTIVIZE SUSTAINABLE LAND USE PLANNING AND INTEGRATED FLOOD MANAGEMENT

To ensure that measures to protect or relocate resources and begin limitation on building in at-risk areas, explore potential mitigation funding, or other creative ways to drive the process. Planners should incorporate 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. The general principles of integrated management include adaptation planning to embrace sustainability while considering equitable distribution and apportionment of costs and benefits of adaptation measures, especially with regard to disadvantaged communities (DWR 2013).

3.2.3 WATER AND WASTEWATER STORAGE AND CONVEYANCE INFRASTRUCTURE

Because of the strong demonstrated link between water and energy, reducing water use results in complimentary reduction energy use and the associated GHG emissions. Water conservation efforts that reduce the use and waste of water, more water-efficient appliances and technologies, and water recycling reclamation efforts that allow for the reuse of wastewater can all also be effective GHG reduction strategies. All of these strategies are being pursued in various ways across the North Coast Region.

The strategies recommended for protection and preservation in Section 3.2.2, Energy Generation and Conveyance Infrastructure should be incorporated to protect and safeguard water and wastewater storage and conveyance infrastructure. Additionally:

- Local governments and agencies should incorporate climate change trends in present day risk and vulnerability assessments for community infrastructure and update their plans accordingly.
- Addressing climate change in plans and ongoing operations procedures (e.g., maintenance) assures improved preparation and greater resilience to climate change impacts (CEMA and CNRA, 2012).
- Particular attention should be paid to economic risks during these assessments. While retrofitting or relocating infrastructure can be costly, the costs associated with projected disruption to these systems can be even greater.
- Community plans and programs, such as local hazard mitigation plans, urban water management plans, stormwater management plans, regional transportation plans, and capital improvement plans, be coordinated and consistent.

3.2.4 TRANSPORTATION INFRASTRUCTURE

3.2.4.1 LEVERAGE NCRP SOCIAL, POLITICAL, AND ECONOMIC CAPITAL

- *Enhance Existing Efforts* – for the transportation sector specifically, significant analytical resources and planning are conducted on an annual basis through Caltrans, county transportation departments, and other entities. The NCRP should focus on collective actions to expand and enhance existing efforts.
- *Determine Shared Transportation Needs of Local Governments* — conduct a high-level initial analysis of current spending on transportation by individual local governments, and potential for shared efforts and planning, to inform whether opportunities for cost savings/ increased quality of service delivery may be realized via regional collaboration.
- *Analyze Current and Potential Public Transit Connections and Infrastructure* – although there are a number of counties within the Region that have established cross-county public transit connections, gaps in the system still exist. Analyses should be considered to assist in closing these gaps and to determine where related infrastructure could potentially be leveraged (e.g. Zero Emission vehicle — ZEV — Infrastructure).
- *Establish/ Expand a Working Group of Regional ZEV Deployment Partners* – over the last ten years, most counties within the Region have seen an emergence and expansion of ZEV infrastructure. Trinity and Modoc Counties are developing theirs: Trinity does have three publicly available charging stations, though they are not conveniently located and two of the three are specific to a single type of vehicle (Tesla); Modoc County hosts two Tesla-specific stations. It "is critical for the NCRP Region to accelerate the deployment of alternative fueling infrastructure (Micheli et al. 2016)."

  Establishing key public and/ or private sector partners, regionally and the development of funding for their activity to expand infrastructure would assist in accelerating deployment. Several jurisdictions have established district taxes to fund transportation priorities, which recently have come to include advance mitigation (ECONorthwest 2017).

  The North Coast Electric Vehicle Readiness Plan identifies the follow supporting activities as necessary to facilitate EV adoption (Woods 2018):

  » Engage with regional permitting entities to encourage the adoption of standardized and streamlined permitting and inspection processes and fee structures.

- Produce a streamlined set of EVCS criteria to assist potential EVCS owners/operators in choosing what equipment to install and to assist contractors with adopting best practices and understanding regional permitting requirements.

  » Engage with potential site hosts for EVCS in the North Coast Region and produce preliminary engineering designs and cost estimates for 30-40 sites.

  » Install directional signage guiding drivers to at least 10 regional EVCS.

  » Promote PEV adoption through public and fleet operator outreach and education campaigns.

  » Educate and support regional municipalities on the potential to adopt local building codes that promote PEV adoption.

   - These activities are currently being implemented through a grant from the California Energy Commission.
- *Encourage Regional Advocacy to Repair/Protect Key Routes and Infrastructure* – leverage the combined strengths of the Region to assist with needed infrastructure repair, especially along major routes

3.2.4.2 EXPAND THE USE AND SAFETY OF BIKE AND PEDESTRIAN FACILITIES

Where appropriate, support a broad range of investments to encourage corridor-wide and community-wide strategies that will increase active (non-motorized) transportation for short trips, first/last mile transit trips and school trips (Caltrans 2016).

3.2.5 RESIDENTIAL AND MUNICIPAL BUILDINGS

3.2.5.1 ENERGY EFFICIENCY

Improving energy efficiency in buildings is a key step in reducing emissions while also saving building owners and residents money on bills and reducing the need to build new energy infrastructure. California Energy Commission releases new building energy efficiency standards approximately every three years. The new 2019 Title 24 California Green Building Standards Code (CALGreen) will go into effect January 1, 2020. The standards apply to construction of buildings resulting in increased energy efficiency and overall less dependence on fossil fuels. Mandatory requirements cover techniques, such as temperature controls for water heaters, limiting air leakage in building envelopes, and high efficiency lighting systems (California Building Standards Commission 2016).

3.2.5.2 GREEN BUILDING PROGRAMS

In the North Coast Region, the County of Sonoma has developed a robust Green Building program, which adopted California Green Building Standards Code (CALGreen) establishing requirements for residential and non-residential construction. CALGreen is composed of certain mandatory measures and two tiers of voluntary measures. Local agencies, such as the County Board of Supervisors, have the option of adopting these state-suggested voluntary measures as mandatory requirements at the local level (County of Sonoma).

3.2.5.3 ZERO NET ENERGY BUILDINGS

Ultimately these efforts are pushing toward zero net energy (ZNE) buildings, which through high-efficiency systems and onsite renewable energy generation are able to produce as much energy onsite as they use over the course of the year. California's Long-Term Energy Efficiency Strategic Plan establishes a State-level goal to have all new residential buildings be Zero Net Energy by 2020, and all new commercial buildings be Zero Net Energy beginning in 2030. A range of tools and resource on this topic are available through the California Zero Net Energy Action Plan web portal at https://www.capath2zne.org/

3.2.6 RELATIONSHIPS AMONG BUILT INFRASTRUCTURE SECTORS

According to the California Air Resources Board, in the face of rising temperatures, six economic sectors — water, energy, transportation, tourism and recreation, agriculture, and public health— would together incur tens of billions per year in direct costs, even higher indirect costs, and expose trillions of dollars of assets to collateral risk (CARB 2010).

To reduce greenhouse gas emissions, there is a clear push for reducing dependency on oil and natural gas by electrifying transportation and heating in homes. Energy efficiency of systems and appliances becomes increasingly important as electrification increases demand. With transportation being a key source of regional GHG emission it is particularly important to address the electrification of transpiration and the need to develop regional electric vehicle charging infrastructure. The electrification of heating and transportation also increases dependence on transmissions and distribution systems, furthering the need for systems that can cope with grid power interruptions.

There is a strong connection between water supply and conveyance with energy use. At its core, the water-energy nexus stems from the fact that there is both limited supply and high demand for energy and water. Climate change has forced the water-energy nexus into the forefront (NCRP 2014).

3.2.7 ECONOMIC AND COMMUNITY IMPACTS FROM FAILING BUILT INFRASTRUCTURE

Infrastructure for electricity, transportation, and communication is critical for everyday life and especially for those in rural and hard-to-reach areas. Mitigation funds remain scarce and often directly compete with funds to tackle decaying national infrastructure and increased disaster response costs stemming from climate change (RCEA 2017). Not only is infrastructure already aging, the rugged terrain and dispersed populations in the North Coast Region add an extra challenge to communities who are trying to mitigate their contributions towards climate change. Logistical and technical feasibility of mitigation projects remain challenges, however funding remains the largest hurdle.

Impacts from climate change, specifically wildfires and sea level rise, are not only broad environmental issues but also pose direct, major threats to the safety, quality of life, and economy of the people of the NCRP region. Counties should continue mitigating their contributions to greenhouse gas emissions, while also planning to adapt to the consequences of climate change that the region is already starting to experience.

3.3 CLIMATE CHANGE & ENERGY INDEPENDENCE STRATEGY

3.3.1 GHG EMISSIONS REDUCTION & ENERGY INDEPENDENCE STRATEGIES

Energy Independence strategies broadly focus on 1) increasing energy efficiency, 2) developing renewable energy resources, and 3) reducing the consumption of carbon-intensive fossil fuels via fuel switching

3.3.1.1 TRANSPORTATION

Alternative fuels refer to vehicles that run on a fuel other than conventional petroleum fuels like gasoline and diesel. Replacement of conventional vehicles with low- or zero-emission vehicles would have the potential to significantly reduce GHG emissions locally and globally.

Plug-in electric vehicle (PEV) drivers have the ability to easily charge vehicles at home during the night, taking advantage of off-peak electricity rates. To encourage modes of non-fossil fuel transportation, Sonoma Clean Power's Drive EverGreen program pays for the cost of home charging equipment for PEVs. Once customers have charging equipment installed, they are also encouraged to buy Sonoma Clean Power's 100% local, renewable electricity option to lower personal GHG emissions (SCP 2018).

Another emerging technology is hydrogen fuel cell electric vehicles, which create electricity from a chemical reaction, not combustion. Currently, there are no commercial hydrogen fueling stations in the North Coast Region.

In addition to building alternative fuel infrastructure, continued implementation of supporting activities called for in regional readiness plans is critical to accelerating adoption. For example, the North Coast Plug-in Electric Vehicle Readiness Plan identifies the follow supporting activities as necessary to facilitate EV adoption (RCEA 2014):

- Engage with regional permitting entities to encourage the adoption of standardized and streamlined permitting and inspection processes and fee structures.
- Produce a streamlined set of EVCS criteria to assist potential EVCS owners/operators in choosing what equipment to install and to assist contractors with adopting best practices and understanding regional permitting requirements.
- Engage with potential site hosts for EVCS in the North Coast Region and produce preliminary engineering designs and cost estimates for 30-40 sites.
- Install directional signage guiding drivers to at least 10 regional EVCS.
- Promote PEV adoption through public and fleet operator outreach and education campaigns.
- Educate and support regional municipalities on the potential to adopt local building codes that promote PEV adoption.

In addition to the technological solutions provided by alternative fuel vehicles, developing programs and incentives that facilitate and support walking, biking, and public transportation use can be key local, community-scale GHG-reduction strategies.

3.3.1.2 LAND USE AND ZONING

The Environmental Protection Agency's Smart Growth development principals helps communities develop while benefitting the economy, environment, and public health. Development principles in urban and rural areas have similarities, such as mixing land use, taking advantage of compact design, encouraging stakeholder collaboration, and preserving farmland, natural beauty, and critical environmental areas.

The EPA's Essential Smart Growth Fixes for Rural Planning, Zoning, and Development Codes outlines the importance of determining areas for growth and for preservation, using cluster development, and encouraging right-size rural roads to protect pedestrian and bike traffic. Counties have the opportunity to reduce greenhouse gas emissions with zoning by reusing existing structures for mixed use development and offering transportation choices other than driving, such as walking and bicycling (EPA).

While infill projects and transit-oriented development are often considered urban planning strategies, adapting these principles in rural areas can help reduce GHG emissions, maintain the rural and historic character of regional small cities and towns, and created more livable and accessible communities (which is often of most important to disadvantaged populations and well as the increasing percentage of senior citizens).

Zoning for the development of renewable energy is also important to energy independence and reduction of greenhouse gas emissions- "The County of Sonoma has adopted changes to its zoning code that enable the construction and use of renewable energy facilities throughout the county, while protecting sensitive resources and ensuring neighborhood compatibility" (Sonoma County Permit and Resource Management Department).

3.3.1.3 RESIDENTIAL AND MUNICIPAL ENERGY INDEPENDENCE OPTIONS

California Assembly Bill 3232 established the goal stating new residential and nonresidential buildings built on or after January 1, 2030, should be zero-greenhouse-gas emission buildings. Zero-emission buildings are buildings with operational parameters that result in zero or negative emissions of greenhouse gases, as measured on an annual basis, when considering the hourly marginal emissions factors from both thermal fuels and electricity at the time when energy is used in the building (California Legislative Information 2018).

The 2019 update to Title 24 building energy efficiency standards will provide tools for local governments to adopt ordinances to achieve zero net energy through reach codes.

A key strategy to achieving energy independence is Net Energy Metering (NEM). Customers who install small solar, wind, biogas, and fuel cell generation facilities to serve all or a portion of onsite electricity needs are eligible for the state's net metering program (CPUC). Pacific Gas and Electric serves most of the North Coast Region and offers NEM programs to reduce customers' monthly electric bills with the energy generated by their own renewable system. All Community Choice Aggregation programs in the North Coast Region, Sonoma Clean Power and Redwood Coast Energy Authority, offer NEM programs to customers.

3.3.1.4 SMALL SCALE BIOMASS GENERATION

Biomass plants process raw plant and waste materials into useable biofuels like wood or paper pellets. Biomass-sourced fuels are, in theory, more sustainable than fossil fuels because the carbon burned (e.g. wood) is newly removed from the carbon cycle, versus coal or oil that had been sequestered more or less indefinitely. Transporting waste or crop biomass over long distances to large, widely distributed biomass processing plants can overcome its actual value as fuel. It is therefore preferable to collect biomass and process it locally, distributing energy via a network of small biomass plants located strategically throughout the region.

Forest biomass utilization offers many benefits far beyond the energy related benefits: it plays a critical role supporting the responsible disposal of residues from the logging and forest products industries. It is also a pathway to help support forest management practices like thinning and fuel reduction efforts; sales of biomass-generated products such as biochar could potentially offset forest management costs, as well as serving to amend soil on agricultural lands. Because of the many faceted benefits associated with biomass energy, it is recommended that key opportunities in the biomass sector be pursued, particularly in Humboldt, Mendocino, Siskiyou and Trinity Counties. Potential biomass energy projects should include both heating and combined heat and power applications, as well as other higher valued products (densified biomass, biochar, torpified material, etc.). Where viable, other biomass projects should be considered as well, such as biogas for WWTP digesters, animal farm manure digesters, landfill gas, and woody biomass crop residues.

3.3.1.5 SOLAR ENERGY

Solar energy can be captured and used to heat water or produce electricity. Solar power implementation should be pursued throughout the region. Solar power generation is now cost competitive with conventional generation sources. Unused power can be stored in batteries or transmitted via the grid to other electricity customers elsewhere. Solar is the quietest way to generate energy, involves no moving parts, and releases no GHGs at the source (production of PVs and other components utilize energy and emits GHGs, however). While some parts of Siskiyou or Modoc Counties might have adequate solar resources to warrant a large, utility-scale solar power plant, these resources are not near population centers where the power is needed. While power generated could be fed into the electrical transmission system, it seems unlikely that utility-scale solar projects in the region would be competitive with those in other parts of the state.

However, distributed scale solar proves competitive, especially if it is valued at the retail electricity rate via a net metering arrangement. Distributed scale solar opportunities could include larger, community-scale systems that serve groups of customers, or facility level systems that serve one facility (residence, commercial facility, etc.). Distributed solar should be pursued in the NCRP region. Note that both Sonoma Clean Power and Redwood Coast Energy Authority Community Choice Energy Programs are pursuing new solar projects, and smaller distributed scale solar projects are common throughout the region.

3.3.1.6 SMALL HYDROPOWER

Hydroelectric energy generation produces no GHG emissions locally and aggressive implementation could significantly reduce local and global GHG emissions. Traditionally, hydroelectric power generation was dam-and-reservoir and reserved for large-scale applications. The endangered and threatened status of local salmonids; future drought scenarios; and the huge physical infrastructure (and capital) required for building a dam and its hydro facility have dissuaded large infrastructure investment.

Small-scale hydroelectric power ("micro-hydro"), which generates at a capacity of 30 megawatts or less, has good potential for the North Coast's rural, widely distributed, off-the-grid locations, particularly where other energy sources are not available. Opportunities, while not insubstantial in the region, are likely to face significant challenges regarding feasibility. In some locations, the possibility of drought and endangered or threatened status of local salmonids may make even micro-hydro unattractive, despite its potential to help lower GHG emissions and provide rural electricity. Conduit hydropower opportunities are another possibility, though substantial opportunities are not apparent in the region; nonetheless, these opportunities should be investigated further and potentially pursued if favorable opportunities are identified.

3.3.1.7 OTHER RENEWABLE SOURCES

Geothermal Energy

Geothermal energy is power extracted from heat stored deep underground, used to generate electricity and heat to run a variety of industrial, desalination and agricultural applications. The North Coast is home to a portion of the largest geothermal energy plant in world: The Geysers field (in Sonoma and Lake Counties), which claims to produce one-fourth of the "green" energy in the state. Though it appears unlikely that a large-scale power plant such as Geysers could be developed elsewhere, geothermal opportunities exist in the NCRP region, as the practice of using underground heat for energy can be applied at scale of the individual home or business. It may be possible to develop a smaller scale electrical generation or district heating system in Siskiyou or Modoc counties. Feasibility depends on finding adequate resources located in close proximity to a population center where the heat or power could be utilized.

Wind Energy

Wind energy generation is a well-established technology with significant regional potential with numerous opportunities throughout the NCRP region, as several locations exist where commercial scale wind farms could be built. Probably the best known is the Cape Mendocino area in Humboldt County. A project on Bear River Ridge was proposed a few years ago and developer are currently evaluating a new project in the same general area. Other potential onshore wind farm sites include locations in Siskiyou and Modoc Counties, however it is uncertain if these locations would prove feasible. Smaller community-scale wind projects or facility-scale wind projects might prove feasible in the right locations throughout the NCRP region.

Perhaps the best wind resource opportunity in the region is offshore. The floating foundation technology needed to deploy offshore wind turbines in deep waters (like those off the Pacific Coast of California) is just now reaching commercialization. This presents another opportunity (see Wave Energy) for Humboldt County to market the Humboldt Bay deep-water port to support the first deployment of this technology in California.

Wave Energy

Wave energy is the transport of energy by ocean surface waves, and the capture of the energy for electricity generation, water desalination, water pumping and other work. Theoretically, wave energy releases no GHGs locally and could be a vast source of local, renewable energy. However, currently it is an immature technology. There are concerns about pursuing wave energy facilities (e.g. inevitable saltwater corrosion of infrastructure; the possibility of entangling marine life in mooring lines; underwater noise pollution; and potential interference with local fisheries and fisheries-based economies).

The wave energy resource off the northern California coast is substantial, with Humboldt Bay a particularly well-suited deep-water port that could provide the needed supporting infrastructure for a wave energy project. Wave generation technology is still very much in the research and development stage, but the region should position itself as a prime location for early wave energy demonstration projects in California

3.3.1.8 POLICY AND FINANCING OPTIONS

In July 2008, Assembly Bill 811 was approved, which allows property owners to enter contractual assessments to finance the installation of distributed generation renewable energy sources or energy efficiency improvements that are permanently fixed to existing homes and businesses. Property Assessed Clean Energy is an innovative mechanism for financing energy efficiency and renewable energy improvements, where property owners finance the up-front cost of energy improvements on a property and then pay the costs back over time through a voluntary assessment. The County of Sonoma developed the Sonoma County Energy Independence Program, which guides commercial and residential buildings through funding mechanisms, such as Property Assessed Clean Energy, rebates, and other incentives (Sonoma County Energy Independence Program).

Sonoma County was an early pioneer of PACE financing with the highly-successful Sonoma Energy Independence Program. Building off of Sonoma's model, numerous state-wide PACE programs have now been established and are available for local governments to join to be able to offer PACE financing in their jurisdictions, with all counties in the region except Trinity now making one or more PACE programs available to their communities.

3.3.2 GHG ACCOUNTING FRAMEWORKS

A robust GHG accounting framework is a central element of accurately tracking GHG emission sources and sinks. GHG accounting is an important tool for developing well-targeted GHG action strategies as well as for evaluating the effectiveness of those strategies over time. This section on GHG Accounting Frameworks is excerpted from *North Coast Resource Partnership Integrated Strategic Plan: Climate Change Mitigation, GHG Emissions Reduction and Energy Independence*, Redwood Coast Energy Authority, 2017 and *Greenhouse Gas Emissions Assessment Roadmap for the North Coast Regional Partnership*, Schatz Energy Lab, 2017 available on the NCRP website.

3.3.2.1 EXISTING GHG INVENTORIES AND ASSESSMENTS IN THE NCRP REGION

Sonoma, Mendocino, and Humboldt counties have seen the most local government action in this space, with Sonoma County and the City of Arcata being recognized early leaders. Furthermore, the BAAQMD is the only entity in the NCRP region to issue guidance on GHG emissions significance thresholds for CEQA compliance. The Mendocino AQMD explicitly recommends the use of the BAAQMD significance thresholds, while all other AQMDs in the region do not address significance thresholds. All AQMDs in the region provide some level of guidance regarding models and data sources on their websites.

Humboldt County

Except for the City of Arcata, Humboldt County and jurisdictions recently began actively inventorying GHG emissions due in large part to the proactive and effective Green Communities program implemented by PG&E and ICLEI.

The City of Arcata is an internationally recognized leader in sustainable community planning. Along with the County of Sonoma, the City joined the Cities for Climate Protection Campaign developed by ICLEI. The City completed their first GHG inventory in 2001, followed by an inventory update and a Greenhouse Gas Reduction Plan in 2006, inclusion of GHG reduction goals in their General Plan in 2008, and another inventory update for 2015. The City now works to align their GHG accounting efforts with those pursued by other county jurisdictions through efforts by the Redwood Coast Energy Authority (RCEA).

In 2005 RCEA partnered with the Schatz Energy Research Center in the development of a technical analysis for the Energy Element of the Humboldt County General Plan Update. This report noted greenhouse gas reductions as a motivation for pursuing alternative and renewable energy sources.

More recently jurisdictions in the County have begun pursuing climate action plans. The City of Trinidad developed a draft climate action plan in 2010, and in the same year the City of Fortuna included GHG reduction goals in their General Plan. In 2011 RCEA conducted a GHG Inventory for the Humboldt County Planning Department's draft Climate Action Plan which was released in 2012. In 2012 RCEA partnered with PG&E and ICLEI in the Green Communities program and began conducting GHG Inventories for all jurisdictions in the County. RCEA continues to update GHG inventories for jurisdictions on a regular basis. Recently other jurisdictions in the County have begun pursuing climate action plans.

Mendocino County

Mendocino County has been very proactive regarding the inclusion of GHG reduction in local government planning. The Mendocino Council of Governments has been including GHG reduction as a motivation in transportation planning since 2000. The 2004 City of Ukiah General Plan directly includes reductions in GHGs, two years before the passage of AB 32.

More recently, the 2009 County General Plan specifically discusses GHG reduction goals. In the same year the Ukiah Department of Planning and Building completed a city- wide GHG inventory. The development of climate action plans followed for both the City of Ukiah and City of Fort Bragg in 2012. The Community Development Commission of Mendocino County has been conducting GHG inventories for jurisdictions in the County through a Green Communities partnership with PG&E and ICLEI since 2012.

Sonoma County

The Center for Climate Protection (CCP) in Sonoma County has been conducting GHG Inventories for the County since 2003 after the county joined the Cities for Climate Protection Campaign developed by ICLEI. This campaign included guidance on the development of a GHG Inventory. The CCP continues to use this guidance facilitating consistent tracking and comparison with past inventories even though the methodology is now outdated.

Partly in recognition of the fact that the GHG Inventory methodology space is dynamic, the Sonoma County Water Agency contracted with the CCP in 2010 to assess the current status of GHG tracking and make recommendations for future action. Notably, they partnered with ICLEI Local Governments for Sustainability (ICLEI USA) who developed a GHG Inventory framework specifically for Sonoma County. Shortly thereafter ICLEI released the U.S. Community Protocol based in part on the county-specific framework developed for Sonoma County. Currently the U.S. Community Protocol is used widely for local-scale accounting of emissions.

In 2016 the Regional Climate Protection Authority (RCPA) developed a climate action plan for the county. For this effort RCPA conducted a community-level inventory of the county, the methodology of which differs from that used by CCP, following primarily the ICLEI U.S. Community Protocol.

Private Sector

There has been a global proactive effort within the private sector to quantify GHG emissions and environmental impacts associated with business operations and product supply chains. This has largely been driven by consumer interest via local government and community pressures in recent years. With the release of International Organization for Standardization (ISO) 14000 series standards focused on corporate and product sectors, the success of the Greenhouse Gas Protocol® suite of guidelines and tools, and the development of widely adopted modeling software, private sector accounting of GHG emissions is becoming increasingly common. As important as this background is, a review of activity in this sector within the NCRP region is left for future work.

3.3.2.2 EXISTING PROTOCOLS, FRAMEWORKS, AND TOOLS

This section presents a preliminary set of recommendations to assist an entity in navigating through the myriad options for accounting GHG emissions. Recommendations focus on local government agencies but are also relevant to other stakeholder groups.

Community

- Humboldt County Greenhouse Gas Emissions Inventory Tool 31
    - » Developed by the Redwood Coast Energy Authority specifically for assessing community inventories for jurisdictions in Humboldt County.
    - » Based upon the ICLEI U.S. Community Protocol.
    - » Output facilitates reporting to the Statewide Energy Efficiency Collaborative (SEEC) ClearPath California tool.
- ICLEI U.S. Community Protocol: http://icleiusa.org/ghg-protocols/
    - » Offered at no cost to cities and counties.
    - » Development was a collaborative between ICLEI, ILG, LGC, and the California Investor-Owned Utilities. The Climate Registry also contributed to its development.
    - » Integrates with the Statewide Energy Efficiency Collaborative (SEEC) ClearPath California tool that is freely available to, and developed specifically for, local government jurisdictions to facilitate tracking emissions and estimating the mitigation potential of actions that can feed into a climate action plan.
- SEEC ClearPath: http://californiaseec.org/seec-clearpath/

» Freely available online tool targeted to local government and Community GHG Inventories.

» Facilitates tracking Inventory updates, forecasting future emissions, and visualizing mitigation impact associated with proposed actions.

Organization

- Local Government Operations (LGO) Protocol: http://icleiusa.org/ghg-protocols/
  - » Freely available, and endorsed and used by The Climate Registry, CARB, CAPCOA, and many others.
  - » Widely used in the NCRP region
- EPA Center for Corporate Climate Leadership: https://www.epa.gov/climateleadership
  - » Targeted to the private sector.
  - » Freely available suite of Protocols and Methodologies with a couple high- level tools.
- Greenhouse Gas Protocol® Corporate Accounting Standard: http://ghgprotocol.org/
  - » The Climate Registry assisted in the development of the Greenhouse Gas Protocol Scope 2 Guidance and Corporate Value Chain (Scope 3) Accounting and Reporting Standard.
  - » Freely available and widely used globally
- Energy Star Portfolio Manager: https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager
  - » Widely used online tool to benchmark and track energy consumption and GHG emissions of buildings.
  - » Built by the EPA Energy Star program
  - » Freely available

Policy

- California Air Pollution Control Officers Association (CAPCOA) Quantifying Greenhouse Gas Mitigation Measures: http://www.capcoa.org/documents/
  - » Freely available and widely used in California
  - » Highly detailed Protocol and Methodology for quantifying the potential impact of both GHG mitigation policies and actions.
  - » Widely utilized in California and recommended by all air quality districts
  - » The CalEEMod tool fully includes the Methodology from this document
- ICLEI Recycling and Composting Protocol: http://icleiusa.org/ghg-protocols/
  - » Compliments the U.S. Community Protocol, and allows for assessing the net GHG impact associated with recycling and composting efforts in a community.
- Greenhouse Gas Protocol® Policy and Action Standard: http://ghgprotocol.org/
  - » Collaboratively developed internationally, and as such is not focused on any particular geographic region
  - » Applicable to all scales of focus entities or actions from a local policy or project to one of international breadth.

Project

- California Emissions Estimator Model (CalEEMod): http://www.capcoa.org/caleemod/
  - » Developed for CAPCOA and recommended by all air quality districts in the NCRP region
  - » Replaces URBEMIS which many local government entities are familiar with
  - » Designed for assessing compliance with CEQA, NEPA, and local air quality standards
  - » CAPCOA Quantifying Greenhouse Gas Mitigation Measures: http://www.capcoa.org/documents/
- Bay Area Air Quality Management District (BAAQMD) CEQA Information: http://www.baaqmd.gov/plans-and-climate/california-environmental-quality-act- ceqa
  - » The BAAQMD provides extensive and useful information regarding assessing GHG emissions for projects and CEQA compliance.
- CalTrans Standard Environmental Reference (SER): http://www.dot.ca.gov/ser/
  - » Provides handbooks of environmental guidance regarding transportation- related projects
  - » GHGs are addressed in Volume 1, Chapter 13
  - » CARB Description of Methodology for ARB Staff Review of Greenhouse Gas Reductions from Sustainable Communities Strategies (SCS) Pursuant to SB 375 [38] and CARB Summary of Off-Model Strategies
- The CARB Description of Methodology provides additional Protocol- level information for MPOs and RTPAs regarding quantifying GHG emissions for Projects related to SB 375 goals and requirements.

  - Significant discretion is left to the practitioner regarding what Methodology to use.
  - The CARB Summary of Off-Model Strategies discusses approaches that other MPOs and RTPAs have taken to quantify the GHG emissions reduction impacts from projects that traditional transportation models are currently not able to quantify, such as ride sharing or intelligent transportation systems.
- CARB Guidance for Projects Funded with Greenhouse Gas Reduction Funds (GGRF): https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/quantification.htm
  - Methodologies developed specifically for projects funded with Greenhouse Gas Reduction Funds which are raised through Cap-and- Trade auction proceeds.
  - Although developed specifically for GGRF-funded projects, can be useful for assessing emissions associated with similar projects. Methods are typically reliant on CalEEMod and CAPCOA Quantifying Greenhouse Gas Mitigation Measures (see above).
- CARB Compliance Offset Protocols: https://www.arb.ca.gov/cc/capandtrade/offsets/offsets.htm
  - Developed by CARB for assessing mitigated emissions for projects to be submitted for compliance under cap-and-trade
  - Can be useful for assessing emissions associated with related projects even if those projects are not pursuing cap-and-trade compliance or credits
- Greenhouse Gas Credit Exchange (GHGRx): http://www.ghgrx.org/
  - Developed by CAPCOA, specific to California
  - Can be useful for assessing emissions associated with related projects even if those projects are not pursuing GHGRx emissions reduction credits
- Protocols from CARB-approved registries: https://www.arb.ca.gov/cc/capandtrade/offsets/registries/registries.htm
  - There are currently three approved registries which are listed on CARB's website, each with their own set of Protocols
  - Can be useful for assessing emissions associated with related projects even if those projects are not pursuing voluntary emissions reduction credits
  - Local AHJ guidance
  - As accounting for GHG impacts for CEQA compliance becomes more common local jurisdictions will be able to offer insight regarding Protocols, Methodologies, and Tools for projects within their local area

3.3.3 CARBON SEQUESTRATION & EMISSIONS AVOIDANCE STRATEGIES

3.3.3.1 MECHANISMS FOR RETAINING CARBON IN NATURAL AREAS AND WORKING LANDS

Carbon sequestration is a collection of techniques for the capture and long-term storage of carbon dioxide, charcoal, or other forms of carbon using combinations of biological, physical, or chemical processes. Natural biological processes that sequester carbon include ocean mixing, photosynthesis and soil sequestration. Since plants and soils naturally absorb carbon dioxide, preventing outright deforestation and managing forests and agricultural lands as carbon sinks can remove significant amounts of GHGs. If large-scale algae farms become viable, they would also act as biological carbon sinks.

It is well-established that forest conservation and management of forests as carbon sinks and to prevent catastrophic wildfires can be a viable strategy to reduce GHGs and the impacts of future climate change. The Forest Investment Zones program is funded by the non-profit US Endowment for Forestry and Communities and is California's first county-wide energy efficiency financing district, authorized by AB 811.

Enhancing resiliency of forests to wildfire and pests is generally achieved by removing biomass that historically and naturally was removed by more frequent wildfire. Investments in fuel reduction help to ward off large scale losses of biomass from wildfire. The material removed can be used to produce energy while displacing energy production from fossil fuels and can be used as feedstock for innovative wood products, such as cross laminated timber, which will increase the proportion of carbon in long-lived wood products.

3.3.3.2 AUCTION PROCEEDS AS A MECHANISM FOR FUNDING

Carbon sequestration is a collection of techniques for the capture and long-term storage of carbon dioxide, charcoal, or other forms of carbon using combinations of biological, physical, or chemical processes. Natural biological processes that sequester carbon include ocean mixing, photosynthesis and soil sequestration. Since plants and soils naturally absorb carbon dioxide, preventing outright deforestation and managing forests and agricultural lands as carbon sinks can remove significant amounts of GHGs. If large-scale algae farms become viable, they would also act as biological carbon sinks.

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3.4 MULTI-OBJECTIVE STRATEGIES FOR VITAL COMMUNITIES, WORKING LANDS & NATURAL SYSTEMS

Since 2005, the NCRP has been implementing integrated, multi-benefit projects that achieve myriad local, state, and national objectives. Given its status as an economically disadvantaged region, the NCRP has become adept at "doing more with less" – creatively using limited funding to attain the most benefit for its communities and landscapes. The thoughtful integration of multiple objectives and strategies allows the NCRP to achieve its goals in an efficient and effective manner, achieving economies of scope and scale by "stacking" benefits within a single initiative, action, or project.

The following section is a set of six high-priority integrated strategies ("actionable priorities") for efficiently achieving the NCRP vision of healthy watersheds, vital communities, and thriving economies. This section builds on the individual strategies for each focus area that are illustrated and summarized in Section 3. Every integrated strategy will inform the NCRP project evaluation and selection process and guidelines, ensuring that funders and project proponents have a clear understanding of the intentions and priorities of the NCRP, and that all projects achieve long-lasting multiple benefits. For detailed description of the strategies, their history in the North Coast, and how they relate to one another, please refer to: Healthy Watersheds, Vital Communities, Thriving Economies: Actionable Strategies for California's North Coast Region.

3.4.1 NATURAL CAPITAL: HEALTHY FORESTS AND WATERSHEDS

Increasingly volatile climate patterns, vegetation stress due to drought, fuel loading due to a long history of fire suppression, and increased human habitation at the wildland-urban interface has resulted in the region's forests and communities being increasingly vulnerable to catastrophic fires. Frequent and severe wildfires have obvious negative consequences for human communities and natural ecosystems throughout the Region. In addition to direct loss of life and property, the aftermath of fires can bring additional hazards (debris flows, flooding, hazard trees, sedimentation, dissolved organic carbon, blockage of water intakes, loss of habitat) and release of massive amounts of GHG emissions.

Impaired air quality due to wildfire is a public health, as well as environmental health, issue. For example, during a 45-day time period in 2017 (August 3 – September 17), for twelve communities in Siskiyou and Humboldt counties (a total of 464 24-hour periods or "community days"), only 27 "community days" (5.82% of the time) had an air quality index (AQI) of "good;" 163 "community days" (35.13% of the time) had an AQI of "moderate," in which unusually sensitive individuals should consider limiting prolonged or heavy exertion, and the rest of the "community days" (274 24-hour periods, or 59.05% of the time), AQI was unhealthy, very unhealthy or hazardous for at least some community members (see Table 12, *45 Days of 24 hour average AQI values across NW California*; Ray Haupt, NCRP Meeting Presentation, Redding, CA, April 20, 2018). Note that seventy-six (of the 464) 24-hour periods did not have data due to equipment failure or other issues. These data gaps mostly occurred in the communities of Willow Creek and Mount Shasta with Orleans, Weitchpec, and Callahan also experiencing data gaps.

TABLE 12. FORTY-FIVE DAYS OF 24 HOUR AVERAGE AIR QUALITY INDEX (AQI) VALUES ACROSS NW CALIFORNIA

AQI	# "Community Days" (24 hour periods)	Percent of time	Recommended Actions
Good	27	5.82%	None
Moderate	163	35.13%	Unusually sensitive individuals should consider limiting prolonged or heavy exertion
USG	73	15.73%	People within sensitive groups should reduce prolonged or heavy outdoor exertion
Unhealthy	111	23.92%	People within Sensitive Groups should avoid all physical activity
Very Unhealthy	53	11.42%	Everyone should avoid prolonged or heavy exertion
Hazardous	37	7.97%	Everyone should avoid any outdoor activity

In addition to impacts on vegetation, forest stress, and the resulting impacts on wildlife habitat, climate change has reduced snow pack and increased the volatility of weather patterns and extreme events: these impacts are expected to increase in magnitude in the coming years. Stream corridors are likely to experience more frequent and intense flood events, impacting fish and wildlife habitat as well as downstream communities.

The NCRP has an opportunity to address many of these challenges via an integrated strategy portfolio focused on protecting and managing North Coast forests and watersheds to maximize their value: as habitat for an array of terrestrial and aquatic species, for carbon sequestration, for water supply and filtration, to reduce fuel loading near vulnerable human development, and to create jobs and revenue for local communities. A preliminary assessment of areas in the Region that provide multiple benefits is seen below.

3.4.1.1 ACTIONABLE PRIORITIES I — NATURAL CAPITAL

i. Advocate for sustainable forest management, fuel load reduction, prescribed fire, and fire management that reduces fuel loads in the understory and maximizes carbon sequestration in larger trees, while protecting wildlife habitat, aquatic ecosystems, and native plant communities.

ii. Support projects that include sustainable forest management to support local jobs and local revenue, including projects that provide education and training for a forestry labor force, projects focused on bio-energy, bio-char, bio-products, cellulosic ethanol, pellets, and other forest products, including forest-based nanocelluloses and other natural-occurring nanocelluloses, and projects that reduce carbon footprints and minimize the need for petroleum based products.

iii. Promote development of and support for state and national policies that result in sustainable forest management, fuel load reduction, prescribed fire, and fire management while enhancing opportunities for local jobs and revenue.

iv. Rely upon Tribal entities and indigenous people's Traditional Ecological Knowledge to ensure that Tribal understanding of ecosystems and land management are used to support positive outcomes.

v. Refine assessment of high priority areas for forest and watershed management and/ or protection, based on amount and concentration of human habitation, fuel loading and forest management status, potential for carbon sequestration, importance of area for water quality and supply, and presence of habitat for threatened and endangered species.

vi. Explore acquisition of conservation easements and similar protective status designations that protect biodiversity, water quality, and water supply values of forests, while allowing for sustainable forest management to reduce fuel load and sequester carbon, improve water quality and supply, and create and maintain local jobs and revenue.

vii. Pursue partnerships with private landowners, companies, and public agencies to align, enhance, and further goals and strategies related to healthy forests and watersheds.

3.4.2 AQUATIC ECOSYSTEMS: UPSTREAM INVESTMENTS & DOWNSTREAM BENEFITS

The NCRP has a strong focus on salmonid recovery, given that salmonids are a primary indicator of watershed and ecosystem health, and the salmon fishery is a foundational part of the culture, economy, and historic subsistence of North Coast tribes and other more recent inhabitants. The North Coast still retains viable salmonid populations, yet these species are threatened with extinction. The factors that are important for salmonid recovery are often the same factors that influence the viability of other species and habitats, and also affect human community health and economic well-being. These factors include stream corridors, freshwater wetlands, salt marshes, estuaries, and near shore marine areas; all are critically important for supporting biological diversity, clean abundant sources of water, and for climate change resiliency and the moderation of extreme events such as flooding. Additionally, stream zones act as a terrestrial and aquatic circulation system in a watershed, creating opportunities for plant and animal populations to move and adapt in response to habitat degradation and changes in the climate. The Region is home to relatively intact aquatic ecosystems when compared to other parts of California, and it is more cost effective to protect them from degradation than to attempt to recover them after they have been damaged. Aquatic ecosystem protection and enhancement are therefore high priorities for the NCRP, given the multiple benefits that flow from these investments.

3.4.2.1 ACTIONABLE PRIORITIES II — FUNCTIONAL AQUATIC ECOSYSTEMS

i. Rely upon Tribal entities and indigenous people's Traditional Ecological Knowledge to ensure that Tribal understanding of ecosystems and land management are used to support positive restoration outcomes.

ii. Expand on existing natural capital documentation to quantify and monetize the multiple benefits of protecting and enhancing aquatic ecosystems, including:

» Water quality: natural filtration, public health, benefits to aquatic organisms

» Water supply: groundwater infiltration, forested watershed runoff

» Recreational tourism: dependent on clean, natural systems

» Biodiversity and economic benefits: of Tribal subsistence and cultural values, , commercial fishery, clean water

» Avoided costs: moderation of extreme events such as flooding

» This monetization will support programs such as Payments for Ecosystem Services, enhance public understanding of the value of functional systems, and provide a more nuanced view of ecosystem services for planning discussions.

iii. Protect riparian corridors and wetlands via conservation easements that protect the floodplain, allow for the long-term meandering of the stream channel, and promote infiltration of groundwater.

iv. Convene aquatic ecosystem experts to prioritize aquatic ecosystems for protection based on multiple benefits and values.

v. Support restoration and enhancement projects on stream corridors, wetlands, and estuaries that use locally collected native plant materials and restore long term physical and ecological processes.

vi. Advocate for unified policy and corresponding funding for protection and restoration of North Coast aquatic ecosystems across agencies and jurisdictions.

vii. Compile existing information regarding aquatic ecosystems, identify data gaps, and prioritize assessments to fill the gaps.

viii. Assess future cost/benefit to Region of out of basin water transfer, power production, and water deliveries to the rest of state.

ix. Use a "planned retreat" approach to protecting and enhancing wetlands and estuaries along the bay and coast in response to projected sea level rise.

3.4.3 BUILT CAPITAL: ENHANCING INFRASTRUCTURE FOR COMMUNITIES

The North Coast Region encompasses many economically disadvantaged and severely economically disadvantaged communities. These communities are challenged by degraded or inadequate built infrastructure, including water and wastewater infrastructure, communications infrastructure (such as broadband and fiber optic networks), transportation systems, and energy transmission infrastructure. Fixing or enhancing this failing or inadequate infrastructure — as well as creating new efficient built infrastructure — has multiple benefits for the local economy, for public health, and for achieving local, state, and national goals related to emissions reductions and climate change adaptation. Additionally, many of the enhancements to this built capital can have positive impacts on natural capital in the region. For example, resolving problems with failing wastewater treatment plants not only enhances human health and local economic viability and reduces energy and financial expenditures, but also avoids the contamination of North Coast streams and habitats with pollutants.

3.4.3.1 ACTIONABLE PRIORITIES III — BUILT CAPITAL

i. Develop and support projects focused on enhancing or replacing failing or inadequate water and wastewater infrastructure with a specific intent to enhance the local economy, create and maintain jobs and revenue, support public health, and protect sensitive habitats.

ii. Develop and support projects that reduce emissions and provide renewable energy generated and used within the region, with an emphasis on small scale energy generation that create and maintain local jobs and revenue.

iii. Develop and support electric car charging infrastructure at accessible locations region-wide.

iv. Create policy and messaging support for the expansion of Community Choice Aggregation models such as Sonoma Clean Power and the Redwood Coast Energy Authority, and partner with these entities where appropriate.

v. Evaluate all proposed built infrastructure projects based on their ability to measurably reduce emissions as a result of implementation, including water conveyance, water conservation, communications, transportation, and energy infrastructure.

vi. Evaluate and communicate the potential for built infrastructure funding mechanisms such as Enhanced Infrastructure Financing Districts, local assessments, and tax mechanisms.

vii. Explore and support infrastructure projects that enhance the ability of the North Coast to adapt to a changing climate, including localized small-scale energy generation, movement of existing infrastructure, comprehensive use of green infrastructure practices, and provisions for redundancy in existing and future systems.

viii. Build on existing regional and local assessments regarding built infrastructure to evaluate the opportunities and benefits of enhancing built infrastructure.

3.4.4 HUMAN CAPITAL: A PLACE FOR PEOPLE

Retention, recruitment, and enhancement of human capital and talent in the North Coast Region are fundamental factors in the current and future success of local communities, as well as the long term health of North Coast economies and watersheds. In both the public and private sectors, people drive success. Ensuring that public entities, local businesses, and non-profit organizations have the talent to carry on and adapt their missions over the long term is an investment that will yield positive results, not only for future residents and generations but for the landscapes, ecosystems, and natural resources that combine to make the North Coast Region a valuable and precious resource for the entire state.

As a source region, the North Coast supplies clean and abundant water, sequesters large amounts of carbon, and retains extremely high levels of biological diversity – attributes which benefit all of California and beyond. These ecosystem services are critical to the state economy and to achieving legislated climate and environmental goals. Yet these watersheds must be managed by people to ensure that these services continue to be provided to communities within and outside the region. For example, the watersheds of the North Coast supply millions of acre feet of water to other regions of California (e.g. Central Valley and Silicon Valley) and this water is translated into billions of dollars of economic value in the agricultural and technology sectors.

Very little of the revenue generated from these sectors is re-invested in the North Coast sources, so its severely economically disadvantaged communities struggle to retain a qualified and stable workforce to steward these important lands. With the increasing impact of climate change on forested landscapes, and the lack of human capital and funding resources for sustainable management, many areas are increasingly likely to experience catastrophic fires which have the potential to negatively impact carbon stocks, biodiversity, water supply, and quality of life. Thoughtful, strategic investments in source regions – with a specific emphasis on retaining qualified people to steward these lands – is critically important to meeting the needs of Californians and the objectives of the State.

3.4.4.1 ACTIONABLE PRIORITIES IV — HUMAN CAPITAL

i. Identify and map current human capital assets region-wide.

ii. Develop strategies for attracting and retaining human capital.

iii. Evaluate opportunities for local job and revenue creation that are sustainable and that rely on intact natural capital.

iv. Evaluate built capital gaps that act as a deterrent to attracting human capital (e.g., failing/ inadequate transportation, communications, water and energy infrastructure).

v. Evaluate opportunities to ensure that the legalization of cannabis results in investments that restore and/ or enhance North Coast watersheds, communities, and economies.

vi. Align current human capital assets with current/ future regional/ organizational needs.

vii. Analyze and enhance current training, education, and leadership programming to reflect future needs, emphasizing jobs focused at the intersection of built and natural capital.

viii. Identify county by county opportunities to broaden the range of economic drivers to limit future boom and bust models.

ix. Assess current quality of life factors based on above; identify gaps and solutions.

3.4.5 FINANCING AND INVESTMENT: EXPLORING TOOLS AND STRATEGIES

The NCRP has a proven track record of working in a voluntary, collaborative framework to bring funding and resources to the economically disadvantaged North Coast Region. These funds have been highly effective at enhancing watersheds and failing built infrastructure, while creating jobs and revenue. Because the NCRP is built on trust and collaboration – respecting local autonomy and acting as a "synchro" between state and local objectives – there is a high level of support for the partnership among a diversity of partners and stakeholders. This long-term trust and collaboration is foundational to the success of the NCRP as an entity that documents, integrates, and shares local priorities with state and federal agencies and other funders, while also acting as an equitable delivery mechanism for funding to the region.

The NCRP has benefitted from long term partnerships with State funding agencies – including the Department of Water Resources, Strategic Growth Council, State Water Resources Control Board and the California

Energy Commission. However, these bond funded grant programs are by their nature volatile.

Many potential funding sources, particularly those emerging from recent legislation and pending voter approved bonds, promise significant potential, yet they are inherently volatile and do not provide the type of stable long-term funding needed to maintain local capacity. Emerging opportunities include Enhanced Infrastructure Financing Districts, Public Goods Charges, Regional Advanced Mitigation/Regional Conservation Investment Strategies, payments for ecosystem services, pre-disaster mitigation, carbon markets, and new approaches to private capital investment. Additional longer-term opportunities include potential tax and fee mechanisms, with significant evaluation of scale and resolution still required. Diversification and stability of base funding are important for the NCRP's continued ability to serve the North Coast region; no single funding source will provide NCRP with the stability and level of investment required to accomplish its goals and objectives — a strategy that focuses on integrating multiple funding sources holds the best potential for supplying the NCRP with a stable and long-term revenue stream.

3.4.5.1 ACTIONABLE PRIORITIES V — FINANCING AND INVESTMENT

i. Explore combinations of financing options with a focus on aggregation, integrating existing finance opportunities at the local and regional level.

ii. Develop legislation for baseline funding that can also include funding for other partners or interests in the region.

iii. Develop a regional profile/story and share it widely with the current network and other prospective funders including outreach to private sector, foundations, agency staff, and legislators to share success stories and the long term vision for the NCRP.

iv. Seek legislated funding, as the North Coast Region may have the opportunity to gain support for state legislation (and potentially federal legislation) that could provide baseline funding; potential alignment and coordination with the nine Resource Conservation Districts (RCDs) within the region, who are also seeking baseline funding, could be effective.

v. Evaluate opportunities to inform and align with the CA Forest Carbon Plan to support the State in achieving its goals for AB 32, SB 32 and SB 375.

vi. Evaluate opportunities to develop public private partnerships with private partners who have shared goals with the NCRP, including natural resource related sectors related to recreation, tourism, renewable energy, agriculture, commercial fishing, and timber.

vii. Providing regular briefings for all of the region's legislative representatives (local, state, national) to share and elevate current and past success and ensure awareness of the NCRP goals, needs, and ability to achieve state and national objectives.

viii. Explore with agencies and NGOs the possibility of building a management program such as payment for ecosystems services (PES). Pilot PES programs could be implemented where barriers to entry are low.

ix. Identify investment opportunities for, and co-benefits of, North Coast capital (e.g. natural, built, human).

INVESTMENTS IN NATURAL CAPITAL

- Protection and enhancement of forested landscapes that supply population centers throughout California with clean drinking water
- Protection and enhancement of wetlands and natural lands that can treat wastewater while achieving other environmental benefits
- Water conservation efforts, resulting in efficient water conveyance that reduces emissions, stress on aquatic ecosystems and groundwater, and volume of municipal and residential water need
- Forest management projects in areas near communities that integrate multiple objectives including fuel load reduction, local jobs and revenue, biomass energy, protection of built infrastructure, carbon sequestration/avoided emissions, avoided public health impacts, and the protection of biodiversity

✔ **Built Capital Co-Benefits** — Less impact on existing infrastructure; less need to mitigate human impacts

✔ **Human Capital and Organization Co-Benefits** — Clean drinking water; more secure water supplies; job creation and economic enhancement; reduction of community risk from wildfire; potential reduced energy costs; improved public health; and potential reduced cost of infrastructure maintenance

INVESTMENTS IN BUILT CAPITAL

- Communications infrastructure that can allow for telecommuting, enhance economic opportunity, reduce emissions, and create stable high paying jobs
- Create, enhance and maintain functional water and wastewater infrastructure that achieves multiple benefits
- Priority built capital in and near towns, cities, and population centers that rely on the services provided by natural and working lands outside of these areas
- Creation or repurposing of energy transmission systems that allow for local, small-scale renewable generation such as biomass from forests and distributed solar
- Remove or modify built infrastructure from areas likely to be impacted due to sea level rise, flooding, fires, or other risks associated with extreme events, including in lowlands around the coast and bays, riparian corridors, and areas of recurrent fires
- Expansion of ZEV vehicle infrastructure and use

✔ **Natural Capital Co-Benefits** — Reduced need for vehicle travel and associated emissions; reduced damage due to aging or at risk infrastructure and associated contaminants; increased environmental health from well managed working lands; statewide improvement in energy sources

✔ **Human Capital and Organization Co-Benefits** — Increased economic jobs and opportunities; increased opportunities for economic diversity which increases economic security; reduced cost of living/operations for individuals, private and public sectors; increased educational opportunities; lowered risk of infrastructure failing during emergency events/natural disasters

INVESTMENTS IN HUMAN CAPITAL AND ORGANIZATION

- Analyze organizational changes/enhancements needed to implement natural environment and built environment investments listed above and begin to communicate those needs region-wide and to partners outside of the Region to secure capital and needed technical assistance
- Identify, document, and engage current human capital assets including current and emergent local leaders, current and emergent technical experts in the region, high-visibility North Coast alumni, and organizational support from outside the region
- Work with current and new partners to identify, enhance and expand current regional training, leadership and talent recruitment programs, including significant outreach to educational institution and private business sectors
- Combine the three investments above into a unified human capital development strategy for lasting natural and built environment strategies for the long term

✔ **Natural Environment Co-Benefits** — Provides the workforce, talent, community support, and longevity needed to implement natural environment investments outlined above and steward the natural capital in the region, which benefits local communities and other regions in California

✔ **Built Environment Co-Benefits** — Provides the workforce, talent, community support, and longevity needed to implement the built capital investments outlined above

3.4.6 ECONOMIES OF SCOPE AND SCALE: INTEGRATING BUILT, NATURAL, & HUMAN CAPITAL

Historically, the relationship between built and natural capital has been one of conflict, with residential development, water supply, wastewater treatment, transportation, and energy infrastructure objectives having negative impacts on natural capital, thereby creating regulatory frameworks that are costly and rife with conflict. At the same time, in some sectors there has historically been a lack of appreciation for the role of working and natural lands (natural capital) in providing the foundational services that are transported or conveyed by built capital, services including clean drinking water, clean air, or renewable energy.

A substantial body of research has demonstrated that protecting and investing in natural capital and working lands while also strategically integrating built capital investments may allow our communities to achieve quality of life and local economic development goals in a more cost effective manner than if these investments were made separately. Although this thinking presents significant "great than the sum of their parts" opportunities through unified strategic investments in natural and built capital, those investments alone will not guarantee success. Across all communities in the North Coast region, some level of change in how we manage ourselves will be required to better align with the surrounding natural environment and to secure the full potential of our communities through long term commitment to these integrated strategies and investments.

The North Coast Region has the opportunity to maintain our traditional, historic, rural quality of life, while effectively stewarding our regional lands and communities, resulting in multiple local, regional, and statewide benefits that can be enhanced for future generations. If successful in implementing this overall combined strategic investment in the people, infrastructure and natural environment, significant shared goals can be achieved. . Future success will require analysis and adaptation of the region's human capital, retention and attraction of a talented workforce, and modification of our organizational structures to ensure that our communities can demonstrate resiliency for the short and long term. Individual communities across the Region have demonstrated great creativity and innovation over the years, especially in times of crisis. As a Region we now have the opportunity to leverage that innovation while also taking advantage of the economies of scope and scale that regional collaboration can provide.

3.4.6.1 *ACTIONABLE PRIORITIES VI — ECONOMIES OF SCOPE AND SCALE*

i. Document the integrated outcomes related to built, human, and natural capital on every project, including summarizing this information on an ongoing basis at the individual project scale and the regional scale; quantitative cost/benefit analyses for each project; and the relationships among built/human/natural capital investments and outcomes.

ii. Drawing from lessons learned by others, identify opportunities to solve challenges facing the North Coast by strategically including and cost-effectively integrating built, human, and natural capital solutions.

iii. Evaluate land conservation strategies, working with willing participants in a voluntary, incentive-based framework to protect ecosystem services that can be integrated in a cost-effective manner with built infrastructure, and including private parties and public agencies.

iv. Evaluate opportunities to avoid sprawl, including avoiding the loss of farmland and natural habitats; plan for growth that allows for functional built infrastructure, intact ecosystems, forests, watersheds and habitats, local agriculture, and healthy places for people to live and share information region-wide.

v. Identify and request priority financial investments in integrated natural-built-human capital projects and plans (see "Actionable Priorities: Financing and Investment" above).

3.4.7 RESOURCE MANAGEMENT STRATEGIES

This section outlines the Resource Management Strategies (RMS) that DWR has developed to implement the California Water Plan (DWR 2009, 2013). An RMS is a project, program or policy that helps local agencies and governments manage their water and water-related resources. The purpose of including RMS in the NCRP Plan is to document the range of strategies considered by the NCRP to meet the Goals and Objectives of the NCRP, and to ensure diversification of the water management strategies and projects as a way to mitigate for uncertain future circumstances, per requirements in the DWR IRWM Guidelines (DWR 2016). Following is a listing of RMS that do and do not apply to the NCRP, as well as a brief discussion of potential synergies that can be gained by combining multiple RMS.

3.4.7.1 RMS THAT ARE ADDRESSED BY THE NCRP

DWR has defined 32 RMS in the 2013 update of the California Water Plan. It is critical that the proposed RMS complement the operation of existing local water systems. Water managers in different parts of the Region likely will have different perspectives on the applicability and cost-effectiveness of RMS for meeting local, regional, and statewide priorities (DWR 2013). The NCRP has determined that 26 RMS have high potential for successful application in the North Coast. Only six RMS do not apply to water management in the Region. Although this section presents RMS as separate elements, in practice various RMS are often connected to each other, as well as to other activities such as local land use planning (DWR 2012).

A subset of fifteen RMS is identified in the 2013 California Water Plan as having "great potential to benefit water quality in the North Coast Hydrologic Region."

- Agricultural Lands Stewardship
- Agricultural Water Use Efficiency
- Conjunctive Management and Groundwater Storage
- Ecosystem Restoration
- Flood Risk Management
- Forest Management
- Groundwater and Aquifer Remediation160
- Land Use Planning and Management
- Pollution Prevention
- Recharge Areas Protection160
- Surface Storage — Regional/Local
- Urban Runoff Management
- Urban Water Use Efficiency
- Water-dependent Recreation
- Watershed Management

The 26 RMS that the NCRP considers applicable in the North Coast Region are listed and described below.

1. Agricultural Lands Stewardship: Farm and ranch landowners (the stewards of the state's agricultural land) producing public environmental benefits in conjunction with the food and fiber they have historically provided while keeping land in private ownership.
2. Agricultural Water Use Efficiency: The use and application of scientific processes to control agricultural water delivery and use to achieve a beneficial outcome. It includes an estimation of net water savings resulting from implementing efficiency measures as expressed by the ratio of output to input, resulting benefits, and strategies to achieve efficiency and benefits.
3. Conjunctive Management and Groundwater Storage: The coordinated and planned use and management of both surface water and groundwater resources to maximize the availability and reliability of water supplies in a region to meet various management objectives. Involves the efficient use of both resources through the planned and managed operation of a groundwater basin and a surface

water storage system combined through a coordinated conveyance infrastructure.

4. Drinking Water Treatment/Distribution: Providing a reliable supply of safe drinking water is the primary goal of public water systems in the Region, which must develop and maintain adequate water treatment and distribution facilities. In addition, the reliability, quality, and safety of the raw water supply are critical.
5. Economic Incentives (Loans, Grants and Water Pricing): Economic incentives include financial assistance, water pricing, and water market policies intended to influence water management. Economic incentives can influence the amount and time of water use, wastewater volume, and source of water supply.
6. Ecosystem Restoration: Restoration of modified natural landscapes and biological communities.
7. Flood Risk Management: Contains four approaches within a single RMS, to respond to the complexity of integrated flood management, including nonstructural, restoration of natural floodplain functions, structural, and flood emergency management.
8. Forest Management: Focuses on forest management activities, on both public and privately owned forested lands, whose goals specifically include improvement of the availability and quality of water for downstream users.
9. Groundwater/Aquifer Remediation: Removing foreign constituents to improve the quality of degraded groundwater for beneficial use. Drinking water supply is the beneficial use that typically requires remediation when groundwater quality is degraded.
10. Irrigated Land Retirement: Not likely to be a common strategy for the North Coast because of the high value of working lands for provision of ecosystem services, farm products, and quality of life value, this strategy may become useful for coastal lands experiencing salt water intrusion due to the effects of climate change. Conversion of these lands to salt water marsh or other appropriate natural ecosystems could buffer storm surges and provide wildlife habitat and ecosystem services.
11. Land Use Planning and Management: More efficient and effective land use is linked to several resource management strategies including watershed, water use efficiency, flood management, parks and recreation, climate change adaptive management, and agricultural lands stewardship.
12. Matching Water Quality to Use: Recognizing that not all water uses require the same level of water quality ensures proper use of limited potable water sources; use of high quality water sources for drinking and industrial purposes and lesser quality water can be adequate for some uses.
13. Outreach and Engagement: Outreach and engagement for water management in California is the use of tools and practices by water agencies that allow public groups and individuals to contribute to good water management outcomes.
14. Pollution Prevention: Reducing or eliminating waste at the source by modifying production processes, promoting the use of non-toxic or less toxic substances, the implementation of practices or conservation techniques including activities that reduce the generation and/or discharge of the pollutants, and the application of innovative and alternative technologies which prevent pollutants from entering the environment prior to treatment. Can also include new equipment designs or technology, reformulation or redesign of products, substitution of raw materials, updating or improvements of existing management practices, continued maintenance of previously implemented management practices, training and education/outreach, and improved collaboration.
15. Precipitation Enhancement/Fog Collection: This RMS has not been used in California as a management technique, but occurs naturally with coastal vegetation. New technologies may have success capturing measurable amounts of water from fog by using a louvered device with slats set vertically for rapid draining.
16. Recharge Areas Protection: Recharge areas are those areas that provide the primary means of replenishing groundwater. Protection of recharge areas requires a number of actions based on two primary goals: (1) ensuring that areas suitable for recharge continue to be capable of adequate recharge rather than being covered by urban infrastructure, such as buildings and roads, and (2) preventing pollutants from entering groundwater to avoid expensive treatment that may be necessary prior to potable, agricultural, or industrial uses.

17. Recycled Municipal Water: The recycling of municipal wastewater treated to a specified quality to enable it to be used again. Focus is water from municipal plant; does not include gray water, untreated industrial water, or agricultural water.
18. Salt/Salinity Management: To reduce salt loads that impact the Region; in some areas this is a key component of securing, maintaining, and recovering usable water supplies.
19. Sediment Management: To stabilize and/ or restore the watershed for sediment production mimics natural sediment production, without eliminating it, and thus provides the various ecological and beneficial uses.
20. Surface Storage (Local/ Regional): The use of human-made, aboveground reservoirs to collect water for later release when needed. Focuses on regional and local surface storage alternatives but does not include the major surface storage investigations of the State and federal CALFED Bay-Delta Program (CALFED)
21. System Reoperation: Changing the existing operation and management procedures for a water resources system to improve existing facilities to meet existing system needs more efficiently and reliably, or to prioritize one system need over another.
22. Urban Runoff Management: A broad series of activities to manage both stormwater and dry weather (e.g. excess landscape irrigation water flows to the storm drain) runoff. Traditionally, urban stormwater runoff management was viewed as a response to flood control concerns resulting from the effects of urbanization; today the stormwater is viewed as a potential water source.
23. Urban Water Use Efficiency: Reduction of urban water use by Demand Management Measures and Best Management Practices to secure water supplies.
24. Water & Culture: Increasing the awareness of how water management affects cultural values, uses, and practices — and how these have an effect on water management — helps inform policies and decisions.
25. Water-Dependent Recreation: Recreation activities in or on water, including fishing, swimming, skiing, snowboarding, waterfowl hunting, motor boating, surfing, and kayaking, wildlife viewing, picnicking, biking, camping, and hiking.
26. Watershed Management: The process of creating and implementing plans, programs, projects, and activities to restore, sustain, and enhance watershed functions.

3.4.7.2 RMS THAT ARE NOT ADDRESSED BY THE NCRP

Six RMS (below) recommended by DWR are considered by the NCRP to be not applicable to water management strategies for water supply in the North Coast at this time. The Region has a high incidence of rainfall and generally exports more water than is consumptively used (DWR 2013). Therefore, RMS focused on water conveyance, transfer, or state water storage efforts are not included in the NCRP Plan strategy development. Likewise, there has not been sufficient demand or investment in desalination of seawater as an alternative water source, so this RMS is also not included in the NCRP Plan.

1. Conveyance — Delta
2. Conveyance — Regional/Local
3. Crop Idling for Water Transfers
4. Desalination
5. Surface Storage — CALFED/ State
6. Water Transfers

3.4.7.3 BENEFITS OF IMPLEMENTING MULTIPLE RMS

The NCRP has always recognized that the management of a natural resource, especially water, requires integration of various management efforts through a watershed-based planning framework. The integration of multiple RMS (e.g. through NCRP projects being implemented throughout the Region) is necessary to provide long-term benefits to the Region's communities, ecosystems, and economies; these benefits cannot be secured by application of a single management strategy.

Strategies not listed in the California Water Plan, but identified by the NCRP as complimentary strategies to achieve climate resiliency and multiple benefits are:

1. Continually Evaluate Climate Vulnerabilities and Impacts: Revisit and revise the NCRP Climate Change Vulnerability Assessment to support development of appropriate adaptation and mitigation strategies.
2. Groundwater Basin Monitoring: Participation in statewide CASGEM monitoring to ensure groundwater elevations are adequate for the North Coast and to monitor effectiveness

of projects and programs implemented to bolster groundwater supplies.

3. Integrate Ecosystem Resilience with DAC Resilience: Recognize the connection between ecosystem function and economic vitality and promote strategies that benefit from this connection.

3.4.7.4 ALIGNMENT WITH NCRP GOALS/ OBJECTIVES & STATE RMS

The process for soliciting and selecting projects to implement the NCRP Plan was designed and is continually refined to enable NCRP's selection of technically sound projects that meet (1) local needs as articulated via the NCRP goals and objectives, (2) statewide priorities related to water planning and resource management, and (3) consideration of climate impacts and adaptation and mitigation actions. Since 2007, as part of the NCRP's adaptive management process, the NCRP's goals and objectives have been refined, although the original themes related to intra-regional cooperation, salmonid recovery, and beneficial uses of water remain constant. The state's Resource Management Strategies (RMS), which identify priorities for the California Water Plan, likewise have been refined over time. Below is a discussion of how recommended state RMS (DWR 2013) have been applied, via project implementation, to address the NCRP goals and objectives.

NCRP Goal 1: Intraregional Cooperation & Adaptive Management

Objective 1 – Respect local autonomy and local knowledge in Plan and project development and implementation

Objective 2 — Provide an ongoing framework for inclusive, efficient intraregional cooperation and effective, accountable NCRP project implementation

Objective 3 – Integrate Traditional Ecological Knowledge in collaboration with Tribes to incorporate these practices into North Coast Projects and Plans

Associated RMS

North Coast IRWMP Goal 1 and associated objectives predate the two new RMS for California Water Plan Update 2013, but also incorporate them. These are the Outreach and Engagement and Water and Culture RMS. Through a transparent, inclusive process and continual outreach and networking efforts, the NCRP demonstrates respect for local authority while providing an ongoing intra-regional framework for analysis, discussion, and innovation. The open and inclusive record of the NCRP speaks to its incorporation of the Outreach and Engagement RMS since its inception. Successful implementation of this RMS has led to the hard-won comity exhibited by the NCRP membership and region's stakeholders and by the recognized success of its implementation projects. By actively incorporating Tribal needs and concerns in all meetings, outreach, and project evaluation, the NCRP recognizes and supports the Tribes' ancestral relationship with water. Likewise, through this Goal and objectives, the NCRP acknowledges and supports the ranching and agricultural communities' historic cultural relationship with the region's waterways.

NCRP Goal 2: Economic Vitality

Objective 4 — Ensure that economically disadvantaged communities are supported and that project implementation enhances the economic vitality of disadvantaged communities by improving built and natural infrastructure systems and promoting adequate housing

Objective 5 — Conserve and improve the economic benefits of North Coast Region working landscapes and natural areas

Goal 2 and its associated objectives are met in part by project implementation of specific RMS, but also through NCRP processes. Through prioritizing projects that support DACs and Tribes during project selection and its stated commitment to the working landscapes heritage of the North Coast, the NCRP contributes to regional economic vitality. To date, the NCRP has invested over $67 million in state, local, and federal funding through implementation of 88 projects that collectively have used all RMS identified as relevant to the NCRP Plan. Most of these projects have employed multiple RMS to achieve multiple benefits for the region, including economic vitality, support of Tribal and Disadvantaged communities, and conservation and improvement of working landscapes and natural areas. These strategies will also protect the region from anticipated climate impacts: healthy natural and working lands provide ecosystem services that sequester carbon and increase resiliency by buffering against storm surges and flood events, protecting groundwater recharge areas, and enhancing ecosystem services such as water filtration and pollination.

Associated RMS

RMS that prioritized projects have used to contribute toward Objective 4 include:

- Agricultural Water Use Efficiency
- Conjunctive Management & Groundwater
- Recycled Municipal Water
- Surface Storage
- Matching Water Quality to Use
- Pollution Prevention

- Agricultural Lands Stewardship
- Ecosystem Restoration
- Forest Management
- Recharge Areas Protection
- Land Use Planning and Management
- Watershed Management

Agricultural water use efficiency, conjunctive management, recycled municipal water, surface storage, and matching water quality to use provides improved water management for working landscapes; these improvements are likely to translate to farm profits, agricultural viability, and help to invigorate the local economy. Pollution prevention projects contribute to maintaining instream water quality, which lessens regulatory burdens (such as TMDL compliance) for agricultural landowners. By voluntarily implementing projects that contribute toward meeting TMDL requirements, farmers and other landowners are also contributing toward agricultural sustainability in the region. Ecosystem restoration, forest management and recharge area protection help to conserve and protect working landscapes and natural areas. Watershed management and land use planning that protect open space and agricultural lands also contribute toward attainment of these objectives.

NCRP Goal 3: Ecosystem Conservation and Enhancement

Objective 6 – Conserve, enhance, and restore watersheds and aquatic ecosystems, including functions, habitats, and elements that support biological diversity

Objective 7 – Enhance salmonid populations by conserving, enhancing, and restoring required habitats and watershed processes

Associated RMS

Many prioritized projects directly or indirectly contribute toward achievement of these Objectives. Specific RMS include:

- Agricultural and Urban Water Use Efficiency
- Agricultural Lands Stewardship
- Ecosystem Restoration
- Forest Management
- Surface Storage
- Groundwater and Aquifer Remediation
- Land Use Planning and Management
- Recharge Areas Protection
- Pollution Prevention and Urban Runoff Management
- Watershed Management

RMS such as agricultural lands stewardship, ecosystem restoration, forest management and recharge areas protection include fish passage enhancement, road repair, native tree plantings, riparian restoration and wetlands enhancement/creation. Such projects directly benefit aquatic ecosystems and salmonid habitat through improved habitat, increased stream canopy cover, or provision of ecosystem services such as pollutant filtration, which improves instream water quality. These RMS also enhance regional resiliency to the impacts of climate change, including increased intensity and frequency of precipitation events, increased length and severity of drought, and increased air temperatures. Ecosystem restoration and forest management also sequester carbon and reduce the chance of wildfires.

Agricultural and urban water use efficiency, surface storage, and groundwater and aquifer remediation benefit aquatic ecosystems by decreasing the amount of water withdrawn from surface waters, thereby increasing instream flow, which can contribute toward cooler summertime temperatures and provide greater pollutant dilution and protection from the stress of hotter, dryer periods expected with climate change. Pollution prevention, urban runoff management and groundwater and aquifer remediation can improve surface water quality, which also improves salmonid habitat. Sediment reduction projects are particularly important for salmonid habitat restoration. Land use planning and watershed planning that factors these strategies into an integrated management framework protects and improves critical habitat as well as providing climate change resiliency.

NCRP Goal 4: Beneficial Uses of Water

Objective 8 — Ensure water supply reliability and quality for municipal, domestic, agricultural, Tribal and recreational uses while minimizing impacts to sensitive resources

Objective 9 — Improve drinking water quality and water related infrastructure to protect public health, with a focus on economically disadvantaged communities

Objective 10 — Protect groundwater resources from over-drafting and contamination

Associated RMS

Many NCRP projects have contributed toward objectives related to water supply and drinking water quality and adaption strategies for anticipated increases in the amount and intensity, timing, quality, and variability of precipitation events and stormwater runoff and recharge. RMS that meet these challenges when implemented include:

- Agricultural and Urban Water Use Efficiency
- System Reoperation
- Conjunctive Management & Groundwater
- Recycled Municipal Water
- Surface Storage
- Drinking Water Treatment and Distribution
- Groundwater and Aquifer Remediation
- Matching Water Quality to Use
- Agricultural Lands Stewardship
- Ecosystem Restoration
- Recharge Areas Protection

Agricultural and urban water use efficiency projects, system reoperation, conjunctive management, matching water quality to use, and recycled municipal water projects increase supply reliability directly and implement practices that will be necessary for adaptation to the hotter, drier conditions predicted with climate change. Water efficiency projects also decrease GHG emissions associated with water delivery systems. Surface storage, including diversion and storage of peak flow during periods of high precipitation for use during the dry summer months, is becoming an increasingly important strategy for local water supply reliability in many North Coast Watersheds. Drinking water quality treatment and distribution projects in DACs protect public health by improving failing infrastructure. Groundwater and aquifer remediation help to buffer supplies, improve drinking water quality, and protect groundwater resources, an important component of climate change adaptation. Agricultural land stewardship protects supply reliability, improves surface water quality, which can lead to better drinking water quality, and protects groundwater resources from over-drafting and contamination. Ecosystem restoration and recharge areas protection contribute toward supply reliability and improved water quality, and enhance carbon sequestration, and will assist with the capture and storage of increased precipitation and stormwater runoff expected due to climate change.

NCRP Goal 5: Climate Adaptation & Energy Independence

Objective 11 — Address climate change effects, impacts, and vulnerabilities, including droughts, fires, floods, and sea level rise. Develop adaptation strategies for local and regional sectors to improve air and water quality and promote public health and safety.

Objective 12 — Promote local energy independence, water/energy use efficiency, GHG emission reduction, carbon sequestration, and jobs creation

Associated RMS

Climate adaptation and energy independence is addressed at the policy level by the NCRP, but several NCRP projects have implemented the following RMS toward the achievement of these objectives:

- Agricultural and Urban Water Use Efficiency
- Economic Incentives
- Forest Management
- Land Use Planning and Management
- Watershed Management
- Ecosystem Restoration
- Recharge Areas Protection

Agricultural and urban water use efficiencies promote water and energy use efficiency and GHG emission reduction. Economic incentives encourage landowners and businesses to install water and energy saving devices, solar energy panels, and other efficiencies. Forest management to produce biochar enhances local energy independence and carbon sequestration. Land use planning and watershed management that consider vehicle miles traveled, enhance walkability, and assess climate change, impacts, vulnerabilities, and strategies also contribute toward this goal. Many of the habitat enhancement and watershed/recharge area protection projects listed above help to make natural and human communities more resilient to the expected impacts of climate change, such as more volatile weather, shifting climate zones, temperature extremes and flooding.

NCRP Goal 6: Public Safety

Objective 13 – Improve flood protection, forest and community resiliency to reduce the public safety impacts associated with floods and wildfires

Associated RMS

Several NCRP projects have improved flood protection and reduced flood risk. RMS employed include:

- Flood Risk Management
- Ecosystem Restoration
- Recharge Area Protection
- Land Use Planning and Management
- Watershed Management

Flood risk management directly addresses this goal by reducing flood impacts. Ecosystem restoration and recharge area protection enhance green infrastructure: the natural capacity of floodplain features to collect and hold excess stormwater when intense precipitation events occur. These RMS also buffer against expected increases in storm surges and precipitation frequency and intensity associated with climate predictions. Land use planning and watershed management that use low impact development and consider downstream impacts also contribute to this objective and regional climate adaptation.

3.4.8 COORDINATION OF LOCAL WATER & LAND USE PLANNING

NCRP objectives were developed and updated to reflect local, regional, and federal priorities and the NCRP has solicited input from these entities throughout the process. NCRP regional planning activities are feeding directly into local planning efforts through (in part):

- The infusion of grant funds for needed projects
- Technical support and professional networking
- Provision of General Plan and municipal ordinance templates and processes
- Development of Community Watershed & Planning Areas
- Development of NCRP Small Community Water Provider Toolbox
- Sharing of the latest information to keep local projects and programs aligned with state priorities

The NCRP strives to provide an inclusive framework for intra-regional cooperation. NCRP members are enabled to focus on programs and activities they subscribe to, and maintain the autonomy to opt out of participating in others, while remaining signatories and active participants in other programs/applications/projects.

3.4.8.1 INTEGRATION OF LOCAL & REGIONAL PLANNING JURISDICTIONS

The jurisdiction for each local plan in the Region coincides with the jurisdiction of the county or municipality that has developed the plan. The jurisdictions of watershed plans, (e.g. TMDLs), however, are basin- or sub-basin-wide. Note that the county and municipal plans carry enforcement authority, while the watershed plans usually call for voluntary participation. Each North Coast jurisdiction meets its local planning and implementation challenges within the broader NCRP framework. Local plans address local challenges and give an indication of local needs. These needs and challenges are considered by the PRP and documented and incorporated into the NCRP Plan through analysis of local plans, incorporation of proposed projects as an indication of regional need, surveys, interviews, outreach, workshops, and conferences. Often, implementation of projects to satisfy local needs also satisfy broader regional goals, such as ensuring a reliable water supply or restoring salmonid habitat.

3.4.8.2 INTEGRATION OF EXISTING PLANS & NCRP GOALS/OBJECTIVES

Lists of local, regional, state, and federal plans and other planning documents related to land and water resource use planning have been compiled by NCRP staff and are available on the NCRP web page (*North Coast Plans, Policies and Reports, May 2019*). All have relevance to the Region's resource planning, and all are at least partially consistent with the current priorities, goals and objectives of the NCRP. Specific sections of all the local planning documents and efforts referenced herein clearly relate to one or more NCRP goals/objectives. Examples of consistencies between the NCRP and existing plans include, but are by no means limited to the following:

- UWMPs and General Plans set water supply reliability as a goal
- Watershed plans often meet several of the primary NCRP objectives related to salmonids, drinking water, and water supply provision with minimal environmental impacts.
- Land and water plans most often apply a diversity of RMS, combining them to achieve multiple goals.
- Because they share fundamental priorities with existing plans (by design), the NCRP projects also frequently implement local and sub-regional watershed plan elements.

As Land Use Plans such as General Plans, Water Resources Elements, Coastal Plans, Forest Plans, and other land management plans are updated, the updates may include strategies provided by the NCRP and template elements developed during the process when municipalities/counties choose to incorporate them. This will place plans into a regional context while preserving local autonomy: individual planning efforts will be tailored to the specific community while keeping regional needs and interdependencies as important planning components.

3.4.8.3 LINKING WATER & LAND USE MANAGEMENT DECISIONS

Historically, the approach to land and water planning has been to manage and make decisions about each resource separately, from the perspective of different agencies. Although water clearly moves across jurisdictional boundaries, water management historically has been based strictly within jurisdictional areas. The IRWM process seeks to resolve this conflict through diverse water management portfolios and early water management input to those responsible for making land use decisions and implementing land use changes (DWR 2012).

In the last decade in California, there has been a movement toward a more inclusive watershed approach to planning. Water, resource and land planners and managers may tackle regional water issues and meet multiple water management objectives by implementing a single multi-benefit project or program, rather than individual projects from one agency with a single purpose. For example, NCRP activities toward floodplain restoration also benefit water supply, water quality, salmonid habitat, recreational access, flood attenuation, and carbon sequestration. The NCRP planning process also provides an opportunity to expand and link existing programs with stakeholders who would benefit from them.

3.4.8.4 COMMUNICATION NEEDS & STRATEGIES

Often, the relationship among and between land and water resource agencies is characterized as reactive in that one agency is expected to act to accommodate a decision the other agency has already made; early communication is critical to change this relationship dynamic from reactive to proactive (DWR 2012). Open and transparent communication between and among NCRP participants and potential stakeholders is integral to the NCRP approach to planning and implementation. Improved interaction between water managers and land use planners can advance the implementation of the NCRP: they can make decisions with better understanding of their impact on each other, and they can identify and act upon opportunities to collaborate and meet multiple goals cooperatively. Communication must flow both ways: to local entities and from local entities into NCRP, state, and federal planning processes. The NCRP has established robust mechanisms to ensure public input during formal review periods, group meetings, and via one-on-one communication. The PRP continually evaluates and improves processes to provide for transparency, inclusiveness, and openness in all NCRP activities.

3.4.8.5 PLANNING & IMPLEMENTATION STRATEGIES

Multi-objective planning frameworks are increasingly the preferred paradigm for local, regional, state, and federal government efforts. Strategies to improve planning and implementation increasingly rely on existing frameworks, plans, programs, and pilot projects. Collaborative strategies provide:

- A cooperative framework to move past differences and implement positive projects and programs locally that have a regional and statewide benefit
- Efficiencies of scale

- Pooling of technical expertise
- Sharing of financial, human, and technical resources
- Opportunities to develop and disseminate General Plan and other templates that can be customized to suit local entities' priorities
- Leverage of collaborative partnership to benefit each partner locally

3.4.8.6 LOCAL AGENCY PARTICIPATION

Currently, relationships between local land use planning entities and water management entities can theoretically be collaborative, cooperative, nonexistent, uncooperative, or confrontational. Agencies are increasingly searching out cooperative, collaborative projects and programs that can accomplish multiple objectives while benefitting the local community. Through the NCRP, local land and water use decision makers are given an opportunity to review and comment on the latest NCRP Plan elements that are related to their respective jurisdictions. Versions of the NCRP and North Coast IRWM Plans (2005, 2007, 2014, 2019) have been signed and adopted by a variety of local and regional agencies with land management authority (including counties, cities, and water agencies). As the NCRP continues to increase benefits to local entities in the Region (i.e. via the Water & Wastewater Service Provide Outreach & Support Program and others) more entities are likely to participate, increasing the synergy, technical capacity, and diversity of participation in the NCRP process.

3.4.8.7 TRIBAL PARTICIPATION

North Coast Tribes have demonstrated support for the NCRP following their inclusion in the decision-making bodies of the NCRP, including the PRP, TPRC and ad hoc committees in 2011. Representatives of North Coast Tribes were added to the NCRP governance and technical bodies in 2011. Formal Tribal participation in the NCRP was approved through a revised MoMU that includes the adopted "Tribal Representation Process", in 2010. This decision has made the North Coast the region in California with the most formal Tribal involvement in water governance and implementation project technical review. Inclusion of Tribal representation has the effect of ensuring the NCRP addresses Tribal priorities and that the existing plans and programs of North Coast Tribes are recognized and included in the synthesis of planning documents herein. In 2015 the NCRP elected the first NCRP Vice-Chair from among the PRP Tribal Representatives, and for the first time two Tribal Representatives serve on the Executive Committee.

The Tribal Representation process and Tribal engagement in the DACTI Program and IRWMs is coordinated by a Tribal Engagement Coordinator who receives instruction from the elected Tribal Representatives and their alternates. All 34 North Coast Tribes are encouraged to participate in NCRP meetings and in particular in the Tribal NCRP quarterly meetings wherein participating Tribes discuss items before the quarterly NCRP meetings and provides feedback to the Tribal Representatives who will vote on NCRP action items.

3.4.8.8 PROCESSES FOR ONGOING COORDINATION & INTEGRATION

The process for coordinating and integrating local water and land use planning with the NCRP Plan is ongoing and is aligned with the processes by which the Plan is amended. The Plan incorporates the most current land use and water management issues, and identifies planning strategies that may be implemented or explored in the future. Reports commissioned for the NCRP and summary tables related North Coast planning efforts help to support ongoing NCRP Plan updates and process refinements; inform continued outreach efforts; and relate North Coast planning efforts to specific Plan elements.

- The NCRP, under the direction of the PRP, is committed to identifying and implementing future plans to further a collaborative, proactive relationship between land use planners and water managers and between both groups and the NCRP. Upcoming opportunities anticipated by the NCRP include:
- General Plan updates are in progress or planned within five years for most local agencies within Region; their updated information will be incorporated into the NCRP Plan
- Future forums, conferences, and workshops to cultivate the relationship between water and land use decision-makers
- Continue to identify and fund water management projects that meet water supply and water quality objectives while being compatible with existing and planned future land use designations
- Continue and extend outreach to and expand collaborative relationships with local, state, federal resource entities, particularly those representing the land use community
- Continue to identify and promote opportunities for shared water-land management that satisfies priorities of all participants

3.4.8.9 COORDINATION WITH STATE AGENCIES AND NEIGHBORING IRWM EFFORTS

The NCRP keeps in close contact with state agencies and other IRWM efforts through participation in agency-led meetings, workshops and conferences and the Roundtable of Regions statewide IRWM group. The NCRP also invites participation by state representatives to quarterly meetings, workshops, and annual events as well as requesting in-person and telephone meetings when warranted. Some of the counties in the NCRP also participate in other IRWMs, and they bring relevant information from those efforts to NCRP meetings. There are no existing water management conflicts with adjacent IRWM regions.

The state can assist with implementation of IRWM planning, processes and projects by continuing to prioritize integrated regional management at the state level and to continue to provide robust funding opportunities for planning and project implementation. The cooperation of multiple state agencies around streamlining permitting (e.g., watershed-based general permits for watershed restoration/ road decommissioning) has been helpful for project implementation; continuation and expansion of this type of assistance, especially as it relates to prescribed burning as a tool in North Coast forest management, would be helpful, especially to North Coast Tribes.

3.5 MODEL PLANNING & POLICY ELEMENTS

3.5.1 PLANNING AND POLICY TOOLS AND MODELS

3.5.1.1 ENERGY & EMISSIONS AVOIDANCE

Site Resilience and Energy Assessment Process for Key Assets, Redwood Coast Energy Authority

This report discusses how to identify natural hazards that affect essential services, identify key assets, and assess energy requirements for a specific asset. The report works in parallel with a spread sheet to collect and track data. The approach addresses a small subset of a much broader, more comprehensive energy assurance planning methodology. For example, the Department of Energy defines a 10-Step Energy Assurance Planning Framework1, which in turn was the basis for work on the CaLEAP2process to establish guidelines for local governments in California.

The goal of this report is to help jurisdictions and agencies to identify and develop high-level energy assessment plans for critical key assets, prepare demonstration sites for future energy independence and resilience funding opportunities, and to promote and sustain awareness of energy assurance planning among local jurisdictions beyond a recent catastrophe.

3.5.1.2 LAND USE

Humboldt County General Planning Models and Environmental Impact Report

This suite of planning models includes a model for an Environmental Impact Report for a County General Plan as well as several model elements of a County General Plan, including: Land Use Element, Community Infrastructure and Services Element, Water Resources Element, Energy Element, Safety Element and an Implementation Action Plan. The Plan for which these model elements were developed was adopted by the County of Humboldt in October, 2017.

North Coast Irrigation Water & Fertigation Management Plan User's Guide & Tool Version 1.0, Humboldt County Resource Conservation District

Humboldt County Resource Conservation District staff has conducted a series of interviews with livestock producers in the coastal bottomlands around the Humboldt Bay region. These producers represent management of hundreds of acres of pastures and crops where seasonal irrigation and fertilization practices have been conducted for years, or decades, or in some cases, generations.

These interviews have included inquiries to find out how producers make decisions on scheduling irrigations and nutrient applications, what kind of volumes of water are applied, and whether they consider soil moisture status, soil water holding capacity and crop needs in their decisions. It was through these types of interviews that HCRCD realized the need and benefits of a project such as the North Coast Irrigation Water and Fertigation Management Plan (IWFMP). Fertigation is the injection of fertilizers, soil amendments, and other water-soluble products into an irrigation system.

The IWFMP uses Excel worksheets as an input framework for use by agricultural producers and is based on calculating a water and nutrient balance for a variety of crop types (System requirements: Microsoft Excel 2010 (or newer)). It is regionally adaptable for use throughout the North Coast Region to inform producers of optimal water and fertilizer use for enhanced management of farm resources and to maximize crop production. Producers input farm-specific data such as acreages, crop type, irrigation sources, application rates, pumping rates, irrigation schedule, and fertilizer applications. The model uses this information to provide the user with a summary of past management for the current year and information for each designated land unit. The IWFFMP includes the ability to incorporate farm-specific equipment information, information for soil moisture monitoring data, well water monitoring, and other agronomic information to better refine outputs.

3.5.1.3 WATER QUALITY AND SUPPLY

Mendocino County Integrated Planning and Outreach, Mendocino County Resource Conservation District

Mendocino County has identified many planning goals and action items which are in alignment with North Coast Resource Partnership/North Coast Integrated Regional Water Management Plan Goals and Objectives. Although the process of identifying which Action items/Projects "fit" with NCRP priorities was cumbersome, it's clear that the outcomes were very positive for the County, particularly at a critical time when their Water Agency is undergoing a capacity building phase.

MCRCD and County Building and Planning Services (PBS), held two meetings regarding the scope of the project and expected outcomes. Additional meetings were conducted concerning CASGEM compliance, with Both Water Agency and PBS staff. During the course of the Project, the Water Agency cycled through two key staff members—one retired, and the other transferred out of the area. To meet CASGEM data gaps and State compliance, MCRCD stepped in at the County's request, to assist with completing the CASGEM Plan for the Ukiah Valley medium/high priority groundwater monitoring elements—and is now under contract to monitor approximately 17 wells.

The elements that might be improved are: 1) to create a simplified database, in an electronic format—entering data by hand is time consuming and doesn't breathe life into the process; 2) CASGEM is an important mechanism for securing future grant funding by and for county government—partnerships could be strengthened for project development and project prioritization in future funding initiatives; 3) Water Agency staff hold critical institutional knowledge—the MCRCD partnership with the County may help facilitate capacity building for the Water Agency and help preserve institutional knowledge.

Assistance for Small Community Water and Wastewater Service Providers, Siskiyou County

Siskiyou County is a large, sparsely populated county located in the northernmost part of California with a population of approximately 45,000 people. In 2014, Siskiyou County contracted with Water Works Engineers (WWE) to assist a limited number of small community water and wastewater service providers in Siskiyou County with assessment of the system's most pressing needs for their water and/or wastewater systems. As part of Water Works Engineers proposal to provide value-added services, a comprehensive list of the small community water and wastewater service providers was compiled from County records and currently known information. This was done to provide the County with a maintainable list of all the service providers for the small, economically disadvantaged communities, in the event that future funding becomes available to pursue potential projects in these communities.

Water Resources Planning Proposal, Trinity County

Trinity County is a sparsely populated county in the North Coast region that lacks the resources of more populous counties. In order to assist the County to respond to drought, this project was completed. It developed recommendations to improve policies to better manage water resources for the review and consideration of the County and local water providers. Strategies for improving water use efficiency and conservation were developed and the County worked with community water providers to: engage in water conservation education and outreach; develop rate structures where cost recovery is proportional to water use; and develop recommendations for increased or additional water supply sources from sustainable and low impact sources. A support network between the County, community water providers, local resource agencies and the development community was established that is designed to assist landowners to be good water stewards. Online resources were developed to enable access by all interested parties and to help bridge the gap between County land use goals, written policies, and practical implementation.

3.5.1.4 EMERGENCY PREPAREDNESS

Mendocino County Water Emergency Preparedness for Underserved Districts, Mendocino County Resource Conservation District

The Mendocino County Resource Conservation District (MCRCD)worked with tribal and small water suppliers to improve their capacity to meet water emergencies by: 1)conducting a needs assessment; 2) holding seven water conservation workshops and events;3) creating the four-part Water Wise radio series on public radio; 4) providing free downloadable educational and outreach materials; 5) publishing an on-line water conservation resource guide;6) training staff to conduct residential water audits; and 7) assisting suppliers with developing drought contingency plans.

The MCRCD found that the primary vulnerability among small water suppliers was water supply insecurity due to reliance on a single source of water, lack of water rights, or insufficient back-up storage. Many suppliers lacked the funds and staff to meter their customers, hampering their ability to institute and enforce water use restrictions. The help requested from the MCRCD focused on assistance with grant writing for meters and storage, free outreach materials, help educating customers, free water audits and help adopting drought policies.

3.5.1.5 WASTE

Decentralized Wastewater Treatment System Planning Options Evaluation Methodology, Disposal Solutions Scenarios, Management Model Guidelines, Hoopa Tribe

This handbook is intended as an introduction to cluster systems, and also provides basic tools for the reader to perform some preliminary planning. The tools are intended to assists the reader in developing a general understanding of their environment, regulatory requirements, and costs required for a cluster system; however, these tools are not intended to replace field investigations, and a certified professional must be consulted should the reader conclude that a cluster system may be a viable option to pursue.

3.5.1.6 TRIBAL MODEL POLICIES

Planning Guide for Tribal Energy Sovereignty, Bear River Band of Rohnerville Rancheria

The goal of this document is to allow for Energy Sovereignty, whereby a Native Sovereign Nation or Tribe can own its renewable energy, and stop burning fossil fuels. This document is intended to be used by local Tribal entities who wish to eliminate fossil fuel use in buildings with their locally available, renewable energy resources such as solar power, wind power, and bio-mass. It includes a description of how existing Tribal buildings use energy, how to switch methane gas ("natural gas") burning equipment to high performance electric equipment and then generate that electricity with local renewable resources.

Trinity River Hoopa Valley LiDAR Technical Data Report, Hoopa Valley Tribal Fisheries

In October 2013, WSI (Watershed Sciences, Inc.) was contracted by the Hoopa Valley Tribal Council to collect Light Detection and Ranging (LiDAR) data and digital imagery in the fall of 2013for the Trinity River Hoopa Valley project in Northern California. Data were collected to assist the Hoopa Valley Tribal Fisheries Department in assessing the topographic and geophysical properties of the study area to support aquatic habitat analysis and fisheries monitoring. This report accompanies the delivered LiDAR data and imagery and documents data acquisition procedures, processing methods, and results of all accuracy assessments

Planning Guide for Development of Tribal Environmental Protection Ordinance, Yurok Tribe Environmental Program

This Planning Guide is a direct result of a specific project the Yurok Tribe undertook to enhance its environmental protection program. Development of a Planning Guide and a Model Tribal Environmental Protection Ordinance is intended to assist other Tribes to improve their environmental protection programs. The project focused on modification of existing Yurok Ordinances for land use and solid waste based on an extensive review of available Tribal Code.

The Yurok Tribe project improved their existing environmental program by reviewing and revising current land use environmental ordinances and writing additional ordinances. Individual Ordinances were then consolidated into a single Ordinance to improve access to subject matter and streamline and clarify the enforcement process. This Planning Guide describes the planning process and options for other tribes to consider while undertaking similar projects to develop codes. The Model Tribal Environmental Protection Ordinance generated for the Yurok project is offered to other tribal nations as a template for their similar efforts, with particular applicability to other North Coast tribal nations. The Planning Guide describes the steps and options necessary to develop a Tribal Environmental Protection Ordinance.

Model Tribal Environmental Enforcement Response Plan, Yurok Tribe Environmental Program

Development of a Model Tribal Environmental Enforcement Response Plan is intended to assist other Tribes to improve their environmental programs. The overall project focused on development of a model Tribal Environmental Protection Ordinance which will contain enforcement elements. The Yurok Tribe project improved their existing environmental program by evaluation of existing environmental codes and policies and development of an Enforcement Response Plan for the Yurok Environmental Protection Ordinance. The Model Tribal Enforcement Response Plan generated for the Yurok project will be offered to other tribal nations as a template for their similar efforts, with particular applicability to other North Coast tribal nations.

Residential Land Use Policy Related to Water Use, Yurok Tribe

In the summer of 2014, creek flow measurements were collected on the following creeks:1)Upper Rock Chute and lower Rock Chute 2)East Burrell and Burrell 100 3)Upper Bens and lower Bens 4)Upper Ha Amar and lower Ha Amar 5)Upper Devil and lower Devil 6) Upper Chqui and lower Chqui 7)Wautec Intake/Achelth 8)Upper Cawtep and lower Cawtep 9)Upper Bertha and lower Bertha 10)Nellie Although there were a total of 16 creeks identified in the proposal as points of interest, some creeks required more than one flow measurement due to the change in the surface water velocity between locations. There were also locations that were unsafe to access due to trespass marijuana grows occupying land near the surface water and were abandoned after one flow measurement was collected.

Flow measurements were collected by the Yurok Land Management cadastral survey crew in August, October, and November. The cadastral survey crew constructed weirs for measurements and converted the times into a conversion formula into gallons per minute. This formula is used by engineers from Indian Health Services.

As flow measurements were being collected, we discussed some of the issues that we were hearing from the community about presence of heavy metals, arsenic, and e-coli in the water. The levels of flows were of little consequence if the water has naturally occurring arsenic. Since the Yurok Reservation was heavily mined in the past, it seemed important to also determine if the main creeks that are providing drinking water are experiencing general water quality issues.

Water quality was extremely poor for all of the creeks. Coliform was present at extremely high levels in every creek as well as e-coli. There is some concern that the high levels of coliform and e-coli could mean septic leaks or dumping on the rural creeks. Without more information, the Yurok Tribe decided to include mandatory sand filtration on residential water systems that are proposing to use surface water sources.

From the flow measurements, the Planning Department, Yurok Land Management cadastral survey crew, and Tribal Council developed a water policy for residential water sources; "Water Resources: Land Use Policy". This policy set forth the goals to monitor future residential developments that through identified goals and implementation tools to ensure water diversions are monitored and the health and safety of the community is prioritized. The final Tribal Council adopted residential water policy requires at least one year of water flow measurements on a creek that has not been measured previously to determine if the surface water source can support a year-round diversion and water quality testing.

3.5.2 NCRP WATER & WASTEWATER SERVICE PROVIDER OUTREACH & SUPPORT PROGRAM

3.5.2.1 2013 –2014 SURVEY AND OUTREACH

The NCRP received a DWR grant to improve the capacity and quality of service of small water supply and wastewater service providers through coordination, technical assistance, trainings, integrated planning, funding opportunity identification, and education.

Survey Efforts

In 2013, Humboldt County staff, acting on behalf of the NCRP, circulated a survey to over 300 entities representing all public water and wastewater systems serving communities in the North Coast Region. The entities surveyed included Tribal systems, cities, special districts, and mutual water companies, many of which provide critical services in small rural communities. The survey was intended to determine technical, managerial, and financial needs and project priorities and it highlighted the following expressed needs:

- Assistance with securing funding and navigating the process of replacing or upgrading aging infrastructure;
- Assistance with general water and wastewater system infrastructure operations, maintenance and repair;
- Support to comply with state standards (especially drinking water standards);
- Assistance with identifying funding opportunities and preparing grant applications; and
- Support to develop and maintain maps of water and wastewater systems.

In response to these needs, the NCRP worked with the Rural Community Assistance Corporation (RCAC), Cal Rural Water, and a team of engineering consultants to develop a suite of trainings and tools that build capacity for providers in disadvantaged communities and that can be replicated statewide. The work followed a "utility management cycle" developed by the North Coast region and includes information that supports the development of capital projects, system management, training for providers and sound financial management. On the capital project side, the effort included development of a "Small Community Toolkit" to assist water and wastewater purveyors in the initial scoping and development of solutions to their infrastructure needs.

Trainings and Tools

For operations support, the targeted grant effort worked to leverage the established "Technical Managerial and Financial" (TMF) template developed by RCAC. This on-line template allows purveyors to prepare the 13 elements required for funding from the California Department of Public Health and is an important resource for "self-help" in disadvantaged communities. Training was provided through a series of workshops that introduced participants to the Small Community Toolkit, the TMF Template, and funding and financing opportunities. Many of the workshop locations also afforded participants the opportunity to upload their Preliminary Project Information onto the NCRP website, which helps them take advantage of future funding opportunities and ensures that the NCRP's understanding of regional funding needs remains current and valid.

Because the survey results revealed significant needs around funding, the NCRP convened a "Small Community Assistance Workshop" in Sacramento on February 28, 2014. The workshop included representatives from DWR, the California Department of Public Health, the State Water Resources Control Board, the U.S. Department of Agriculture's Rural Utility Service, California's Infrastructure Bank, the Indian Health Service and RCAC. These state, federal and non-profit organizations work together to organize the California Funding Fair and provided valuable insight on the needs survey results, the tools being developed by the NCRP and the funding and financing vehicles available for small communities. Their input informed the funding opportunities considered in the 2014 Plan and subsequent updates (2019). Workshop participants also identified barriers to assisting disadvantaged communities, including:

- Disadvantaged and Tribal systems often don't have drought plans
- Disadvantaged and Tribal systems often don't have emergency plans
- Disadvantaged communities need a way to fund storage
- Indian Health Service emergency funding can only be accessed when supply is reduced to 15-25 gpd
- Disadvantaged communities need technical assistance with financials and rate studies because rates must be at 1.5% to 2% of MHI before grants
- Disadvantaged communities need technical assistance with hiring consultants

- USDA requires a Vulnerability Assessment and Emergency Response Plan to fund a project
- CDPH planning funding requires four Technical, Managerial, and Financial (TMF) elements
- CDPH construction funding requires full TMF
- Decentralized systems are difficult to manage without a governance overlay for O&M
- Board members for small districts need training
- Solar projects can reduce long-term costs but payback benefits aren't universally understood
- It is very difficult to assist non-federally recognized tribes
- Mobile home park systems are often private, for-profits making them very difficult to assist
- Forming legal entities that can receive assistance is difficult, time consuming and expensive
- It is hard to access pre-planning funding for early application work

While the Small Community Toolbox, TMF template and workshops help address some of these barriers, the list is an important reminder of how financing plans need to be structured to support disadvantaged communities.

Small Community Toolbox

The NCRP Small Community Toolbox was created to provide resources to help with system maintenance, replacement and upgrades as well as to assist in the project development process. The Toolbox is intended to help small utilities develop a "first order" understanding of what their options are, how they should begin to budget, where to find funding opportunities, and how to get help. This resource is organized around the steps associated with the "Utility Management Cycle". Tools contained in the Toolbox may be provided as documents, maps, charts, or links to web resources. The goal of the toolbox is to provide additional resources to small communities that help them minimize gaps and allow small and or disadvantaged purveyors to more effectively move through the Utility Management Cycle and access financial and technical assistance. The Toolbox is not a substitute for professional assistance with operations, management, engineering and legal issues (*see Appendix K, Table 51, Small Community Toolkit Elements).*

Demonstration Projects

In order to test the usefulness of its tools, the NCRP's targeted grant also included ten demonstration projects where the tools will be applied to help agencies move forward in the application process. These projects each received approximately $15,000 of assistance, are outlined in Appendix K Table 52 (*Economically Disadvantaged Community Demonstration Projects*). This assistance is additive to the IRWM funding outlined in Appendix K, Table 49 ("Summary of NCRP Use of Funds") and Table 50 ("Summary of Funding and Financing to Date").

3.5.2.2 2017–2019 SURVEY AND TECHNICAL ASSISTANCE

Survey & Results

In 2017, the NCRP received Proposition 1 funding for outreach and assistance to Tribal and Economically Disadvantaged Communities. The NCRP, using the 2013 survey as a basis, developed a follow-up survey for water suppliers and wastewater treatment operators that was administered in late 2017 through mid-2018 primarily via email and the internet with some phone interviews and US Postal Service mail surveys also conducted for those who preferred. A special effort was made to obtain responses from the small systems that did not participate in the 2014 NCRP System Needs Survey. The survey was left open on the internet and responses continued to trickle in through early 2019. Results of the first set of surveys were analyzed in May 2019 (see Disadvantaged Community Water & Wastewater Service Provider Water Needs Survey Summary).

By April 25, 2018, there was a 54% response rate to the survey (120 responses representing 112 systems). The top five areas of concern were aging treatment systems (need to replace system parts), financial stability for operating the system and maintaining a reserve, fire suppression supply reliability, drinking water supply reliability, and outdated treatment system (need new/ improved technology). With respect to technical assistance, the greatest need was for assistance with funding opportunities. About 40% of respondents expressed moderate need for assistance with maintenance and repair, operations, and capital improvement planning, while about a third of the respondents indicated moderate need for assistance with meeting regulations, rate structures, and equipment calibrations.

Nearly 40% of 88 respondents indicated that sharing resources with neighboring or nearby systems would help address needs for specialized tools, equipment, qualified operators, or system management. Slightly more indicated that this would not be useful, while about 20% weren't sure. Many of the systems indicated that they currently share resources or technical staff with other facilities. For example, one water treatment operator serves many small coastal systems. Others assist or receive assistance from a neighboring system. Of those who do not think sharing resources would be beneficial, several commented that they are too far away from other systems for it to be practicable. In response to the query about resources to share, over half of the 103 respondents replied that they do not have specialized tools, equipment, or other resources to share through partnerships. About one quarter of respondents indicated that they do have resources to share, while another 20% were uncertain. The list of items that respondents indicated they are willing to share with other systems is impressive: qualified operators, backhoe and other tools, CCTV for sewer/ pipe videoing, fleet equipment, operators, generators, system repair tools, storage tanks, vactor trucks, water level indicator tools, waterline leak detection and waterline location equipment, and technical expertise were some of the items offered for sharing. Some respondents indicated that they already assist smaller entities or have service contracts or MOUs for sharing specialized equipment. These responses indicate that there is a need in the North Coast for sharing equipment, tools, operators, and technical expertise, and that there are many individuals and agencies willing to do so. The NCRP, through its website, conferences, workshops, and other mechanisms, is uniquely positioned to facilitate the expansion of existing efforts.

Technical Assistance

Concurrent with the water and wastewater treatment needs survey, NCRP staff compiled a list of water and wastewater system providers in the North Coast region in need of technical assistance (see Disadvantaged Community Water & Wastewater Service Provider Water Needs Survey Summary). This list was put through a rigorous screening and prioritization process. A list of preliminary evaluation criteria was developed that included economic status (only systems in or serving areas considered disadvantaged by the state were considered), Drinking Water State Revolving Fund criteria for public health need, Clean Water State Revolving Fund criteria for public health and water quality, implementation readiness, and sustainability criteria, including infill development, existence of capital and asset management plans, climate change planning, protection of environmental or agricultural resources, and presence of project in one or more regional environmental management plans. DWR IRWM Program Statewide Goals were also factored into the prioritization process, including drought readiness, ecosystem protection and restoration, expansion of water storage capacity, improvement of groundwater management and increased flood protection. The resulting list of water and wastewater system providers in the region was reviewed with the NCRWQCB and Division of Drinking Water District Offices 01, 03 and 18 to ensure that systems were good candidates for assistance based on state experience and knowledge. When the preliminary ranking was developed and DWR and NCRWQCB had added their input, additional adjustments were made based on system responsiveness to outreach, whether systems were currently receiving planning or construction funds from other sources, whether systems had previously received NCRP assistance, and whether projects were consolidations, which increase regional self-reliance. Once the final adjusted points were developed each project was ranked based on their score within each NCRP member county. Top candidates were selected for technical assistance.

About twenty disadvantaged water and wastewater systems in the North Coast region were helped by this first allocation of technical assistance. The first allocation of technical assistance focused on entities with a project that were almost ready to apply for the first round of NCRP IRWMP Proposition 1 Implementation funding in spring of 2019. In these cases, technical assistance supported application development and/ or minor project development assistance. Additionally, the prioritization process identified communities that were not ready to apply for implementation funding in 2019, but need technical assistance to develop a project for the second round of DWR IRWMP funding anticipated in 2021.

The NCRP anticipates more than one round of technical assistance to be provided as part of the overall DACTI program. The first allocation of technical assistance focused primarily on water and wastewater providers, but the NCRP is developing a separate strategy to outreach to economically disadvantaged communities, Tribes, and other organizations responsible for watershed management, stormwater, and other ecosystem functions.

3.6 LONG-TERM ECONOMIC & FINANCING PLAN

Since 2005, the NCRP planning process and project implementation has been financed from a variety of sources, including via Proposition 50 and Proposition

84 grant funding; alternative grant sources (e.g. California Energy Commission, Energy Efficiency & Conservation Block Grant Program; and Strategic Growth Council Sustainable Communities Grant); and local cost-share agreements with the Sonoma County Water Agency, Humboldt County, and other NCRP member counties. NCRP funding awards from 2005-2019 total over $65 million and leverage over $95 million in funding match. With its commitment to achieving multiple objectives through local action, the NCRP is well poised to attract and utilize new federal, state, local, and private funding sources as they become available. NCRP projects are likely to qualify for many types of grants and low interest loans. The NCRP was initiated with and continues to benefit from voluntary member contributions. Financial contributions have not been a requirement of membership in the NCRP, although all members have contributed substantial staff time to the effort. See Appendix K "Financing History and Future Financing" for more information.

The NCRP developed a financing plan to help stakeholders understand the complex history of NCRP funding and develop future funding to sustain the NCRP effort. The financing plan identifies a diversity of funding types to ensure the long-term sustainability of the NCRP framework, processes, and projects. The Financing Plan accommodates a 20-year planning horizon and includes the following elements:

- Sources of funding (program-level description of funding sources for Plan development and potential sources for project implementation and O&M costs) including but not limited to ratepayers; operating funds; water enterprise funds; special taxes, assessments, and fees; state, federal, and private grants & loans, and local bonds
- Potential alternative funding including opportunities to leverage ecosystem service value (consider other than grant awards; consistent, secure, long-term funding e.g. general funds, rate-based funds)
- Certainty of funding (current statues as secure, submitted, proposed)
- Conclusions and recommendations of professional economists based on consideration of stakeholder and NCRP review and input, previous funding sources, and projected funding needs.

3.6.1 CHALLENGES TO FINANCING IN THE NORTH COAST REGION

Relatively small communities and spectacular natural resources characterize the North Coast Region. However, an uncounted number of potentially beneficial projects have been stalled because of the hurdles created by the need for affirmative votes to implement them. As the Public Policy Institute of California (PPIC) recently described, Article XIII of the State's Constitution (put in place by Proposition 13 in 1979 and Proposition 218 in 1996) can "stymie local agencies' ability to pursue the modern water management techniques needed to maintain reliable… service." Rigid constitutional requirements that rates and fees must be specifically linked to services for each property jeopardize the implementation of innovative programs and the provision of basic services.

Despite these universal challenges, the integrated planning process has been successful in the North Coast Region. To date, the State's investment has been approximately $69 million and the North Coast Region has used this as leverage to complete over $160 million of watershed improvements. This has more than doubled the State's investment and created a framework and processes for implementing additional successful integrated projects.

An assessment conducted by the U.S. Environmental Protection Agency in 2011 found California could use $44.5 billion to fix aging drinking-water systems over the next two decades (U.S. Environmental Protection Agency 2013). ASCE's 2012 "Infrastructure Report Card for America" gave the state a "C" and assigned the following investment needs for water infrastructure:

- Levees/Flood Control: $2.8 billion per year
- Urban Runoff: $6.7 billion per year
- Wastewater: $4.5 billion per year
- Water: $4.6 billion per year

More recently, the PPIC's 2014 work focuses on the same type of investments that are included in the NCRP and reports funding gaps of $2 to $3 billion dollars annually including:

- $30 million to $160 million to provide safe drinking water in small, disadvantaged, rural communities
- $800 million to $1 billion for floods
- $500 million to $800 million for stormwater management
- $400 million to $700 million for ecosystem support for endangered species
- $200 million to $300 million for integrated water management

3.6.2 DESIRED OUTCOMES

3.6.2.1 FUNDING & CERTAINTY OF OPERATIONS & MAINTENANCE

Operations and maintenance (O&M) funding for NCRP projects comes from various sources including ratepayers, landowners, operating funds and future grants. Many of the municipalities and agencies that provide water or wastewater services fund implementation projects through utility rates and/or operating funds. Nonprofit agencies implementing NCRP projects fund O&M through landowner agreements for project maintenance, operating funds, and by obtaining future grants (in which O&M costs may be funded) and private donations. Landowner agreements are obtained prior to implementing projects on private lands; landowners commit to maintaining projects for a specified time period – usually 10 – 20 years – in exchange for having the project implemented on their land. Resource Conservation Districts and other natural resource agencies are expected to fund O&M from operating funds and, where appropriate, through landowner agreements. Tribes fund O&M through Tribal operating funds.

O&M funding source certainty is considered high for most NCRP projects. Nonprofit organizations, RCDs, Tribes, and natural resource entities that participate in the NCRP have a proven track record of obtaining funding, implementing projects, and maintaining completed projects, which increases confidence that O&M funding for NCRP projects will be ongoing. Likewise, the large municipalities and water supply and wastewater treatment agencies have the customer base and rate structure to be confident of long-term O&M funding for implementation projects. The least certain sources of O&M funding for the NCRP are the smaller water supply and waste water treatment providers located in economically disadvantaged communities (DACs). Because O&M costs are shared across a smaller number of customers, rate increases are often not feasible in DACs leaving small utilities financially burdened and unable to commit scarce operating funds to O&M for a completed project. North Coast Tribal Representatives are discussing options for sharing O&M staff and funding regionally to promote resiliency and consistency in services (*see Appendix K, Table 50, Summary of Funding and Financing to Date*).

3.6.2.2 CAPACITY BUILDING FOR ECONOMICALLY DISADVANTAGED COMMUNITIES

For the past several years, the NCRP has focused on building capacity for disadvantaged communities. This has included outreach in 2014 to ascertain need and then workshops and technical classes, development of a "Small Community Toolbox," and implementation of several demonstration projects. This effort was followed by another outreach effort in 2018 that led to identification of communities most in need of technical assistance, provision of technical assistance in the form of project planning and grant application development in early 2019. Further technical assistance is in development for communities in need.

3.6.2.3 ENERGY/WATER USE EFFICIENCY

The NCRP has successfully expanded the types of assistance it provides to include energy efficiency and greenhouse gas reduction efforts, which is consistent with the goals for the Region. In 2009/10, the NCRP managed an energy efficiency block grant program that provided nearly $1 million in funding and assisted 11 agencies in accomplishing a variety of upgrades and conversions (*see Appendix K, Table 53, Energy Efficiency Block Grant Program*).

The results of the Energy Efficiency Block Grant Program highlight a concept that became evident in the DAC Targeted Grant Program; saving energy pays for itself and that helps the Region. Several of the DAC Demonstration Projects will facilitate the conversion of local utilities to renewable solar power, which USDA and the Indian Health Service have both concluded reduces the operations and maintenance costs for utility systems. Because of these experiences, the funding opportunities considered in this plan include programs that fund energy conservation and conversion to renewable power. While this is not required by DWR's IRWM Guidelines, the NCRP has learned that funding these improvements reduces uncertainty around future costs and upward pressure on utility rates, while reducing greenhouse gas emissions.

3.6.3 FUNDING OPPORTUNITIES CONSIDERED FOR THE NCRP

Because of the North Coast Region's strong history in matching IRWM funds, the NCRP brings an understanding of available funding mechanisms, including several local funding structures that have supported project implementation, operations and maintenance. In accordance with the IRWM Guidelines, this section documents various funding opportunities outside the IRWM process. The NCRP understands that projects can be more easily matched to funding sources when applicants understand the mandate of the funding agency. Through its work on the DAC Targeted Grant Program, the NCRP has coordinated with a number of funding agents representing state, federal, Tribal and private organizations (*see Appendix K, Table 55, Summary of Funding Agencies, Mandates and Eligibility and Table 56, NCRP Funding Opportunity Descriptions by Type*).

3.6.3.1 LOCAL FUNDING MECHANISMS

Because grants will rarely cover 100% of any projects cost and because many of the identified funding agencies provide loans, the NCRP has identified common local funding mechanisms that can secure loans and support operations and maintenance. Appendix K Table 54 "Common Local Agency Funding Mechanisms" illustrates how local rates, assessments, and taxes can be utilized to secure debt to implement projects. As also highlighted by PPIC's findings, four of the commonly employed local funding mechanisms require affirmative votes to implement, which can be a barrier to project implementation and long-term operational funding. When local rates, assessments or taxes have been put in place, they provide a certain and long-lived mechanism for funding capital, operational and maintenance costs. However strong community outreach and understanding are often required to establish or increase these various local funding mechanisms.

The Region's water and wastewater utilities generally employ rate revenue to fund operations and maintenance, capital improvements and to match grants. Within the Region, several other local funding mechanisms support water supply, water quality and restoration activities. For example:

- The Sonoma County Agricultural Preservation and Open Space District is funded by a ¼ cent sales tax
- The Sonoma County Water Agency's Flood Control Zones receive revenue from benefit assessments
- The City of Santa Rosa's Stormwater Utility is funded by a local property-based fee

3.6.3.2 ALTERNATIVE PROJECT FINANCING

The NCRP has experienced situations where an approved project was not able to fully expend its grant allotment. In an effort to keep unexpended dollars in the Region, the PRP in 2012 formalized the process for reallocation the funding of alternative projects. The NCRP Project Funding Reallocation Process policy was updated and approved by the PRP in 2018 and is described below.

3.6.3.3 NCRP PROJECT FUNDING REALLOCATION PROCESS

With concurrence from DWR, the NCRP allows reallocation of funds to another project within ***the existing suite*** of projects to supplement budget short-falls and/or expand the current scope of work to increase the project benefits. Funds will not be reallocated to a project not included within the existing suite of projects. NCRP staff will have the discretion to determine if a portion of the reallocation is necessary to supplement the grant administration budget.

1. For amounts less than $50,000, NCRP staff will use discretion to reallocate the funds to an eligible project within the existing suite of projects with a priority for:
   a. Supplementing budget short-falls.
   b. Supplementing a project that received less than their requested amount during the original selection process.
2. For amounts greater than $50,000, project funding reallocation will occur, to the greatest extent feasible, within the County or Tribal region where the original project is located and is within *the existing suite* of projects in the grant agreement. PRP members from the County or Tribal region, where the original project is located, will determine which projects receive reallocation and the amount of funding.
   a. If the original funds are from a non-Tribal project, they will be made available to another project within the existing suite of projects in the county where the original project was located. The PRP members representing that County will determine which projects receive reallocation and the amount of funding.
   b. If the original funds are from a Tribal project, the funds will be made available to another project within the existing suite of projects in the Tribal region where the original project was located. The PRP member representing that Tribal region will determine which projects receive reallocation and the amount of funding.
3. If the County or Tribal region of origin option is not available (i.e., no projects from the County or Tribal region of origin within the project suite need additional funding):
   a. Staff will announce the availability of funds to project proponents within the grant agreement suite of projects; staff will solicit project requests and description of need from eligible project proponents
   b. Staff will determine eligible projects
   c. TPRC ad hoc committee will be formed via email or at NCRP meeting if timing allows
   d. Ad hoc committee will develop criteria for project reallocation selection
   e. Ad hoc committee will develop project reallocation option recommendations

f. PRP will review and approve recommendations at the next PRP meeting

g. TPRC ad hoc committee will be disbanded

3.6.3.4 NEW FUNDING SOURCES AND STRATEGIES

The 2017 financing plan: *A Review and Assessment of Potential Funding Sources for the North Coast Resource Partnership* (ECONorthwest 2017) describes and evaluates multiple funding sources based on criteria developed from NCRP's funding goals and objectives including demands for future funding and current and past funding sources. The comparison matrix developed by ECONorthwest is provided below as *Table 13. Comparison of Funding Sources*. The table is color-coded to highlight points; dark green shows more favorable scoring while light green indicates less favorable scoring. The final column provides the sum total for each funding type.

TABLE 13. COMPARISON OF FUNDING SOURCES

Funding Source	Funding Capacity	Administrative Requirements	Long-Term Stability	Flexibility	Acceptability	Ancillary Benefits	Total Points
Sales Tax	3	3	3	2	2	1	14
Property Tax	3	3	3	1	2	1	13
Transient Occupancy Tax	3	3	3	2	2	1	14
Fees	3	3	3	1	2	1	13
AB 32 Auction revenues	2	1	1	2	3	2	11
EIFDs	2	1	3	1	2	3	12
Community Choice Aggregation	2	2	3	1	3	3	14
SB 375 Integration	1	1	2	2	2	2	10
Regional Advance Mitigation Planning	1	1	3	3	3	3	14
Public Goods Charge	1	3	3	3	1	1	12
Regional Energy Networks	1	1	2	1	1	2	8
Natural Capital as Infrastructure	1	1	2	3	3	3	13
Pre-Disaster Mitigation	2	2	2	3	3	2	14
Carbon Markets	2	2	3	2	3	2	14
Foundation Partnerships	1	1	2	3	3	1	11
Research Partnerships	1	1	2	3	3	1	11
Public-Private Partnerships	1	1	2	3	3	3	13

Through this assessment, several conclusions and recommendations emerge:

- The NCRP is not alone in searching for funding solutions. Resources for investing in water-related goods and services are lacking throughout California. This is a statewide problem, and efforts at the state level may yet yield a statewide solution that could, at least in part, become part of NCRP's overall funding strategy.
- No single funding source will provide the NCRP with the stability and level of investment required to accomplish its goals and objectives.
- A strategy that focuses on integrating multiple funding sources holds the best potential for supplying the NCRP with a stable and long-term revenue stream.
- Many potential funding sources, particularly those emerging from recent legislation, hold huge potential but are still in development. This presents NCRP with two opportunities: to nudge the policy development in ways that align with the goals of the region; and to lead in implementation, which may afford more opportunities for experimentation and innovation. This leadership may come with additional costs as well, in the form of uncertainty and social capital development. These costs should be factored into a decision to pursue less-well-developed funding sources.
- The NCRP should consider new regional assessments, in the form of taxes or fees, to pay for environmental investments. This type of funding source provides long-term stability and comes with relatively low administrative overhead. The logistics of implementing and collecting the revenue across the region may prove more challenging, but worth exploring.

ECONorthwest recommends the NCRP initiate the development of a formal funding strategy as a next step. This would involve a detailed assessment of all or a subset of the funding sources identified in this report, with the goal of assembling an integrated portfolio of funding sources that would yield a quantifiable amount of revenue over a set period of time. The strategy document would outline a timeline and specific set of steps for developing this integrated portfolio over time (e.g., a five-year development period).

3.6.4 FUNDING OPPORTUNITIES LEVERAGING THE NORTH COAST AS A SOURCE REGION

As described in Section 2.3.11 Natural Capital Values, the value of working lands and natural ecosystems of the North Coast region are approximately $861 billion using a 3% discount rate or $1.3 trillion using a declining discount rate. Owners of natural and working lands may be able to "cash in" on some of this value while retaining and even improving the land and the ecosystem services it provides. Payments for ecosystem services (PES) are payments to individuals or institutions for land conservation or improvements that yield environmental benefits. The most common direct payments for ecosystem services in the United States have been implemented through the USDA via payments to landowners on agricultural land. Wetland mitigation banking is common throughout California as well. Individual transactions to protect specific services in specific locations, such as forests for source water protection, occur occasionally as well. More recently, efforts have focused on developing established markets for ecosystem services where prices are reflective of the demand including avoided costs associated with supply of natural resources both in extractive and conservation contexts. Regulatory compliance drivers and pursuit of cost-savings efficiencies are common forces driving market activity.

Multiple examples of ecosystem service markets currently exist in California: water supply, water quality trading, and carbon cap-and-trade with offsets. Although the ability to participate in these markets is limited due to situational and regulatory constraints, NCRP may have opportunities to create local revenue streams through the carbon offset market in particular. Participation in water supply transactions may be an option for water rights holders within the NCRP, but is not likely a useful strategy for the NCRP to pursue collectively. Water quality markets also tend to be driven by regulation and limited in geographic scope and scale, so are also less likely to be a promising avenue to pursue without new regulatory drivers. The carbon offset market is addressed in more detail below.

Leveraging the value of ecosystem services provided by the natural capital in the North Coast doesn't have to happen through a formal market: by officially recognizing and quantifying the goods and services it supplies, and identifying the beneficiaries of those services, the NCRP is taking the first step toward forging partnerships that may evolve into future revenue streams designed to secure and enhance the supply of ecosystem services. Beneficiaries have traditionally not had to pay directly for these services, so translating supply and demand into payments may take time and additional political assistance or regulatory incentives.

As PES schemes have evolved over the years, the federal government remains one of the largest payers, through conservation programs administered by NRCS and USDA. Conservation organizations are another leading payer, through transactions that secure conservation easements and land trusts. More recently, utilities have become common payers, motivated to reduce their costs for drinking water treatment, stormwater treatment, or wildfire mitigation.

ECONorthwest (2017), in *A Review and Assessment of Potential Funding Sources for the North Coast Resource Partnership* describes several avenues through which organizations have found success leveraging funding through ecosystem services: securing funding normally reserved for large-scale infrastructure for ecosystem improvement; tapping the emerging markets for carbon, through the AB 32 offset program; and accessing disaster-preparation funding for ecosystem (and thus community) resilience. There are also potential avenues through which partnerships could lead to payments for ecosystem services, absent formal government funding programs or markets.

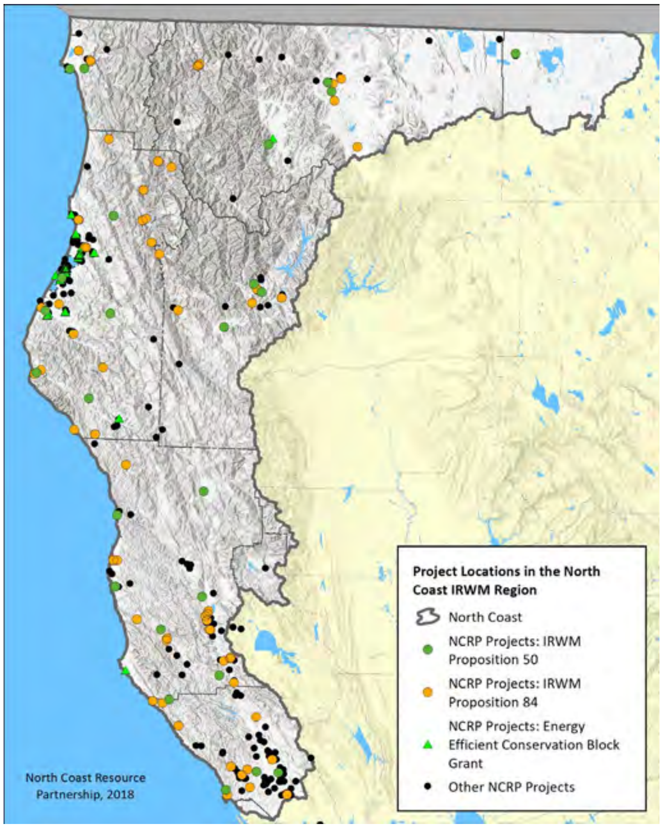
3.6.5 ASSESS CURRENT NCRP GOVERNANCE TO ENSURE LONG-TERM FINANCIAL VIABILITY

Although the NCRP has never charged for membership, an option to fund staffing and programs at the regional level would be to require financial contributions from each governing body which has membership on the PRP. These financial contributions would not need to be the same for each member entity, but could potentially be scaled with consideration for population size, relative median household income, current monetary commitment to the NCRP, or other relevant factors. Due to the economically disadvantaged status of several North Coast governments, this could potentially impose a hardship on some members.

3.6.6 CERTAINTY AND LONGEVITY OF IRWM PLAN AND PROJECT FUNDING

Because of its proactive approach to and proven success in acquiring funding for projects and programs that further its goals, the NCRP is highly likely to be able to obtain and maintain funding into the foreseeable future. The NCRP has been "ahead of the curve" on several key issues, such as pursuing energy independence, reducing greenhouse gas emissions, forest and working lands management for carbon sequestration, and economic valuation of ecosystem services, obtaining funding for such projects and programs before they became state standards. With this forward-thinking adaptive management style, the NCRP is very likely to remain on the forefront of natural resources and water management and continue to obtain funding from a variety of sources to achieve regional goals.

4 NCRP PROJECTS



MAP 51 NCRP PROJECT LOCATIONS IN THE NORTH COAST REGION

4.1 PROJECT APPLICATION, REVIEW & SELECTION PROCESS

This section describes the process steps and guidelines developed by the NCRP Policy Review Panel (PRP) and utilized by the PRP and Technical Peer Review Committee (TPRC) to identify, rank, and select priority projects to implement the NCRP Plan. The current NCRP 2019 Project Review and Selection Process Guidelines (NCRP Guidelines) standardize the process and are subject to continual review and refinement per recommendations of the PRP, TPRC, NCRP staff, funding opportunity requirements and state focus.

The NCRP process and implementation of NCRP Priority Projects identified through the planning process address economic and ecological impacts at their source and generate lasting benefits that will materialize in the local, regional, and statewide economy. In a bottom-up manner, these projects have been planned and proposed to address a suite of local needs identified by North Coast stakeholders through the NCRP process (*see, Appendix L, NCRP Project Information*). Projects are implemented at the basin scale by local entities in accordance with local jurisdictional planning.

To be included in the NCRP and to qualify for related funding opportunities, projects proposed for PRP and TPRC approval must demonstrate how project implementation will contribute to achieving one or more of the specific NCRP Goals & Objectives, and how the project relates to one or more California Water Plan Resource Management Strategies identified in the NCRP Plan. Projects must also align with the priorities of local, Tribal, regional, state, and federal stakeholders, as well as the funding source preferences and requirements. Further, project proponents must sign the Memorandum of Mutual Understanding for the NCRP Plan. These and other North Coast priorities provide the foundation for ongoing refinement of the NCRP Guidelines.

4.1.1 OVERVIEW OF PROCESS STEPS

The NCRP project application, review and selection process is an ongoing, multi-step progression that involves the participation of the NCRP PRP, TPRC, project proponents and other regional stakeholders. The process and Guidelines are continually revised as needed and as opportunities for input are presented and priorities of funding programs change. The details of some project selection steps have been revised since earlier Plans, but these seven steps continue to form the foundation for identifying, evaluating, and recommending projects for inclusion in the NCRP Plan and related funding applications.

STEP 1 — Preliminary Project Information Upload

Project proponents are provided with information about IRWM guidelines and funding opportunities via the NCRP website, email listserve, workshops and other media. Project proponents upload Preliminary Project Information to the NCRP website on an ongoing basis; project proponents submit a signed MoMU; and staff publishes eligible NCRP Projects.

STEP 2 — Project Solicitation & Supplemental Project Information Request

At the direction of the PRP and when there is a funding opportunity, a call for proposals will be announced to North Coast stakeholders. Staff will develop and make available Project Solicitation application materials based on the NCRP priorities and the funding source solicitation and requirements. The project application materials will include an application, detailed instructions and a clear description of scoring guidelines and evaluation criteria, all of which will be reviewed by the TPRC and PRP and approved by the PRP prior to public release. Project applicants will provide application materials to NCRP staff via email. A Microsoft Word version of the NCRP project application will be made available for reference, for application development and for submittal to NCRP staff. Staff will provide outreach, education and technical assistance via workshops and informal meetings by phone, internet and in person.

STEP 3 — Individual TPRC Review & Scoring of Project Applications

Staff compiles and provides application materials to the TPRC for review and scoring using approved evaluation forms. TPRC members individually review and score the NCRP Step 1 project applications for contribution to strategic implementation of the Plan, technical merit, technical feasibility, project costs, financing and matching funds, project readiness (planning, permits, CEQA, implementation), project's expected contribution to climate change adaptation and GHG reduction compared to alternatives, and specific benefits to critical resource issues for Tribal communities as well as other criteria as defined by the funding solicitation, NCRP PRP-directed guidelines, and the professional expertise and judgment of the TPRC (see NCRP 2019 Project Review and Selection Process Guidelines for detail). The mix of criteria for the 2019 RFP include climate change, statewide and Tribal priorities, water self-reliance and safety, and benefits for economically disadvantaged and severely economically disadvantaged communities; the criteria comprise the NCRP's focus on Environmental Justice for this funding round. Additionally, since over 93.4% of the area of the North Coast is considered an Economically Distressed Area, most projects that encompass human communities contain an environmental justice component. TPRC members provide individual scores to NCRP staff for compilation. TPRC members review all projects referred to them unless they recuse themselves due to a potential conflict of interest.

STEP 4 — Group TPRC Review of Project Applications & Scores

Staff compiles all preliminary scores assigned by individual TPRC members to determine a preliminary average project score. TPRC members and staff meet to discuss each project and may make adjustments as necessary to their individual scores based on the group discussion. Staff compiles all updated TPRC individual scores to determine an updated average project score and ranks proposed projects. TPRC review meetings are open to project proponents and the general public with time allotted for public comment. All meeting deliberations, project scores, applicant and public input and recusals are recorded and made available via the NCRP website.

STEP 5 — TPRC Selection of Draft Portfolio of NCRP Priority Projects

During the group project review meeting, the TPRC selects a draft portfolio of NCRP Priority Projects, including draft budget totals for each project. This selection is based on technical project scores, project scalability, critical need, potential funding allowance, the overall balance of projects based on the PRP's defined guidelines for project selection (e.g. for regional equity and balance of grey and green project types), and the ability of the project portfolio to meet NCRP goals and the associated Resource Management Strategies (Section 3.4.7). The TPRC also recommends a list of contingency projects, which are approved to replace one or more of the priority projects, if necessary (i.e. if a project becomes unable to proceed, or if additional appropriate funding becomes available).

STEP 6 — PRP Review, Consideration and Final Approval of Draft Portfolio

During a public NCRP meeting, the PRP reviews and makes adjustments as appropriate to the draft suite of NCRP Priority Projects recommended by the TPRC and approves a final suite of NCRP Priority Projects to forward to the funding entity. The PRP makes their final decision based on TPRC recommendations, PRP guidelines, funding requirements, and other factors that they believe represent the best interest of the North Coast Region. Final approved NCRP Priority Project lists are made publicly available through posting to the NCRP website. Project review scores and review meeting materials are made available to the project proponents and, as requested, to the general public.

STEP 7 — Priority Project Application Materials for Regional Proposal(s)

NCRP Priority Project proponents may be asked to provide additional project information to include in a competitive regional application. Additional information may include, but not be limited to, a detailed work plan, budget, schedule, eligibility certification, monitoring & performance measures, and technical documentation to support the project. Where feasible, NCRP staff provides technical assistance to those project proponents who request it.

The 2019 NCRP Project Review & Selection Process Guidelines, which included climate change, economic need, and Tribal considerations, are available on the NCRP website. The active participation by North Coast Tribal representatives in the NCRP enables the group to understand in detail the challenges faced by Tribal communities, and ensures that projects that help to address critical water supply and water quality needs of Tribal communities are prioritized. For a description of targeted technical assistance to Disadvantaged Communities and Tribes in project identification and proposal development based on a needs assessment survey conducted in 2018, please see [Disadvantaged Community Water & Wastewater Service Provider Water Needs Survey Summary](#).

4.1.2 PRIORITY CONSIDERATIONS

The intent of the PRP-directed NCRP Guidelines is to provide an acceptable method to solicit, identify, and evaluate projects proposed for NCRP -related funding. The NCRP Guidelines allow the PRP to objectively compare and confidently select planning or implementation projects that promote NCRP goals and objectives, while allowing for local flexibility in addressing specific statewide program preferences and funding requirements. The PRP includes the following priority considerations in its decision-making process and scoring criteria:

4.1.2.1 Regional Representation

The PRP will make every effort to ensure geographic representation by including projects from each of the six WMAs; seven counties; and from the north, mid and southern Tribal areas of the North Coast Region. This guideline will apply only to those projects which are eligible for funding under the NCRP and other state and federal requirements, and which have met the technical criteria established by the PRP and evaluated by the TPRC.

4.1.2.2 Economically Disadvantaged Community & Environmental Justice

As part of its commitment to respecting the local autonomy and local culture of each NCRP member, the group has opted out of using some common terminology, such as "Environmental Justice," that can have multiple meanings and may be considered inflammatory to some members. The North Coast is a rural region where economic disparity is the main driver. Thus, there is a strong focus on severely disadvantaged, disadvantaged and underserved communities within the region and the PRP has regularly and consistently supported efforts to address economic disparity as the predominant mechanism to address environmental justice. Project review, selection and NCRP Plans consistently and comprehensively address economic disparity through implementation of projects that serve these communities. To date, 94% of the projects selected for funding by the NCRP leadership benefit disadvantaged communities and 15% benefit Tribes.

In an effort to build capacity and extend services to communities that are under-served and/or limited by socioeconomic barriers, the TPRC includes screening criteria that will confer additional weight to projects that, in addition to meeting other NCRP criteria, will benefit North Coast Tribes, severely disadvantaged and disadvantaged communities and/ or mitigate economic disparity. The PRP reserves the right to prioritize Tribal, disadvantaged communities and/ or environmental justice projects, based on a project's ability to mitigate threats to public health, watershed health, and the economic and public health benefits that project implementation would bring to these communities.

4.1.2.3 Jurisdictional Notification & Coordination

Project applicants are required to demonstrate that they have notified counties and Tribes re: proposed projects in the proposed project impact area of a particular watershed or relevant area of County or Tribal interest. Project applicants are required to demonstrate coordination and outreach to potentially interested stakeholders including Tribes in the relevant watershed, sub-watershed or project impact area; including source and receiving water areas.

4.1.2.4 Programmatic Integration and Balance of Project Type

The PRP requires that proposed projects effectively implement NCRP goals and objectives and, further, address specific federal, state, regional, and local priorities. Projects that address specific priorities identified by the PRP may be prioritized by the PRP (examples may include, but are not limited to, biomass-related projects, effective instream flow approaches, energy retrofits, or drought/ flood preparedness).

Diversity in project "type" (including, for example, built infrastructure projects and natural system restoration projects) will be achieved at the project portfolio level. That is, small and/ or individual projects are not required to demonstrate integration of all priorities, yet they must contribute to a comprehensive suite of projects that achieve a multi-benefit, integrated program. Programmatic integration and project type diversity will be achieved over time and through multiple rounds of funding. Projects that propose to provide multiple benefits will be prioritized, when all else is equal.

4.2 NCRP FUNDING

4.2.1 PROJECT FUNDING HISTORY

A brief description of NCRP project planning and implementation funding sources and awards (beginning in 2005) is provided below and in Appendix K, Table 50 "Summary of Funding and Financing to Date". Grants have been managed through the County of Humboldt.

- Proposition 50 IRWM, NCIRWMP Planning Grant (2005)
  - » Award Amount: $500,000
  - » Award Description: This grant allowed for North Coast regional planning and pilot local planning efforts and also provided funding for revisions of the Phase I NCIRWMP document.
- Proposition 50 IRWM, Implementation Grant, Round 1(2006)
  - » Award Amount: $25,000,000
  - » Award Descriptions: This grant funded implementation of 21 IRWM projects throughout the North Coast Region. Sub-grantees include city governments, Resource Conservation Districts, Community Service Districts, state agencies, and non-profits throughout the Region.
- Proposition 50 IRWM, Implementation Grant, Round 2 (2007)
  - » Award Amount: $2,079,000
  - » Award Description: This supplemental grant provided support four priority Integrated Coastal Watershed Management (ICWM) projects via the NCIRWMP.
- Proposition 50 IRWM, Implementation Supplemental Funding (2010)
  - » Award Amount: $2,176,860
  - » Award Description: This grant continued support for the four priority ICWM projects.
- California Energy Commission Energy Efficiency and Conservation Block Grant (2010)
  - » Award Amount: $959,117
  - » Award Description: This grant provides funding for projects that propose to deliver lasting financial benefits to California consumers and the economy through promotion and facilitation of energy efficiency.
- Proposition 50 IRWM, DAC Assistance Grant (2011)
  - » Award Amount: $500,000
  - » Award Description: This grant was DWR directed funding intended for local assistance planning funds to support water quality and supply objectives of small wastewater and water supply entities in disadvantaged communities. The funding enabled the development of the pilot NCRP Water Supply & Wastewater Services Provider Outreach & Support Program.
- Proposition 84 IRWM, NCIRWMP Planning[12] Grant (2011)
  - » Award Amount: $1,000,000
  - » Award Description: This grant allowed for "Phase III" North Coast regional planning and pilot local planning efforts and also provided funding for revisions of the Phase II NCIRWMP document.
- Proposition 84 IRWM, NCIRWMP Implementation[13] Grant, Round 1 (2011)
  - » Award Amount: $8,222,000
  - » Award Description: This grant continues funding for implementation of Round 1 projects, providing funding for 18 NCRP projects throughout the Region.
- Strategic Growth Council, Sustainable Communities Grant (2012)
  - » Award Amount: $1,000,000
  - » Award Description: This grant provides funding for projects that propose to improve air and water quality, natural resource protection, and public health.

12 Proposition 84 Planning Grant information at https://water.ca.gov/Work-With-Us/Grants-And-Loans/IRWM-Grant-Programs/Proposition-84

13 Proposition 84 Implementation Grant information at https://water.ca.gov/Work-With-Us/Grants-And-Loans/IRWM-Grant-Programs/Proposition-84

- Proposition 84 IRWM, NCIRWMP Implementation Grant, Round 2 (2013/2014)
  - » Award Amount: $5,386,000
  - » Award Description: This grant continues funding for implementation of Round 2 projects, providing funding for 13 NCRP projects throughout the Region.
- Proposition 84 IRWM, NCRP 2014 Drought Project Grant (2014)
  - » Award Amount: $8,700,000
  - » Award Description: This grant provides expedited funding for implementation of drought-related and preparedness projects.
- Proposition 84 IRWM, NCRP 2015 Implementation Grant, (2015)
  - » Award Amount: $11,047,939
  - » Award Description: This grant is the final Proposition 84 funding for implementation of NCRP projects.
- Proposition 1 IRWM, NCRP Disadvantaged Community Involvement Grant (2017)
  - » Award Amount: $2,650,000
  - » Award Description: This grant is 10% of the Proposition 1 North Coast Funding Area allocation to support the NCRP Disadvantaged Community & Tribal Involvement Program.
- California Department of Conservation, Regional Forest and Fire Capacity Program Block Grant
  - » Award Amount: $4,250,000
  - » Award Description: Preparation of a Regional Priority Plan; project development and permitting; demonstration projects; and outreach, education and training.

4.2.2 ONGOING NCRP PROJECT SUBMITTAL

Increasingly, funding opportunities for project implementation require or give preference to projects that are included in a regional Plan. The NCRP Leadership Guidance Handbook describes the PRP approved policy and the Project Funding portion of the NCRP website provides instructions and an application for including projects on an on-going basis into the NCRP Plan.

4.3 IMPACTS & BENEFITS

This section and Appendix M, "NCRP Project Impact & Benefit Analysis" documents the impacts and benefits of the NCRP and its projects; relates past and current projects to local, regional, and state priorities, goals, and objectives; and presents a framework for communicating observed impacts and benefits to NCRP stakeholders and other interested parties. It is recognized that this is a screening-level discussion that is not intended to be highly quantitative or specific to proposed projects at this time. However, estimated impacts and benefits of the 88 previously funded NCRP projects are presented below and these estimates will be updated and refined with future iterations of the NCRP Plan as data and improved economic estimates become available. A NCRP Project Benefits Summary can be downloaded at the NCRP website Impacts and Outcomes section.

4.3.1 ADVANTAGES OF INTEGRATING REGIONAL PLANNING AND LOCAL EFFORTS: THRESHOLD EFFECTS

While respecting and acknowledging local autonomy, the NCRP and the NCRP Plan act as a synchronizing feature between state priorities and local individual plans and projects. A regional plan such as the NCRP that includes the local knowledge and experience and preferences of local community members has many advantages – regional planning that integrates locally unique individual projects may reduce project implementation costs, enhance the types and amounts of benefits achieved from projects, enhance sharing of information among individual entities, and minimize adverse impacts on biophysical and socioeconomic resources in the Region.

Implementing projects through a framework of regional cooperation can be more cost effective than implementing individual projects separately or on an ad-hoc basis. With regional coordination, aspects of project planning and implementation can be consolidated, which prevents the duplication of efforts and reduces costs. The coordination required to implement a regional approach also leads to greater levels of information and data sharing, reducing costs by allowing project sponsors to learn from past efforts and design future projects with increased efficiency. In addition to reducing costs, coordinated efforts reduce adverse impacts of projects, such as ecological disturbances or disruptions to community resources, by better integrating or timing actions to acknowledge and address ecological and community constraints and opportunities.

A regional framework such as the NCRP has the potential to achieve greater benefits than a series of individual efforts. This may occur as coordination among stakeholders to identify opportunities to extend and connect projects, resulting in economies of scale unachievable individually. The NCRP also helps target resources to projects with the greatest benefits. The organizational capacity offered by regional coordination provides resources and support to projects that might not materialize on their own, and over time helps identify and support the implementation of projects that yield greater benefits region-wide. For the rural and sparsely populated North Coast, individual diverse communities working together cooperatively at the regional scale has allowed the region to identify and further its unique goals and priorities for consideration by the State and DWR.

For these reasons, over time, the NCRP regional framework of cooperation among individual autonomous communities has the potential to support projects that generate greater levels of benefits for the region's communities with the same (or fewer) technical, organizational, and financial resources. This is especially the case for Economically Disadvantaged Communities and Tribes, which may lack resources and/ or expertise to obtain funding for projects on their own. Often, these communities do not have the financial resources to meet funding match requirements, but through the NCRP's project bundling framework, projects that have large matching funds availability compensate for the smaller, more disadvantaged communities that might have no matching funds available.

Working collaboratively also has greater potential to reduce costs and adverse impacts to ecological and community resources in the region than implementing individual projects without coordination. These "threshold effects" contribute to strengthening the economy of the region, which in turn increases regional coordination and broadens stakeholder participation over time. This regional cohesion will serve residents of the North Coast well when adapting to anticipated impacts of climate change and working to reduce GHG emissions – lessons learned in one area can be readily communicated with others and likewise, resources can be used to maximize climate readiness.

4.3.1.1 INTEGRATION OF INDIVIDUAL PROJECT IMPACT/BENEFIT ANALYSIS

The NCRP regional framework also has advantages when it comes to assessing the benefits and impacts of individual projects. By integrating the analyses of benefits and impacts across a suite of regional projects, those projects that can achieve the highest level of benefit for their costs become more evident. An integrated and consistent analysis of project-level benefits and impacts allows data collection and monitoring standards to mature and evolve in ways that better support the assessment of benefits and impacts over time. This process helps regional managers direct funds and other resources to those projects that will have the greatest benefits over the long run. It also helps educate and encourage project applicants to design projects more effectively, leading to more efficient project outcomes. Finally, lessons learned and planning opportunities through the NCRP have led to technical assistance and improved capacity for disadvantaged and Tribal communities that otherwise may have lacked the resources and/ or staffing expertise to participate.

4.3.1.2 POTENTIAL IMPACTS & BENEFITS TO THE REGION & BEYOND

Projects implemented through the NCRP produce benefits throughout the region and have the potential to generate benefits that spill over into adjacent regions. Adjacent regions may realize the value of benefits produced in the North Coast directly, as some ecological effects (e.g., carbon sequestration, salmon population enhancement) are not strictly confined to the boundaries of the watersheds that make up the North Coast region, and thus have the potential to improve ecological and economic conditions across a wider area. Water supply and water quality improvements in certain parts of the region (e.g., the Trinity WMA) have the potential to provide benefits across a much wider area as other regions become more dependent on the exports and provision of resources produced in the North Coast. Benefits may accrue to other regions indirectly as lessons learned in the North Coast from project implementation, inter-organization coordination, and data collection and management yield best practices that other regions throughout the state adopt.

While adverse impacts arising from projects implemented under the NCRP are likely to be minimal and short-term in nature (compared to benefits, which are more likely to be long-lasting), they have the potential to materialize both within the region and in adjacent areas. Whenever possible, the project analysis and review process used by the NCRP seeks to minimize the adverse impacts through careful project design and assessment. The benefit-cost analyses of projects submitted for implementation through the plan explicitly account for adverse impacts as part of the analysis of costs. The cost analysis monetizes adverse impacts where possible so they can be directly compared with monetized benefits.

4.3.2 QUALITATIVE & QUANTITATIVE INDICATORS

Projects proposed through the NCRP produce a wide variety of benefits and impacts that can be measured, both in biophysical and economic terms. Some of these measures are qualitative in nature and others can be assessed quantitatively (*see Appendix M, Table 63 Indicators of Benefits and Impacts of NCRP Projects*).

From an economic perspective, projects comprise actions that enhance or create the basic resources that underpin the ecological and economic health of the Region. Economists refer to these basic resources as forms of capital, and categorize them into four groups: natural capital, human-built capital, human capital, and social capital. Most projects that are part of the NCRP are designed to improve the natural and human-built capital in the Region, but produce benefits that bolster human and social capital as well. Adverse impacts of projects also act on these forms of capital by reducing the availability of some resources, usually for a short period of time and over a limited geographic area. When adverse impacts occur from projects in the Plan portfolio, the net effect on the different forms of capital is designed to be positive in the long run.

4.3.3 NCRP IMPLEMENTATION PROJECTS BENEFITS SUMMARY

Following is an overview of potential economic, social, ecological, and cultural benefits provided by NCRP implementation projects funded by Proposition 50 and Proposition 84. Content was developed from information provided by project proponents in reports, contracts, grant proposals, with research and analysis by ECONorthwest, an economics consulting firm. Consistent with widely accepted professional standards, ECONorthwest considered a broad suite of goods and services including those values derived from indirect or non- use of resources. Where sufficient detail exists, the project sponsors' estimates of expected or realized benefits were used.

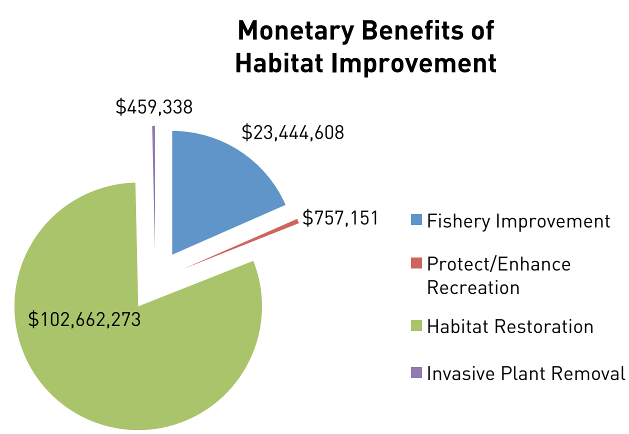
Note: because not all projects could quantify their benefits, and because the economists erred on the side of caution (underestimating rather than overestimating when calculating benefits), the benefits listed are at the low-end of the continuum of estimates of benefits provided by implementation of these 88 projects.

The quantification of benefits represents the NCRP's best effort to present a realistic description of the value accruing from NCRP project implementation. Given that over half of the projects are currently in progress, project scope may change with enhanced or more limited funding, and the predictions of benefits — even those based on the best available science and socio-economic data — are inherently variable.

4.3.3.1 MONETIZATION OF IMPACTS & BENEFITS

Monetization of impacts (costs) and benefits is conducted by project sponsors when they propose specific projects to become part of the integrated plan. Project proponents are provided with a list of suggested economic unit values to apply to the physical units associated with the indicators of benefits and impacts their projects may generate. Project sponsors may also use custom values if they have information that can support them (*see Appendix M, Table 66, Estimated Project Benefits for Water Supply, Quality, and Services*).

Not all benefits and impacts can be monetized. Both the screening analysis and the benefit-cost analysis explicitly acknowledge this. Limitations of monetization arise both from project sponsors' ability to adequately measure the biophysical effects of projects, especially over the long run, and in economists' ability to assign economic values to goods and services that materialize outside the market economy. Non-market valuation approaches provide good information to assign values to many of these effects, allowing them to be assessed alongside market effects. Some effects (especially those related to cultural services derived from the environment) are impossible to adequately value in monetary terms for all stakeholders. These benefits and impacts are described qualitatively, using details to characterize the importance of the effect, such as its timing, magnitude, duration, and the populations that it would affect.



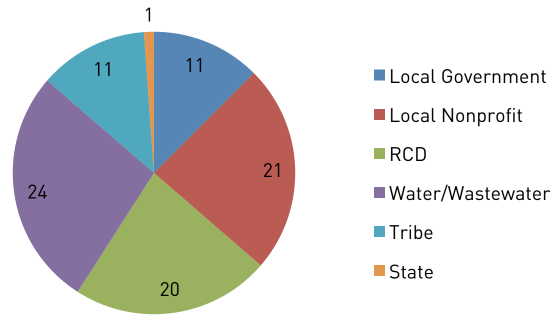
4.3.3.2 CRITICAL IMPACTS OF NOT IMPLEMENTING PROJECTS

Projects implemented through the NCRP address a wide variety of challenges facing the ecological resources and human communities across the North Coast. Without the NCRP supporting the implementation of these projects, the ecological and socioeconomic challenges would continue to mount, further eroding the basic resources that support economic vitality in the Region. Funding these projects now will help avert a range of impacts that would occur if the projects were not implemented. These include:

- Decreases in drinking water supply reliability, especially in disadvantaged communities and Tribal communities that have few other options to access capital needed to repair aging water and wastewater systems. With supply reliability already an issue, decreases will impact the resilience of communities throughout the region to the increased variability in storm events and increased and more severe drought events predicted in the climate vulnerability analysis.
- Degradation of water quality and riparian habitat that adversely affects salmonid populations and the livelihood of communities dependent on healthy commercial, recreational, and Tribal fisheries resources.
- Reductions in surface and groundwater supply availability and increases in water scarcity that affects the production of agricultural and ecological goods and services, leading to loss of economic resiliency and increased conflict throughout the Region as well as vulnerability to climate change impacts including longer, more severe, and more frequent drought events.
- Increases in the spread of invasive species that impair habitat function and reduce the value of goods and services produced by the Region's ecosystems, especially as climate change reduces the fitness of native plants and animals.

Critical impacts, if not addressed in a coordinated and timely way, would have cumulative and long-term adverse impacts that translate to economic costs within and outside of the region and make the entire region more vulnerable to anticipated impacts of climate change.

NCRP Project Sponsors



4.3.3.3 IMPLEMENTATION PROJECTS BENEFIT SUMMARY

NCRP projects include integrated local and regional solutions to water and wastewater infrastructure, stream and watershed enhancement, greenhouse gas emissions reduction, energy independence, forest health and local economic development. NCRP projects are selected via a rigorous and transparent process of scientific and technical review provided by the NCRP Technical Peer Review Committee.

Impacts from these projects were minimal and generally resulted from temporary disruptions to ecosystems and infrastructure during project construction. Any adverse impacts resulting from these actions were remediated as reconstruction efforts were completed and ecosystem restoration matured over time (*see Appendix M, Table 64 & 65, Benefits and Impacts of Proposition 50 & 84 Implementation Projects*).

PROJECT COMPOSITION

88 NCRP IRWM Implementation Projects Total

- 17 Proposition 50 Round 1 projects
- 4 Proposition 50 Round 2 projects
- 18 Proposition 84 Round 1 projects
- 13 Proposition 84 Round 2 projects
- 11 Proposition 84 Drought projects
- 25 Proposition 84 2015 projects

Project Type

- 51 water/wastewater infrastructure projects (51/88 = 58%)
- 58 water quality improvement projects (58/88 = 66%) – these include both instream water quality improvement and drinking water quality improvement projects

- 51 water supply reliability projects (58%)
- The above numbers do not add up to 100% because over half (51%) of the projects provided both water quality and supply reliability benefits

Impacts & Benefits to DACS

The majority of the projects produced benefits that directly or indirectly benefited the North Coast Region's DACs and/ or Tribes. Projects in DACs have improved water supply reliability, shored up critical infrastructure, and enhanced the resiliency of the surrounding ecosystems these communities depend on. The projects produced tangible monetary benefits for the communities, such as reduced operations and maintenance costs and avoided replacement costs. They also produced benefits that are not quantifiable in monetary terms, but are economically important because they enhance the quality of life for people in these communities. Examples of the benefits include opportunities for education, training, networking, and cultural preservation.

Impacts & Benefits to Sensitive Habitats & Species

Well over half of the projects (62.5%) directly enhanced salmonid populations and their habitat. The projects accomplished this through water quality improvement efforts (e.g., by reducing sedimentation), water supply and infrastructure projects such as off-stream storage that increased water available for instream flows at critical times during the year, and riparian and forest restoration activities that improved salmonid habitat.

Socioeconomic Benefits

Approximately 45% of the projects protect the agricultural and resource-dependent heritage of farmers, ranchers, Tribes, and other residents of the North Coast. About 34% provide for social health and safety by improving access for emergency vehicles, improving impacted drinking water quality, and protecting public health through contaminant reduction. Thirty-six projects (41%) reduce local conflicts in areas where tensions exist between competing beneficial uses of water and thirty-two projects provide an education/ technology component that improves the human capital and potential of the North Coast. Approximately 613 jobs were created and maintained through implementation of these projects.

Together, these projects provide between $449,480,000 and $1,302,714,000 in 2014 dollars to the North Coast Region, providing a cost/ benefit ratio of between $1 cost to $5 benefit and $1 cost to $14 benefit. These figures are provided as a range in order to present the most accurate picture of estimated benefits from NCRP project implementation. Because of limitations in assigning economic value to many benefits, these are likely underestimates of the true value of project implementation.

4.4 PROJECT & PROGRAM MONITORING & EVALUATION

This section and Appendix N, " Project & Program Monitoring & Evaluation" describe the framework and proposed processes to establish a standardized Plan and project performance monitoring system based on measurable indicator data, and to evaluate performance based on objective benchmarks.

4.4.1 STATUS OF EXISTING MONITORING ACTIVITIES

Watershed and water quality monitoring is currently conducted by a number of state agencies, each with its programmatic mission to fulfill. Watershed and water quality monitoring in the North Coast is vital for evaluation of the effectiveness of sediment reduction programs, instream habitat restoration programs, fish passage projects and other watershed enhancement projects. On-going monitoring is critical to understanding how land use practices such as road building, timber harvest, irrigated agriculture, and land conversion impact the aquatic resources and habitats of the North Coast Region. Equally important is the compliance monitoring of public wastewater treatment facilities to ensure the health and safety of water quality for beneficial uses. In keeping with its commitment to adaptive management, the NCRP uses existing and proposed monitoring efforts to inform management decisions and guide changes to management, policy, and decision-making in the North Coast Region (*see Appendix N, Table 69, Monitoring Plans of the North Coast Region*).

Data gaps exist throughout the North Coast Region. Although numerous assessment efforts, such as the

North Coast Watershed Assessment Program (NCWAP) and individual watershed assessments have been conducted, and the SWRCB, DWR, and NCRWQCB conduct monitoring on several waterways, most of the watersheds, rivers, and streams in the region have not been adequately assessed or monitored using standardized, scientifically accepted protocol. It is a goal of the NCRP to further identify these watersheds, rivers and streams and to prioritize them for future assessment and monitoring programs. Key monitoring programs with applications to NCRP project and process evaluation are briefly described below with other important and relevant programs described in (*see Appendix N, Table 68, Monitoring Protocols for NCRP Evaluation*).

4.4.1.1 DEPARTMENT OF WATER RESOURCES

- **California Statewide Groundwater Elevation Monitoring (CASGEM)**
  This program was established in 2009 to track seasonal and long-term groundwater elevation trends in groundwater basins throughout the state. Its mission is to establish a permanent, locally-managed program of regular and systematic monitoring in all of California's alluvial groundwater basins.
- **Proposition 1 Monitoring and Maintenance Reporting**
  These project-specific templates encompass post project monitoring and maintenance and post project performance. Primary and secondary benefits of the project must be identified and then monitored using quantitative metrics. Performance measures and success/failure criteria are also required. The monitoring and maintenance plan template also require frequency and duration of monitoring and reporting, frequency and duration of maintenance activities, responsible party, and adaptive management strategies for when problems are encountered.

4.4.1.2 STATE WATER RESOURCES CONTROL BOARD

- **Surface Water Ambient Monitoring Program (SWAMP)**
  Trends in surface water quality and habitat, the effectiveness of control strategies, TMDL implementation, and nonpoint source pollution are monitored as part of the statewide Surface Water Ambient Monitoring Program (SWAMP), which is administered by the SWRCB. The goals of the program include statewide monitoring that is consistent and systematically applied through the development of data quality assurance protocols and centralized data management. SWAMP data are housed on the California Environmental Data Exchange Network (CEDEN).. Other surface water monitoring programs that are managed as part of the SWAMP program include Bioaccumulation Monitoring Program, Bioassessment Program, Freshwater CyanoHABs Program, and Stream Pollution Trends Monitoring Program. The SWAMP monitoring approach utilized by the NCRWQCB incorporates both long-term trend monitoring at permanent monitoring stations and rotating site-specific monitoring closely related to the TMDL development and implementation schedule (NCRWQCB 2013). The regional board also commissions water quality studies periodically, such as the 2018 Russian River Watershed Monitoring of Constituents of Emerging Concern (CECs).

  The permanent monitoring stations established by the NCRWQCB includes sites located along the Smith, Klamath, Scott, Shasta, Trinity, Mad, Eel, Gualala and Russian Rivers and Redwood Creek (NCRWQCB 2013). These sites record core metrics that will be used for long-term water quality trend detection; they are sampled at the same frequency and time each year. Selection of these indicators is based on scientific, practical and programmatic objectives and the amount of available funding. The goal is to provide a broad, accurate view of water quality and watershed health in the region. The permanent stations' data will be applicable for trend analysis as well as testing yearly or seasonal differences at station locations, among different reaches in a given watershed, and between watersheds.

  Site-specific monitoring in the North Coast Region rotates among the NCRWQCB designated WMA on a planned schedule to support remedial actions, develop TMDLs and collect information towards the potential listing or delisting of waterbodies under the Clean Water Act Section 303(d). Water quality parameters measured in each basin are based on specific watershed characteristics and water quality objectives identified in the individual WMA sections in the NCRWQCB Watershed Planning Chapter (NCRWQCB 2013).
- **Clean Water Team Citizen Monitoring Program**
  Through a partnership with many local Resource Conservation Districts, the SWRCB is actively promoting volunteer monitoring among landowners, farmers, ranchers, and community members through SWAMP. The "Clean Water Team Citizen Monitoring Program" is a statewide program developed by the SWRCB Nonpoint Source Pollution Control Program to offer suggestions, guidelines and protocols for volunteer monitoring efforts. This

program is increasingly being incorporated into the SWAMP monitoring program to complete site-specific monitoring in the North Coast Region.

- **National Pollutant Discharge Elimination System** The National Pollutant Discharge Elimination System (NPDES) program is a federal program that is currently administered by the SWRCB to regulate wastewater discharge to surface waters, stormwater drains and groundwater. All wastewater discharges in the North Coast Region are regulated through NPDES permitting which requires self-monitoring of relevant water quality data to be submitted to the NCRWQCB for compliance evaluation in accordance to the "Waste Discharge Requirement, General Monitoring and Reporting Program" (SWRCB 1997).

4.4.1.3 CALIFORNIA DEPARTMENT OF FISH & WILDLIFE

- **Survey and Monitoring Protocols and Guidelines** The CDFW provides a web page containing protocols and guidelines from various sources that have been tested and reviewed and are considered to be appropriate for their intended purposes. In some cases, the protocols and guidelines represent what the Department believes to be the best available methodology for the intended purpose. Protocols and guidelines are grouped by subject: plants, invertebrates, amphibians, reptiles, birds, mammals, and monitoring.

4.4.1.4 CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION

- **Fire and Resource Assessment Program** The California Department of Forestry and Fire Protection's Fire and Resource Assesment Program (FRAP) assesses the amount and extent of Calfornia's forests and rangelands, analyzes their conditions and identifies alternative management and policy guidelines. The FRAP website provides data on California's forests and rangelands through a variety of mapping tools and assessment reports.

4.4.1.5 CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

- **Marine Biotoxin Monitoring Program** The Environmental Management Branch of the CDPH manages the Marine Biotoxin Monitoring Program for bivalve shellfish. California has the longest-standing biotoxin monitoring program in the U.S., beginning in 1927 in response to a massive paralytic shellfish poisoning (PSP) episode that resulted in several deaths and over 100 illnesses. Because PSP and domoic acid toxicity represents a serious ongoing public health threat, the CDPH has implemented a prevention program that consists of coastal phytoplankton, coastal shellfish, and commercial shellfish monitoring programs.

4.4.1.6 INTERAGENCY PROGRAMS

- **Groundwater Ambient Monitoring and Assessment** The Groundwater Ambient Monitoring and Assessment (GAMA) Program is California's comprehensive groundwater quality monitoring program that was created by the State Water Resources Control Board (State Water Board) in 2000. It was later expanded by Assembly Bill 599 — the Groundwater Quality Monitoring Act of 2001. AB 599 required the State Water Board, in coordination with an Interagency Task Force (ITF) and Public Advisory Committee (PAC) to integrate existing monitoring programs and design new program elements as necessary, resulting in a publicly accepted plan to monitor and assess groundwater quality in basins that account for 95% of the state's groundwater use. The GAMA Program is based on interagency collaboration with the State and Regional Water Boards, Department of Water Resources, Department of Pesticide Regulations, U.S. Geological Survey, and Lawrence Livermore National Laboratory, and cooperation with local water agencies and well owners. The GAMA website contains an online mapping tool that integrates and displays groundwater quality data from multiple sources on an interactive Google-based map interface.
- **Pacific Northwest Aquatic Monitoring Partnership** The stated purpose of the Pacific Northwest Aquatic Monitoring Partnership (PNAMP) is to provide a forum for coordinating state, federal, and Tribal aquatic habitat and salmonid monitoring programs. The intent of the partnership is to improve communication, share resources and data, and use compatible monitoring protocols to increase scientific credibility and provide greater accountability to local stakeholders. The PNAMP provides a monitoring resources website, which is a network of information and tools to support many facets of monitoring including a community forum, a place to document methods, the ability to describe projects and upload monitoring locations, and tools for creating sample designs.

4.4.2 MONITORING & EVALUATION APPROACH

NCRP staff work with project proponents and responsible parties to develop simple monitoring plans to track project progress toward project-specific goals according to DWR contract guidelines and reporting templates. The NCRP website and Appendix N, Table 68 "Monitoring Protocols for NCRP Evaluation" provide a comprehensive listing of monitoring protocols for NCRP project evaluation and provides links to websites that contain the most relevant and useful (to state data integration efforts) monitoring protocols for NCRP implementation projects. Most of the SWAMP, GAMA, and/or CEDEN comparable and compatible monitoring protocols listed have been used in NCRP projects.

The NCRP approach to monitoring, evaluation, and adaptive management and improvements ensures that:

- The NCRP is making progress toward Plan Objectives using measurable indicator metrics
- The NCRP is implementing projects listed in the NCRP Plan
- Each implementation project complies with applicable rules, laws, and permit requirements
- Implementation projects demonstrate a commitment to long-term monitoring and assessment of climate change adaptability in management options

NCRP Plan performance is directly related to implementation project performance. To measure how closely the NCRP is meeting its stated objectives, the success of the individual projects in achieving their specific project goals must be evaluated.

For example, consider NCRP Objective 6: "Enhance salmonid populations by conserving, enhancing, and restoring required habitats and watershed processes." The progress that the NCRP make toward this objective can be evaluated by tallying the number of projects that, when implemented, will contribute towards this goal. How well the objective is being met is measured by summing the separate NCRP performance measures. The NCRP has achieved Objective 6 by improving 153 miles of fish passage for fish populations and reducing the amount of sediment input into salmonid bearing streams by stabilizing 6,405,991 yd3 of potential upslope sediment. Thus, overall NCRP performance becomes a measure of the cumulative success of the implementation projects portfolio.

The indicator data collected by project proponents as part of project monitoring, and by the NCRP as part of Plan update/evaluation/adaptive management is used to systematically and objectively evaluate success. The indicator data types are a subset of, and fully compatible with, the measures used to conduct the formal project impact/benefits analysis. In addition to ecological and social indicators, the NCRP has developed a suite of economic indicators including the valuation in dollars of natural capital and working landscapes. Data are monitored via protocols established by and compatible with existing statewide systems (*see Appendix N, Table 68, Monitoring Protocols for NCRP Evaluation*).

4.4.2.1 INDICATOR METRICS FOR PERFORMANCE EVALUATION

Both the NCRP and its projects are evaluated by monitoring a suite of measurable (qualitative or quantitative) indicator data metrics that are directly associated with each objective, and comparing the results to baseline, benchmark, or desired conditions. A listing of indicators recommended for the NCRP and projects is presented below. The preliminary framework for using indicator data to calculate project and Plan performance is provided in the table below.

TABLE 14. INDICATORS TO MEASURE NCRP PROCESS AND PROJECT SUCCESS

	PROCESS SUCCESS MEASURES			PROJECT SUCCESS MEASURES	
GOAL #	NCRP OBJECTIVE	QUALITATIVE INDICATOR(S)	QUANTITATIVE INDICATOR(S)	PROJECT-LEVEL PRIORITY (example)	PROJECT-LEVEL INDICATOR METRIC (example)
1	**Objective 1** — Respect local autonomy and local knowledge in Plan and project development and implementation	Inclusion of projects that meet goals stated in local plans.	Number of NCRP projects that meet goals stated in local plans.	NA (Plan-level priority and indicator)	
1	**Objective 2** — Provide an ongoing framework for inclusive, efficient intraregional cooperation and effective, accountable NCRP project implementation	1. Publicly noticed, publicly held meetings that provide opportunity for public participation; 2. Inclusion of and opportunity for public input in planning and project prioritization process.	Number of publicly noticed, publicly held meetings that provide opportunity for public participation.	NA (Plan-level priority and indicator)	
1	**Objective 3** — Integrate Traditional Ecological Knowledge in collaboration with Tribes to incorporate these practices into North Coast Projects and Plans	1. Inclusion of TEK criteria in project evaluation process 2. Inclusion of TEK considerations of NCRP plans and documents	1. Number of NCRP plans/ documents including and recognizing TEK principles/ priorities	1. Prioritized projects recognizing TEK principles and incorporating into implementation	1. Number of projects that include TEK principles/ priorities in project implementation and recognize them as TEK
2	**Objective 4** — Ensure that economically disadvantaged communities are supported and that project implementation enhances the economic vitality of disadvantaged communities by improving built and natural infrastructure systems and promoting adequate housing	Inclusion of DAC considerations in project prioritization process.	Number of projects implemented in DACs	Economic Benefits	1. Number of jobs created/ maintained through project implementation in DACs 2. Economic analysis of benefits provided by project implementation in DACs (e.g., $80 per acre-foot per year for environmental purposes) (Brown 2007)
2	**Objective 5** — Conserve and improve the economic benefits of North Coast Region working landscapes and natural areas	Inclusion of projects that benefit working landscapes and natural areas.	Number of projects that benefit working landscapes and natural areas.	Economic Benefits	1. Number of jobs created/ maintained through project implementation in working landscapes and natural areas 2. Economic analysis of benefits provided by project implementation in working landscapes and natural areas (e.g., $80 per acre-foot per year for increased instream flow for environmental purposes) (Brown 2007)
3	**Objective 6** — Conserve, enhance, and restore watersheds and aquatic ecosystems, including functions, habitats, and elements that support biological diversity	Inclusion of projects that conserve, enhance, and restore watersheds and aquatic ecosystems and ecosystem function.	Number of projects that conserve, enhance, and restore watersheds and aquatic ecosystems and ecosystem function.	Watershed/ Habitat Improvement	1. % survival of seedlings planted 2. Number of acres of revegetation 3. Number of acres of invasive species removed 4. Number of acres of permanent seasonal wetland 5. Number of linear feet of streambank stabilized
3	**Objective 7** — Enhance salmonid populations by conserving, enhancing, and restoring required habitats and watershed processes	Inclusion of projects that conserve, enhance, and restore salmonid habitat and watershed processes that support salmonids.	Number of projects that conserve, enhance, and restore salmonid habitat and watershed processes that support salmonids.	Salmonid Habitat Improvement	1. Number of river miles made accessible for potential rearing habitat 2. Habitat inventory (i.e. instream features – pools, riffles etc., large woody debris, substrate) 2a. Thalweg surveys to determine pool depth and frequency and channel degradation 2b. Cross-sectional surveys to determine thalweg degradation and bank stability 2c. D50 (gravel diameter) surveys to determine coarsening of spawning gravels 3. Percent canopy closure 4. Spawning surveys, snorkel surveys 5. % reduction in fisheries closures

GOAL #	PROCESS SUCCESS MEASURES			PROJECT SUCCESS MEASURES	
	NCRP OBJECTIVE	**QUALITATIVE INDICATOR(S)**	**QUANTITATIVE INDICATOR(S)**	**PROJECT-LEVEL PRIORITY (example)**	**PROJECT-LEVEL INDICATOR METRIC (example)**
4	**Objective 8** — Ensure water supply reliability and quality for municipal, domestic, agricultural, Tribal, and recreational uses while minimizing impacts to sensitive resources	NA	Number of projects that provide water supply reliability or improve water quality for municipal, domestic, agricultural, cultural, or recreational uses; number of projects that provide the above benefits to Tribal communities.	Water Quality Improvement	1. % reduction in sanitary sewer overflows 2. Percentage of volume of wastewater discharge that meets state water quality standards 3. Water quality monitoring: DO, temperature, contaminants, etc. 4. Post-treatment erosion cavity measurements (per DFW Salmonid Habitat Restoration Manual, Part X: Upslope Assessment and Restoration Practices) 5. % reduction in beach closures due to pathogen contamination 6. Number of Low Impact Development techniques/ practices implemented 7. Number of projects implemented that provide water supply or water quality benefits to Tribal communities with respect to municipal, domestic, agricultural, cultural, or recreational uses or other uses deemed beneficial and necessary to their community by the Tribe.
4	**Objective 9** — Improve drinking water quality and water related infrastructure to protect public health, with a focus on economically disadvantaged communities	NA	1. Number of drinking water quality and water related infrastructure projects; 2. Number of drinking water quality and water related infrastructure projects implemented in economically disadvantaged communities.	Water Supply Reliability	1. Stream flow measurements 2. Amount of water supplied by alternatives – such as offstream storage or recycled tailwater or wastewater 3. Reduction in system water losses 4. Number of new or improved drinking water connections 5. % of time that drinking water meets or exceeds federal and state drinking water quality requirements
4	Objective 10 — Protect groundwater resources from over-drafting and contamination	NA	Number of projects that provide alternative sources of water to groundwater use and/ or reduce groundwater contamination.	Drinking Water Improvement	1. Percent reduction of percolation from oxidation ponds to groundwater 2. Trends in groundwater quality 3. Trends in groundwater elevation
5	**Objective 11** — Address climate change effects, impacts, vulnerabilities, including droughts, fires, floods, and sea level rise. Develop adaptation strategies for local and regional sectors to improve air and water quality and promote public health	NA	Number of projects (implemented by NCRP or project proponents) that assess climate change effects, impacts, vulnerabilities, and strategies for local and regional sectors.	Water Supply Reliability	1. Number of projects that add rainwater catchment or rainy season diversion holding tanks 2. Number of projects that increase infiltration or restore wetlands or floodplain hydrology
5	**Objective 12** — Promote local energy independence, water/ energy use efficiency, GHG emission reduction, and jobs creation	NA	Number of projects (implemented by NCRP or project proponents) that promote local energy independence, water/ energy use efficiency, GHG emission reduction, and jobs creation.	Energy Independence	1. Amount of energy generated using green technology 2. Amount of energy saved through water/ energy use efficiencies 3. Percentage reduction in GHG emissions 4. Number of jobs created/ maintained through project implementation

GOAL #	PROCESS SUCCESS MEASURES			PROJECT SUCCESS MEASURES	
	NCRP OBJECTIVE	QUALITATIVE INDICATOR(S)	QUANTITATIVE INDICATOR(S)	PROJECT-LEVEL PRIORITY (example)	PROJECT-LEVEL INDICATOR METRIC (example)
6	**Objective 13** — Improve flood protection, forest and community resiliency to reduce the public safety impacts associated with floods and wildfires	NA	Number of projects included in NCRP Plan implementation that improve flood protection and reduce flood risk. Number of projects in NCRP Plan implementation that improve forest health and reduce vulnerability to wildfires	Public Safety	1. Percent reduction in flood events given historic rainfall patterns 2. Percent reduction in damage caused by wildfires to built infrastructure given historic wildfire patterns and predicted wildfire occurrence 3. Percent reduction in catastrophic, canopy-level wildfires in areas where prescribed fire or other fuel reduction has occurred compared to "control" areas where projects have not been implemented

4.4.2.2 PLAN-LEVEL PERFORMANCE EVALUATION

The evaluation of the Plan as a whole is based on measurable achievement of NCRP Goals and Objectives and the overall success to the NCRP projects toward meeting the Goals and Objectives.

PLAN-LEVEL PERFORMANCE: NCRP GOALS & OBJECTIVES

The NCRP goals and objectives form the foundation for development, implementation, evaluation, and adaptive management of the Plan and its projects. Below is a listing of each goal, associated objectives, and measurable "indicators" for each objective that will be monitored to ensure success of the NCRP Plan and its projects. A suite of 24 indicators have been developed for the preliminary evaluation process. Indicators may be either qualitative (descriptive) or quantitative (numeric) metrics.

Of increasing importance are Objectives 11 – 14, which address assessing impacts of predicted climate conditions and efforts to prepare for and adapt to those conditions. As part of its adaptive management approach to plan review, the project prioritization process, and planning methods, the NCRP will put emphasis on these Objectives and how well they are met as well as actively seeking and implementing new, relevant climate change information, predictive tools, and methods of mitigating and adapting to climate impacts as they materialize.

Goal 1: Intraregional Cooperation & Adaptive Management

Objective 1 — Respect local autonomy and local knowledge in Plan and project development and implementation.

1. Inclusion of projects that meet goals included in local plans (qualitative)
2. Number of projects in NCRP that meet goals included in local plans (quantitative)

These two indicators help determine the degree to which the NCRP is achieving Objective 1; if NCRP projects meet local goals, there is respect for those goals and the local knowledge used to develop them. Additionally, during the application process, project proponents can be asked to name the local plans and the goals within them that project implementation will meet, allowing the TPRC and PRP to quantitatively include this Objective in the project evaluation process and allowing NCRP staff a relatively easy way to quantitatively measure this indicator.

Objective 2 — Provide an ongoing framework for inclusive, efficient intraregional cooperation and effective, accountable NCRP project implementation.

1. Publicly noticed, publicly held meetings that provide opportunity for public participation (qualitative)
2. Inclusion of and opportunity for public input in planning and project prioritization process (qualitative)
3. Number of publicly noticed, publicly held meetings that provide opportunity for public participation (quantitative)

These three indicators help determine the degree to which the NCRP is achieving Objective 2; if public meetings are held and public input solicited and considered during Plan/ policy formation and the project prioritization process, then the framework is providing for inclusive cooperation and effective, accountable project implementation.

Objective 3 — Integrate Traditional Ecological Knowledge in collaboration with Tribes to incorporate these practices into North Coast Projects and Plans

1. Inclusion of TEK principles/ priorities in project selection criteria (qualitative – presence of

TEK principles/ priorities in project selection criteria; quantitative – number of criteria, number of projects meeting criteria)

2. Inclusion of TEK principles/ priorities in NCRP Plans and documents after 2019 (quantitative)

Goal 2: Economic Vitality

Objective 4 — Ensure that economically disadvantaged communities are supported and that project implementation enhances the economic vitality of disadvantaged communities by improving built and natural infrastructure systems and promoting adequate housing.

1. Inclusion of DAC considerations in project prioritization process (qualitative)
2. Number of projects implemented in DACs (quantitative)
3. Number of jobs created/ maintained through project implementation (quantitative)

These three indicators help determine the degree to which the NCRP is achieving measurable support for, and some of the economic benefits realized by, DACs through the NCRP planning process.

Objective 5 — Conserve and improve the economic benefits of North Coast Region working landscapes and natural areas.

1. Inclusion of projects that benefit working landscapes and natural areas (qualitative)
2. Number of projects that benefit working landscapes and natural areas (quantitative)

These two indicators help determine the degree to which the NCRP is achieving Objective 4 through prioritization of projects that improve working landscapes and natural areas, which indirectly provide economic benefits for these areas.

Goal 3: Ecosystem Conservation & Enhancement

Objective 6 – Conserve, enhance, and restore watersheds and aquatic ecosystems, including functions, habitats, and elements that support biological diversity

1. Inclusion of projects that conserve, enhance, and restore watersheds and aquatic ecosystems and ecosystem function (qualitative)
2. Number of projects that conserve, enhance, and restore watersheds and aquatic ecosystems and ecosystem function (quantitative)

These two indicators help determine the degree to which the NCRP is achieving Objective 5 through prioritization and inclusion of projects that conserve, enhance, and restore watersheds and aquatic ecosystems and ecosystem function.

Objective 7 — Enhance salmonid populations by conserving, enhancing, and restoring required habitats and watershed processes.

1. Inclusion of projects that conserve, enhance, and restore salmonid habitat and watershed processes that support salmonids (qualitative)
2. Number of projects that conserve, enhance, and restore salmonid habitat and watershed processes that support salmonids (quantitative)

These two indicators help determine the degree to which is achieving Objective 6 through efforts to include projects that enhance salmonid population through restoration of ecosystems and ecosystem function.

Goal 4: Beneficial Uses of Water

Objective 8 — Ensure water supply reliability and quality for municipal, domestic, agricultural, Tribal, cultural, and recreational uses while minimizing impacts to sensitive resources.

1. Number of projects that provide water supply reliability or improve water quality for municipal, domestic, agricultural, Tribal, or recreational uses (quantitative)
2. Number of projects that improve water bodies that support the cultural, spiritual, ceremonial, or traditional rights or Lifeways of California Native Tribes, including, but not limited to: navigation, ceremonies, or fishing, gathering, or consumption of natural aquatic resources, including fish, shellfish, vegetation, and materials.

This indicator helps determine the degree to which the NCRP is achieving Objective 7 through inclusion of projects that improve water supply reliability or water quality for multiple beneficial uses. Because of the strict state and federal environmental regulations governing project implementation, minimization of impacts to sensitive resources is inherent in CEQA/NEPA compliant project implementation.

Objective 9 — Improve drinking water quality and water related infrastructure to protect public health, with a focus on economically disadvantaged communities.

1. Number of drinking water quality and water related infrastructure projects (quantitative)
2. Number of drinking water quality and water related infrastructure projects implemented in DACs (quantitative)

These two indicators help determine the degree to which the NCRP is achieving Objective 8 through inclusion of projects that are focused on improving drinking water quality and water-related infrastructure, particularly when those projects occur in DACs.

Objective 10 — Protect groundwater resources from over-drafting and contamination.

1. Number of projects that provide alternative sources of water to groundwater use and/ or reduce groundwater contamination (quantitative)

This indicator helps determine the degree to which the NCRP is achieving Objective 9 through inclusion of projects focused on groundwater supply and quality protection.

Goal 5: Climate Adaptation & Energy Independence

Objective 11 — Address climate change effects, impacts, and vulnerabilities, including droughts, fires, floods, and sea level rise. Develop adaptation strategies for local and regional sectors to improve air and water quality and promote public health and safety.

1. Number of projects (implemented by NCRP or project proponents) that assess climate change effects, impacts, vulnerabilities, and strategies for local and regional sectors (quantitative)
2. Number of projects that incorporate strategies for anticipated changes in precipitation amounts and intensity (quantitative)
3. Number of projects that incorporate strategies that address anticipated drought conditions, extreme flooding events, or other climate change challenges

These indicators help determine the degree to which the NCRP is achieving Objective 11 by pursuing or including in the NCRP projects that assess climate change effects, impacts, vulnerabilities and strategies.

Objective 12 — Promote local energy independence, water/ energy use efficiency, GHG emission reduction, carbon sequestration, and jobs creation.

1. Number of projects (implemented by NCRP or project sponsors) that promote local energy independence, water/ energy use efficiency, GHG emission reduction, carbon sequestration, and jobs creation (quantitative)

This indicator helps determine the degree to which the NCRP is achieving Objective 11 by pursuing or including in the NCRP projects that promote local energy independence, water/ energy use efficiency, GHG emission reduction, and jobs creation.

Goal 6: Public Safety

Objective 13 — Improve flood protection, forest and community resiliency to reduce the public safety impacts associated with floods and wildfires

1. Number of projects included in the NCRP Plan that improve flood protection and reduce flood risk (quantitative)
2. Number of projects included in the NCRP Plan that improve forest health and reduce risk of catastrophic wildfires

This indicator helps determine the degree to which the NCRP is achieving Objective 12 through inclusion of flood protection and forest health and wildfire reduction projects in the NCRP Plan.

PLAN-LEVEL PERFORMANCE: NCRP PROJECT SUCCESS

The level of project success bears directly on determination of NCRP Plan performance as all projects are required to align with the NCRP objectives. If all projects meet their stated goals (e.g. as evidenced by results of indicator monitoring) then NCRP Plan performance can be considered "excellent." However, if only a percentage of goals are met, then NCRP Plan performance may be less than excellent and requires intervention. The NCRP proposes the use of the following standard Plan performance benchmarks to define "performance" level:

- If 92 – 100 percent of project goals are met = EXCELLENT
- If 85 – 92 percent of project goals are met = GOOD
- If 75 – 84 percent of project goals are met is = FAIR
- If 74 percent or fewer of project goals are met = POOR

Should the NCRP earn a Plan Performance rating of less than 85% project-level goals met, project selection criteria will be re-evaluated to ensure that projects are of sufficient technical capacity to meet their stated goals. Plan Performance is closely related to project-level performance, which is detailed below.

4.4.2.3 PROJECT-LEVEL PERFORMANCE EVALUATION

The evaluation of the individual prioritized projects that implement the NCRP Plan is based on progress toward stated goals of each project application and each project's monitoring plan (project-specific, including by whom, by what methods, and when). Project proponents have primary responsibility for development of project-specific monitoring plans. Project-specific monitoring plans will conform to SWAMP and other state requirements mentioned below. They will include, but not be limited to, the following elements:

- Project complies with all applicable rules, laws, and permit requirements
- Clear, concise description of what is being monitored for each project
- Measures to remedy or react to problems encountered during monitoring
- Location of monitoring
- Monitoring frequency
- Monitoring protocols/ methodologies, including who will perform the monitoring
- DMS or procedures to track monitoring data
- Procedures to ensure the monitoring schedule is maintained and adequate resources are available to maintain monitoring through scheduled lifetime.

The eight NCRP project-level priorities and examples of specific indicators of success toward these priorities are outlined below. The project priorities have been organized around the following: drinking water improvement, economic benefits, energy independence, groundwater protection, public safety, salmonid habitat improvement, watershed/habitat improvement, and water quality improvement. The specific indicator data types and metrics vary for projects, as applicable.

Drinking Water Improvement

- Project complies with all applicable rules, laws, and permit requirements
- Stream flow measurements
- Amount of water supplied by alternatives such as offstream storage or recycled tailwater or wastewater
- Reduction in system water losses
- Number of new or improved drinking water connections
- Percent of time that drinking water meets or exceeds federal and state drinking water quality requirements

Economic Benefits

- Number of jobs created/ maintained through project implementation in working landscapes and natural areas
- Economic analysis of benefits provided by project implementation in working landscapes and natural areas (e.g. $80 per acre-foot per year for increased instream flow for environmental purposes; Brown 2007)

Energy Independence

- Project complies with all applicable rules, laws, and permit requirements
- Amount of energy generated using green technology
- Amount of energy saved through water/energy use efficiencies
- Percentage reduction in GHG emissions
- Number of jobs created/maintained through project implementation

Groundwater Protection

- Project complies with all applicable rules, laws, and permit requirements
- Percent reduction of percolation from oxidation ponds to groundwater
- Analyze samples drawn from monitoring wells for groundwater contamination

Public Safety

- Project complies with all applicable rules, laws, and permit requirements
- Percent reduction in flood events given historic and projected rainfall patterns
- Percent reduction in severity/duration of flood events given historic and projected rainfall patterns
- Amount of fire-fighting water supply newly available
- Number of new fire hydrants

Salmonid Habitat Improvement

- Project complies with all applicable rules, laws, and permit requirements
- Number of river miles made accessible for potential rearing habitat
- Habitat inventory (i.e. instream features such as pools, riffles etc., large woody debris, substrate)

  - » Thalweg surveys to determine pool depth and frequency and channel degradation
  - » Cross-sectional surveys to determine thalweg degradation and bank stability
  - » D50 (gravel size) surveys to determine coarsening of spawning gravels
  - » Percent canopy closure
  - » Spawning surveys, snorkel surveys
  - » Percent reduction in fisheries closures

Watershed/Habitat Improvement

- Project complies with all applicable rules, laws, and permit requirements
- Percent survival of seedlings planted
- Number of acres of revegetation
- Number of acres of invasive species removed
- Number of acres of permanent seasonal wetland
- Number of linear feet of streambank stabilized
- Amount of sediment prevented from entering surface water

Water Quality Improvement

- Project complies with all applicable rules, laws, and permit requirements
- Percent reduction in sanitary sewer overflows
- Percentage of volume of wastewater discharge that meets state water quality standards
- Water quality monitoring: DO, temperature, contaminants, etc.
- Post-treatment erosion cavity measurements
- Percent reduction in beach closures due to pathogen contamination
- Number of Low Impact Development techniques/ practices implemented

4.4.2.4 INSTITUTIONAL-LEVEL PERFORMANCE EVALUATION

Evaluation of institutional-level performance occurs on an ongoing basis and is based on the efficacy of the NCRP in conducting the processes it utilizes to engage stakeholders and achieve process transparency, inclusion, local autonomy, jurisdictional authority, adaptive management, and integration. Indicators for the two objectives of Goal 1 "Intraregional Cooperation and Adaptive Management" are related to determining success of the NCRP, and include provision of ample outreach and input, and judicious selection of implementation projects that propose to meet NCRP goals.

4.4.2.5 DATA MANAGEMENT & INFORMATION SHARING

The NCRP regularly collects and analyzes data and scientific information related to built, natural and human capital. This information is evaluated by NCRP staff and the Technical Peer Review Committee, and used to inform planning, decision making and project prioritization. The NCRP also places a strong emphasis on sharing data with partners and the community makes data available to the pubic via NCRP website sections:

- The Region: informational story maps, animations and interactive climate change maps
- Planning: project and policy planning tools, small community toolbox, monitoring resources and protocols
- Resources: assessments, analysis and expert reports
- Data: interactive data map and downloadable geospatial data to assess landscape and human factors impacting ecological and social health in the North Coast region

The Data Management Plan for the North Coast Region was developed as part of a process intended to result in more efficient, effective, standardized data acquisition, input, analysis, and dissemination throughout the Region. The over-arching goal for the NCRP Data Management Plan is a streamlined and easy to use framework that is fully compatible with ongoing and newly-emerging state systems that will objectively assess and improve, through an adaptive management process, the performance of the NCRP Plan, its implementation projects, and other regional water management activities.

Limited economic resources in the North Coast Region encourage efficiencies in accomplishing common goals and objectives. Sharing data and successful technology, and developing replicable materials and programs for region-wide dissemination are proven models for effective implementation of the NCRP. Using the NCRP's cooperative, regional association and infrastructure, the NCRP identifies best practices underway throughout the Region, analyzes results achieved based on their success, and develops demonstration models and corresponding metrics and materials to replicate and distribute proven and tested programs. This approach provides rural North Coast communities with an established framework and the organizational capacity to ensure that those entities that desire these tools, methods, policies, and planning models have access to them through the NCRP and NCRP Plan. It also generates large amounts of data.

4.4.2.6 IDENTIFYING & ADDRESSING DATA GAPS

The NCRP regularly develops science-based assessments and plans that fill data gaps in the region and reflect the shared goals, objectives, strategies and priorities for the North Coast Region. Supported by a Strategic Growth Council Sustainable Communities grant, the NCRP significantly enhanced the climate change data informing its planning and implementation framework. The NCRP released a number of technical reports and assessments that formed the basis of key guidance and planning documents. Technical reports, assessments and strategy plan can be found on the North Coast Integrated Regional Planning — Healthy Communities, Functional Watersheds and Viable Economies webpage. Geospatial data from these assessments have been made available for download via the NCRP website as ESRI map packages (see https://northcoastresourcepartnership.org/data/).

Data Gaps Identified by the North Coast Data Management Plan

Indicator Categories:

- Landscape Condition: composition, connectivity, land use
- Biotic Condition: ecosystem/community measures, species and population measures,
- Organism Condition: Individual organism measures
- Chemical and Physical Characteristics: water and soil concentrations of nutrients, inorganic/organic chemicals
- Hydrology and Geomorphology: surface/groundwater flow, dynamic structural characteristics, material transport/distribution

The degree of data paucity varies for these data categories: for example, data for chemical and physical characteristics of water are relatively abundant, current, and available (more so for surface than groundwaters). So too are data on biotic condition: data for condition of populations and communities are more readily available than for individuals. Biotic data primarily relate to salmonids, but increasingly relate to bio-indicators like benthic macroinvertebrates (prey for fishes) and algae blooms. Data gaps become apparent, however, in the realms of surface/groundwater interactions, water use and supply, and climate uncertainty.

Data Gaps Identified by Synthesis of North Coast Water/Land Use Plans

While there is a substantial amount of planning and watershed information available for the North Coast, the region lacks complete coverage. Many very thorough watershed-specific assessments have been conducted; however, the entire region can benefit from additional and enhanced existing conditions reports and analyses. In general, coastal and populated areas contain more plans and programs than sparsely populated and inland areas. Locations or subjects around which there is controversy, for example the Klamath basin or the Potter Valley diversion of water from the Eel to the Russian River, typically generate a greater number of studies and planning documents than less contentious areas.

On the coast, detailed watershed assessments by the CDFG Coastal Watershed Planning and Assessment Program are lacking for Alder Creek, Bear River, Brush Creek, Elk Creek, Freshwater Creek, Garcia River, Greenwood Creek, Gualala River, Mattole River, Salt River, Scott River, Shasta River, and South Fork Eel River. In the Klamath WMA, data coverage is weak or lacking for the Middle Klamath, Lower Klamath and Upper Butte and Lost River Hydrologic Units (HUs). In the Humboldt Bay WMA, data coverage is weak or lacking for the Mad River, Redwood Creek, and Trinidad HUs. Data coverage is also weak for parts of the Eel River WMA.

There is a dearth of current information about recent and current conditions such as the 2007 – 2009 or 2012 – 2019 droughts, precipitous salmonid population decline, and economic conditions. Current land and water resource planning documents in the North Coast lack detailed planning information and specific management strategies for coping with extended drought. There is also limited information about climate change, although more effort has been directed toward projected conditions and adaptation measures in recent years. Although general predictions about future climate and weather conditions for the state have been developed, detailed predictions specific to the entire region are lacking. Regional planning documents also lack recent data regarding and proposed strategies for contending with the salmon fisheries collapse. In order to implement adaptive management strategies in response to changing conditions, the most recent salmonid population and habitat monitoring data should be readily available in order for planners and decision makers to act promptly.

4.4.2.7 DEVELOPMENT & MAINTENANCE OF THE DATA MANAGEMENT PLAN (DMP)

The NCRP periodically documents project benefits through the NCRP website, via an Impacts and Outcomes webpage that provides programmatic summary statistics for the region as well as data for individual projects. NCRP implementation projects are analyzed after each funding cycle and the NCRP Project Benefits Summary is updated and posted to the website. This benefits summary is distributed to relevant state agencies. At all times, the NCRP maintains open communication channels with state agencies and serves as a conduit to disseminate information between local and state/federal levels.

The listing below describes the data management responsibilities related to the project and program evaluation.

Data Management and Dissemination Task	Frequency
Responsible Party: Project Sponsor	
Develop Monitoring Plan, determine relevant state agency/ program/portal for environmental monitoring upload	Upon grant award
Compile, maintain, and upload project monitoring information to relevant state agency/program/portal	Quarterly or as dictated by grant agreement
Perform quality assurance and quality control to ensure validity of monitoring data	Ongoing
Provide project interim implementation reports and final project report to Humboldt County	Quarterly or as dictated by grant agreement
Responsible Party: NCRP Staff	
Consolidate and present regional information, including detailed analyses of socioeconomic factors (including economic benefits) related to project implementation as appropriate or required	Upon conclusion of grant cycles or periodically
Develop spatial data layers of project locations and other attributes specific to the North Coast region as appropriate and add to the NCRP website interactive application and for download	Periodically
Obtain and provide spatial data layers of interest for planning efforts in the North Coast and add to the NCRP website interactive application and for download	Periodically
Provide project application data on NCRP website	Periodically
Compile and provide grant application, meeting, conference, and workshop materials online in the NCRP website's resource library	Periodically when appropriate

4.4.2.8 PROJECT PERFORMANCE — QUALITY CONTROL AND BENEFITS

Each project proponent will develop a monitoring plan according to the DWR contract guidelines to track project performance. These plans will describe tools used to monitor project performance (*see Appendix N, Table 68, Monitoring Protocols for NCRP Evaluation*) for monitoring protocols chosen for consistency with State Data Clearinghouses such as GAMA, CASGEM, CEDEN, and SWAMP) so that data collected will conform to statewide requirements for data collection and reporting including units, standardization, and metadata format. The monitoring plans will include QA/QC measures; many of the NCRP recommended monitoring protocols provided in include QA/QC measures. The plans will also set interim targets to track the project's progress toward meeting the benefits claimed and indicate where and which data will be collected and the types of analyses to be used. The plans will also describe and justify monitoring tools and targets and provide a discussion of how monitoring data will be used to measure project performance.

In an effort to avoid duplication of effort and in recognition that most project proponents are disadvantaged communities with limited resources, statewide data will not be collected at the regional level, but instead, as described above, project proponents will be required in their monitoring plans to upload relevant information to statewide databases. In addition, the NCRP will require submission of project-specific metrics as determined from the project application and scope of work. These metrics will be synchronized with other reporting requirements and reported on a regular basis and will document physical benefits for each project as they accrue. Data will be quantitative and will include physical units of measure as provided in detail in. Examples include: acres of habitat restored, tons of sediment prevented from entering stream system, acre-feet of water per year left instream, number of participants in workshops or programs, number of households with access to improved water supply reliability, etc.

4.4.2.9 DATA COLLECTION TECHNIQUES

Data collection techniques are varied to capture the widest range of applicable information. The Preliminary Implementation Project Application will provide a mechanism for including projects on an on-going basis into the NCRP Plan, which allows for continual identification of need in the region. The Preliminary Implementation Project application requests information such as organization, project type, goals and objectives, statewide priorities addressed, funding status, location, and benefits. Project reporting contributes to statewide databases and also provides quantitative information relevant to plan performance, which will be collected on a regular basis as described above. Project reporting includes quantitative benefits information relevant to Plan performance evaluation.

Meeting, conference, workshop, and other events are posted in the Calendar section of the NCRP website and a monthly listing of other funding opportunities is compiled and posted to the NCRP website. Stakeholders are invited to provide information to staff regarding their organization/event and that information is uploaded. Special topics are identified by stakeholders in the Region and once determined to constitute a need by a significant number of stakeholders, a topic is researched by NCRP staff with findings presented to the PRP, which decides upon further action, if any. This process (and the data it generates) is documented during meetings and on special topic web pages as relevant.

4.4.2.10 DATA MANAGEMENT AND DISSEMINATION

The data collected through the methods described above will be compiled and disseminated at several levels and all of the data will be made available on the NCRP website through specific pages, such as the NCRP Projects Page, interactive mapping application or through the North Coast Resources Library. This furthers the

RWMG's efforts to share collected data by providing the information in an easily accessible website and in multiple ways to ensure the information is available for a wide range of uses and to a variety of interested parties.

Project Level

The NCRP website contain the NCRP Project Benefits Summary dedicated to providing benefits information and plan performance measures that highlight achievements in summary statistics and graphic format. Additionally, specific North Coast project location data is made available on the NCRP website interactive data map and project fact sheets and are available at: https://northcoastresourcepartnership.org/projects/ Implementation project videos are available through YouTube links:

- Shasta Water Association & Araujo Dam Restoration projects: http://www.youtube.com/watch?v=6A2I5kF4sjk
- Salt River Ecosystem Restoration Project: http://www.youtube.com/watch?v=D6BoI4peVL4
- Newell Water System Renovation: http://www.youtube.com/watch?v=nKnbtYgvLkk
- Yurok Lower Klamath Restoration: https://www.youtube.com/watch?v=b3T6G_PG-gQ
- Lower Mid-Klamath Habitat Protection Road Decommissioning Implementation Project: https://www.youtube.com/watch?v=XOhLp5cw7Po
- Gualala River Watershed Council: https://www.youtube.com/watch?v=wLndRkL5PhI
- Raw and Recovered Water for Irrigating Public Agencies — Trinity County Waterworks District #1: https://www.youtube.com/watch?v=05v-hfx-gb4
- Forsythe Creek Sediment Reduction Program: https://www.youtube.com/watch?v=NNCzTS8nyDI
- Mid Van Duzen River Ranch Road Sediment Reduction Program: https://www.youtube.com/watch?v=8xV2Bho-8j0
- Sonoma County Water Recycling and Habitat Preservation Project Phase 2A: https://www.youtube.com/watch?v=eYUVw6d5tys

Regional Level

The NCRP website also includes a web portal that houses and makes public plan performance data and analyses, educational materials; and monitoring and assessment protocols and data sources relevant to the North Coast region. Additionally, spatial data is made available through an interactive map application that includes commonly used layers and project specific data for download as a set. The NCRP's entire spatial data catalog consisting of over 300 data layers can be downloaded as map packages, based on the following topics:

- Boundaries and Districts
- Climate Change
- Critical Habitat
- Energy Potential
- Fisheries
- Hazards & Risk
- Hydrology
- Land use & Landcover
- Protected and Public Lands
- Socioeconomic

The website, special handouts, and meetings, workshops, and conferences are used to disseminate data and information on a regional level. The website and the NCRP Plan (available through the website) provide descriptions of the NCRP process, participants, identified needs, and planning and implementation projects, etc. Related materials are provided through the North Coast Resource Library. Additionally, North Coast Plans, Policies and Reports is made available in the NCRP Resource Library and is a comprehensive list of plans and guidance documents and includes municipal plans, climate planning, natural resources and watershed plans and assessments, state agency plans and documents, and relevant federal planning documents, including species recovery plans and salmonid recovery planning. The list is provided as an excel spreadsheet with: links to the document website, a brief summary, and agency author.

NORTH COAST RESOURCE PARTNERSHIP PLAN

Healthy Communities, Functional Ecosystems, & Vibrant Economies

PHASE IV
July 2019

APPENDICES

PUBLIC REVIEW DRAFT

NORTH COAST RESOURCE PARTNERSHIP PLAN

PHASE IV, July 2019
PUBLIC REVIEW DRAFT | APPENDICES

APPENDIX A.
INTEGRATION OF NCRP GOALS & OBJECTIVES

Per state IRWM Guidelines (DWR 2016), Table 1 and Table 2 demonstrate that the NCRP integrates into the Plan and processes the latest NCRP goals and objectives and (1) statewide IRWM priorities and (2) local project priorities[1], respectively. The Phase I/II/III NCRP IRWM Plans includes equivalent tables for the original Plan objectives and projects.

Table 1 Matrix of NCRP Objectives & Statewide IRWM Priorities

NCRP GOALS & OBJECTIVES	STATEWIDE INTEGRATED REGIONAL WATER MANAGEMENT PRIORITY						
	Make Conservation a California Way of Life	Increase Regional Self-Reliance and Integrated Water Management Across All Levels of Government	Protect and Restore Important Ecosystems	Manage and Prepare for Dry Periods	Expand Water Storage Capacity and Improve Groundwater Management	Provide Safe Water for All Communities	Increase Flood Protection
Goal 1: Intraregional Cooperation & Adaptive Management							
Objective 1 — Respect local autonomy and local knowledge in Plan and project development and implementation		•				•	
Objective 2 — Provide an ongoing framework for inclusive, efficient intraregional cooperation and effective, accountable NCRP project implementation		•					
Objective 3 — Integrate Traditional Ecological Knowledge in collaboration with Tribes to incorporate these practices into North Coast Projects and Plans		•	•			•	
Goal 2: Economic Vitality							
Objective 4 — Ensure that economically disadvantaged communities are supported and that project implementation enhances the economic vitality of disadvantaged communities by improving built and natural infrastructure systems and promoting adequate housing	•	•				•	
Objective 5 — Conserve and improve the economic benefits of North Coast Region working landscapes and natural areas		•					
Goal 3: Ecosystem Conservation and Enhancement							
Objective 6 — Conserve, enhance, and restore watersheds and aquatic ecosystems, including functions, habitats, and elements that support biological diversity	•		•		•		
Objective 7 — Enhance salmonid populations by conserving, enhancing, and restoring required habitats and watershed processes			•		•		
Goal 4: Beneficial Uses of Water							
Objective 8 — Ensure water supply reliability and quality for municipal, domestic, agricultural, Tribal, and recreational uses while minimizing impacts to sensitive resources	•	•	•	•	•	•	
Objective 9 — Improve drinking water quality and water related infrastructure to protect public health, with a focus on economically disadvantaged communities		•		•	•	•	
Objective 10 — Protect groundwater resources from over-drafting and contamination	•	•			•	•	
Goal 5: Climate Adaptation & Energy Independence							
Objective 11 — Address climate change effects, impacts, and vulnerabilities, including droughts, fires, floods, and sea level rise. Develop adaptation strategies for local and regional sectors to improve air and water quality and promote public health and safety		•		•	•	•	•
Objective 12 — Promote local energy independence, water/ energy use efficiency, GHG emission reduction, carbon sequestration, and jobs creation		•					
Goal 6: Public Safety							
Objective 13 — Improve flood protection, forest and community resiliency to reduce the public safety impacts associated with floods and wildfires		•					•

1 Note that "project/local priorities" as used in this document are the *project-specific priorities*, as compiled by NCRP staff and project proponents, *of locally-implemented projects, not necessarily of local entities per se*).

Table 2 Matrix of NCRP Objectives & Local Project Priorities

NCRP GOALS & OBJECTIVES	LOCAL PROJECT PRIORITIES							
	Salmonid Habitat Improvement	Watershed and Habitat Improvement	Water Quality Improvement	Water Supply Reliability	Groundwater Protection	Energy Independence	Public Safety	Economic Benefits
Goal 1: Intraregional Cooperation & Adaptive Management								
Objective 1 — Respect local autonomy and local knowledge in Plan and project development and implementation						•	•	•
Objective 2 — Provide an ongoing framework for inclusive, efficient intraregional cooperation and effective, accountable NCRP project implementation						•	•	•
Objective 3 — Integrate Traditional Ecological Knowledge in collaboration with Tribes to incorporate these practices into North Coast Projects and Plans	•	•	•		•			
Goal 2: Economic Vitality								
Objective 4 — Ensure that economically disadvantaged communities are supported and that project implementation enhances the economic vitality of disadvantaged communities by improving built and natural infrastructure systems and promoting adequate housing							•	•
Objective 5 — Conserve and improve the economic benefits of North Coast Region working landscapes and natural areas	•	•	•		•			•
Goal 3: Ecosystem Conservation and Enhancement								
Objective 6 — Conserve, enhance, and restore watersheds and aquatic ecosystems, including functions, habitats, and elements that support biological diversity	•	•	•		•		•	•
Objective 7 — Enhance salmonid populations by conserving, enhancing, and restoring required habitats and watershed processes	•	•	•				•	•
Goal 4: Beneficial Uses of Water								
Objective 8 — Ensure water supply reliability and quality for municipal, domestic, agricultural, Tribal, and recreational uses while minimizing impacts to sensitive resources		•		•	•			•
Objective 9 — Improve drinking water quality and water related infrastructure to protect public health, with a focus on economically disadvantaged communities			•				•	•
Objective 10 — Protect groundwater resources from over-drafting and contamination			•	•	•		•	
Goal 5: Climate Adaptation & Energy Independence								
Objective 11 — Address climate change effects, impacts, and vulnerabilities, including droughts, fires, floods, and sea level rise. Develop adaptation strategies for local and regional sectors to improve air and water quality and promote public health and safety			•	•		•	•	•
Objective 12 — Promote local energy independence, water/ energy use efficiency, GHG emission reduction, carbon sequestration, and jobs creation				•		•	•	•
Goal 6: Public Safety								
Objective 13 — Improve flood protection, forest and community resiliency to reduce the public safety impacts associated with floods and wildfires			•				•	•

Table 3 ARB Scoping Plan Strategies Considered in NCRP Strategy & Goal Development

1.	**Create Inclusive Policies and Broad Support for Clean Technologies**
a.	Continue to engage local organizations and invest in disadvantaged communities to ensure broad access to clean technologies;
b.	Ensure air pollution reductions happen where they are needed the most;
c.	Integrate across programs and agencies to ensure complementary policies provide maximum benefits to disadvantaged communities;
d.	Implement California Energy Commission and CARB recommendations to overcome barriers to clean energy and clean transportation options for low-income residents;
e.	Provide energy-efficient affordable housing near job centers and transit; and
f.	Implement AB 617 to dramatically improve air quality in local communities through targeted action plans.
2.	**Enhance Industrial Efficiency & Competitiveness**
g.	Evaluate and implement policies and measures to continue reducing GHG, criteria, and toxic air contaminant emissions from sources such as refineries;
h.	Improve productivity and strengthen economic competitiveness by further improving energy efficiency and diversifying fuel supplies with low carbon alternatives;
i.	Prioritize procurement of goods that have lower carbon footprints
j.	Support and attract industry that produces goods needed to reduce GHGs; and
k.	Cut energy costs and GHG emissions by quickly transitioning to efficient HFC alternatives

3.	**Prioritize Transportation Sustainability**	
	l.	Connect California's communities with a state-of-the-art high-speed rail system;
	m.	Promote vibrant communities and landscapes through better planning efforts to curb vehicle-miles-traveled and increase walking, biking and transit;
	n.	Build on the State's successful regulatory and incentive-based policies to quickly make clean cars, trucks, buses, and fuels definitive market winners;
	o.	Coordinate agency activities to ensure that emerging automated and connected vehicle technologies reduce emissions; and
	p.	Improve freight and goods movement efficiency and sustainability to enable California's continued economic growth.
4.	**Continue Leading on Clean Energy**	
	q.	Effectively integrate at least 50 percent renewables as the primary source of power in the State through coordinated planning, additional deployments of energy storage, and grid regionalization;
	r.	Utilize distributed resources and engage customers by making net zero energy buildings standard, implement Existing Buildings Energy Efficiency Action Plan to double existing building efficiency, and increase access to energy efficiency, renewable energy, and energy use data; and
	s.	Reduce the use of heating fuels while concurrently making what is used cleaner by minimizing fugitive methane leaks, prioritizing natural gas efficiency and demand reduction, and enabling cost-effective access to renewable gas
5.	**Put Waste Resources to Beneficial Use**	
	t.	Develop and implement programs, including edible food waste recovery, to divert organics from landfills and reduce methane emissions;
	u.	Develop and implement a packaging reduction program; and
	v.	Identify a sustainable funding mechanism to support waste management programs, including infrastructure development to support organics diversion
6.	**Support Resilient Agricultural and Rural Economies and Natural and Working Lands**	
	w.	Protect, enhance and innovate on California's natural and working lands to ensure natural and working lands become a net carbon sink over the long-term;
	x.	Develop and implement the Natural and Working Lands Implementation Plan to maintain these lands as a net carbon sink and avoid at least 15-20 metric tons of GHG emissions by 2030;
	y.	Measure and monitor progress by completing CARB's Natural and Working Lands Inventory and implementing tracking and performance monitoring systems; and
	z.	Unleash opportunity in the agricultural sector by improving manure management, boosting soil health, generating renewable power, electrifying operations, utilizing waste biomass, and increasing water, fertilizer, and energy use efficiency to reduce super pollutants
7.	**Secure California's Water Supplies**	
	aa.	Increase water savings by certifying innovative technologies for water conservation and developing and implementing new conservation targets, updated agricultural water management plans, and long term conservation regulations;
	ab.	Develop a voluntary registry for GHG emissions from energy use associated with water; and
	ac.	Continue to increase the use of renewable energy to operate the State Water Project

APPENDIX B. STAKEHOLDER ENGAGEMENT & INTEGRATION

Table 4 Stakeholders & Participants in NCRP Planning Processes

DATE	TYPE	# PARTICIPANTS	LOCATION	SUBJECT
NORTH COAST RESOURCE PARTNERSHIP / NCRP GOVERNING BODY MEETINGS				
1/20/05	TPRC	25	Eureka	Overview of proposed planning process, communication tools, application process
3/3/05	PRP	26	Fortuna	Chapter 8, Proposition 50 IRWM Grant Program, NCRP Plan outline, Plan Review Process, Grant application submission
4/28/05	PRP & TPRC	27	Eureka	Themes emerging locally and regionally, long-term vision, overview of projects, project review process
6/2/05	TPRC	18	Arcata	Project review & prioritization
6/8/05	PRP & TPRC	25 (3 via video conferencing)	Arcata	Project prioritization
9/7/05	PRP & TPRC	23	Fortuna	NCRP Plan Phase I submittal process, Day in the Capitol, IRWM process and strategies, proposal development and grant writing workshops and technical assistance
4/13/06	PRP	30	Redding	NCRP Plan Timeline, State Process Recap, Planning Grant Update, NCRP Modifications for Step 2 Grant application, potential scenarios for budget reduction
5/11/06	TPRC	15	Redding	Step 2 requirements and scoring criteria, project review and evaluation, PRP recommendations
5/15/06	PRP	19	Redding	State process/workshops update, TPRC update, next steps for TPRC project recommendations and regional application
1/26/07	PRP & TPRC	23	Eureka	IRWM program changes and approach, planning grant update, public outreach, NCRP evaluation process and lessons learned, new opportunities, Phase II discussion
3/22/07	DWR, PRP & TPRC	35	Redding	DWR IRWM efforts, Q&A with DWR, discussion of outcomes of DWR meeting, review of draft alternatives of planning process, future planning approaches
5/17/07	PRP	30	Eureka	Evaluation process report, Phase II Plan, preservation of local autonomy, process and plan for future, tribal representation
4/23/08	PRP & TPRC	28	Redding	North Coast Integration with State Programs, California Water Plan Update, Prop 84 update, DOC Statewide Watershed Program, Sub-committee formation for integrated coastal issues, implementation update, Prop 50, Round Two, Step 2 application update
1/9/09	PRP & TPRC	23	Redding	Statewide Proposition 50 & 84 Stop Work Order, Prop 84 and 1E update, potential funding strategies, protocols for decision making, Regional Sediment Master Plan, RWQCB Basin Plan Amendment: Water Recycling, mechanism for ongoing project identification
6/25/09	PRP & TPRC	25	Eureka	RAP Update; North Coast Energy Independence Initiative updates: stakeholder meetings, webpage, 'white paper', legislative updates, funding opportunities; Project identification; Regional Master Sediment Plan; PRP Decision-making Approach
2/11/10	PRP & TPRC	48	Eureka	Tribal representation; MoMU revision; Prop 50 Supplemental Funding, Prop 84 & 1E updates; North Coast Energy Independence Initiative updates: NCEECBG and NCEIP grant proposals, climate/energy technical advisors; NCRP 2010 workshops & 2011 conference
6/24/10	PRP & TPRC	35	Ukiah	Tribal representation; Prop 50 Supplemental Funding, Prop 84 & 1E updates; North Coast Energy Independence Initiative updates: Biomass planning initiatives, NCEECBG award and NCEIP grant award/update, climate/energy technical advisors; NCRP 2010 workshops & 2011 conference
10/28 & 29/10	TPRC	25	Eureka	Proposition 84 Round 1 requirements and scoring criteria, conflict of interest policy, project review and evaluation, prioritization, PRP recommendations
11/10/10	PRP	24	Eureka	North Coast Energy Independence, MoMU revisions, TPRC project recommendations, nominations 7 elections
7/21/11	PRP & TPRC	38	Weaverville	NCRP Structure, Roles, Responsibilities, Staffing; Project budget under-runs and funding reallocation processes; Future Vision for NCRP: strategy, priorities, next phase of plan; Proposed Process for Updated Project Evaluation and Ranking Process
12/15/11	Sub-committee Meeting	8	conference call	Project Evaluation: Process description, criteria refinement, documentation, conflict of interest
12/19/11	Executive Committee		Willits	SGC Sustainable Communities Planning Grant; Project evaluation review process; Prop 84 Guidelines/PSP Scoping Comments; NCRP January 19th meeting planning, agenda refinement; NCRP roles discussion, leadership planning and regional relationship maintenance; Tribal Outreach; Planning grant project management & DAC grant planning
01/19/12	PRP & TPRC	27	Ukiah	SGC Sustainable Communities Planning Grant and interview input; PRP interview summary: next phase of NCRP Plan; NCRP Project Application, Review and Selection Process; Presentation: Russian River Watershed Association, Update on Draft Phase II MS4 permit
06/11/12	Executive Committee meeting	10	Eureka	Humboldt County Staffing Changes & Updates; NCRP July Meeting, Yreka agenda review; IRWMP general timeline for future funding opportunities; Project Review and Selection Process updates; Conference discussion: themes, location; Orick project funding re-allocation — Humboldt projects; PRP/TPRC membership changes & openings

DATE	TYPE	# PARTICIPANTS	LOCATION	SUBJECT
07/19/12	PRP & TPRC	40	Yreka	Approval of NCRP resolution for Vice-chair Jimmy Smith; Strategic Growth Council Sustainable Communities grant; IRWM Program tentative schedule, funding opportunities & Guideline changes; NCRP Project Application, Review and Selection Process; Support & Technical Assistance to Rural & Small Water and Wastewater Service Providers; NCRP Proposition 84 Planning Grant, Draft outreach strategy, PRP input on staff planning activities, Conference planning; PRP Direction re. website, name, re-branding and logo refinement; presentations: Siskiyou Biomass Utilization Group: It's Mission, Projects and Accomplishments; Modoc County: Sage Steppe Restoration on USFS/BLM Lands and Potential Biomass Solutions; Shasta Valley Resource Conservation District: Araujo and Shasta Water Association Dam Restoration Projects
10/18/12	PRP & TPRC	40	Eureka	NCRP Elections;NCRP Planning Sub-contracts:Proposition 84 Planning Grant & Strategic Growth Council; Tribal Outreach Coordinator RFP; Proposed Process and Criteria for Sub-contracts to counties and Tribes; Formation of ad-hoc committees; Draft NCRP Plan outline; North Coast NCRP Logo and Name; North Coast Resource Partnership Conference; NCRP Project Application, Review and Selection Process; NCRP Plan Proposition 84, Round 2 Project Implementation grant application development
1/3/13	Executive Committee meeting	8	conference call	Planning for NCRP meeting, January 17; New PRP and TPRC members; Tribal Coordinator process & selection
1/17/13	PRP & TPRC	36	Ukiah	NCRP Plan Proposition 84, Round 2 Implementation Priority Project portfolio selection; NCRP Planning Sub-contracts; Proposed Process and Criteria for Sub-contracts to counties and Tribes; Formation of ad-hoc committees: Prop 84 Planning Grant, & SGC Planning Grant; Updates: Tribal Coordinator Consultant selection & process; NCRP Plan, Version 3 Review and Input Process; North Coast Resource Partnership logo; Project Presentation: Joseph Scriven, Mendocino County Resource Conservation District
3/22/13	Executive Committee meeting	8	conference call	North Coast Resource Partnership Plan, Version 3; Planning for NCRP April 19; Review/ refine Draft Process and Criteria for Sub-contracts to Counties and Tribes
4/12/13	Executive Committee meeting	8	conference call	Planning for NCRP April 19; New TPRC member — Sean Curtis, Modoc County; Dis-band Tribal coordinator ad hoc committee
05/19/13	PRP & TPRC	34	Yreka	State Water Resource Control Board presentation; Update on SWRCB priorities; North Coast Resource Partnership Plan, Version 3: Review and Input Process ; NCRP Plan schedule; North Coast partner and stakeholder interviews; Intent of the Plan and IRWM Program requirements; Review changes to the annotated NCRP Plan outline; NCRP Plan, Version 3: Content Development; PRP consideration of recommended approaches for representing diverse views/local autonomy in plan update; Review and provide input: NCRP Goals and Objectives; Tribal Coordinator Update; TPRC Project Review Process De-brief; Consideration of options for prioritization of technical assistance, NCRP DAC Water & Wastewater Service Provider Outreach & Support Program; Project Presentation: Modoc Newell Project; Water Plan Update/ Forum Meeting Update
07/18/13	PRP & TPRC	36	Weaverville	NCRP Plan, Version 3: Review and Input Process; NCRP Plan schedule review; North Coast partner and stakeholder interviews synthesis & discussion; Review changes to the annotated NCRP Plan outline based on Public Input; NCRP Plan, Version 3: Content Development; NCRP Planning Ad hoc Committee Report: proposal selection for planning sub-contracts to counties and Tribes; PRP consideration of recommended approaches for representing diverse views/local autonomy in plan update; Roundtable discussion: NCRP Goals and Objectives; Process for prioritization of technical assistance: NCRP DAC Water & Wastewater Service Provider Support Program; Strategic Planning — Innovative Financing & the Future of the NCRP; Opportunities for innovative financing: upcoming Strategic Growth Council grant; NCRP Conference: discussion and input; Tribal Coordinator Update
05/17/14	PRP & TPRC	39	Yreka	NCRP Governance: PRP Decision Making and Role/Composition of Ad Hoc Committees; PRP Decision Making Process — Policy Clarification; Review composition of existing committees; Sonoma Clean Power presentation — potential applications to the NCRP; North Coast Tribal Engagement Process; Panel presentation and discussion: Improvements to administration and invoicing of IRWM implementation project contracts; IRWM Proposition 84 2014 Drought Solicitation; New legislation and program updates; NCRP Proposition 84 2014 Drought Project Solicitation and Regional Application; NCRP Plan, Version 3: Review Process and Content Development ; NCRP Plan schedule
quarterly	Executive Committee	6–12	conference call or in-person	Plan NCRP quarterly meetings; general governance; NCRP Plan review & discussion
monthly	NCRP planning meetings	5–9	Rohnert Park	NCRP working team meeting
ongoing	meetings, presentation	varies	region-wide	NCRP PRP & TPRC orientation; NCRP background
10/2018	PRP and TPRC meeting	76	Regional	Meeting included a Panel on State Agency Updates and Priorities featuring representatives from state offices including the Tribal Policy Advisor and Assistant Deputy Director from the DWR, the Executive Director from the Strategic Growth Council, Director of the California Department of Conservation, Resilience Program Manager of the Governor's Office of Planning and Research, and Undersecretary of the Department of Food and Agriculture.
WORKSHOPS				
12/03	public workshop	57	Humboldt	Chapter 8, Proposition 50 IRWM Grant Program, NCRP Plan outline, Plan Review Process, Grant application submission

DATE	TYPE	# PARTICIPANTS	LOCATION	SUBJECT
11/04	public workshop	13	Del Norte	Chapter 8, Proposition 50 IRWM Grant Program, NCRP Plan outline, Plan Review Process, Grant application submission
12/04	public workshop	9	Del Norte	Chapter 8, Proposition 50 IRWM Grant Program, NCRP Plan outline, Plan Review Process, Grant application submission
12/04	public workshop	47	Mendocino	Chapter 8, Proposition 50 IRWM Grant Program, NCRP Plan outline, Plan Review Process, Grant application submission
12/04	public workshop	23	Trinity	Chapter 8, Proposition 50 IRWM Grant Program, NCRP Plan outline, Plan Review Process, Grant application submission
01/05	workshop: RRWA	67	Santa Rosa	Chapter 8, Proposition 50 IRWM Grant Program, NCRP Plan outline, Plan Review Process, Grant application submission
02/05	public workshop (BOS)	21	Siskiyou	Chapter 8, Proposition 50 IRWM Grant Program, NCRP Plan outline, Plan Review Process, Grant application submission
05/05	workshop: RRWA	35	Santa Rosa	Chapter 8, Proposition 50 IRWM Grant Program, NCRP Plan outline, Plan Review Process, Grant application submission
05/05	workshop: RWQCB	83	Santa Rosa	Chapter 8, Proposition 50 IRWM Grant Program, NCRP Plan outline, Plan Review Process, Grant application submission
03/09	public workshop	19	Trinity	North Coast projects and strategies for energy independence, climate adaptation, and GHG emission reduction
3/11/10	public workshop: CBC	64	Fairfield	California Biodiversity Council: Integrated Water Management in California Panel Discussion
9/22/10	public workshop	12/26	Crescent City & Eureka	NCRP Plan Proposition 84 Round 1 & 1E Grant Workshop
9/23/10	public workshop	6/14	Weaverville & Yreka	NCRP Plan Proposition 84 Round 1 & 1E Grant Workshop
9/29/10	public workshop	28/16	Santa Rosa & Ukiah	NCRP Plan Proposition 84 Round 1 & 1E Grant Workshop
11/15/12	public workshop	6	Weaverville	NCRP Plan Proposition 84 Round 2 Implementation Grant Workshop
11/16/12	public workshop	8	Yreka	NCRP Plan Proposition 84 Round 2 Implementation Grant Workshop
11/19/12	public workshop	8	Crescent City	NCRP Plan Proposition 84 Round 2 Implementation Grant Workshop
11/19/12	public workshop	22	Eureka	NCRP Plan Proposition 84 Round 2 Implementation Grant Workshop
11/20/12	public workshop	14	Ukiah	NCRP Plan Proposition 84 Round 2 Implementation Grant Workshop
11/20/12	public workshop	30	Santa Rosa	NCRP Plan Proposition 84 Round 2 Implementation Grant Workshop
2/28/14	GHD and RCAC	16	Sacramento	Water & Wastewater Service Provider Outreach & Support Program Small Community Assistance Workshop
5/6/14	public workshop	4	Weaverville	North Coast 2014 Drought Project Solicitation
5/7/14	public workshop	16	Yreka	North Coast 2014 Drought Project Solicitation
5/8/14	public workshop	22	Eureka	North Coast 2014 Drought Project Solicitation
5/9/14	public workshop	27	Santa Rosa	North Coast 2014 Drought Project Solicitation
5/9/14	public workshop	12	Ukiah	North Coast 2014 Drought Project Solicitation
10/2016	Celebration Workshop	41	Sonoma County	Goals of the workshop were to enhance and expand understanding of the NCRP among elected officials and funders to positively influence perceptions of NCRPimpact and the need for regional investment, and to expand the circle of supporters of the NCRP.

DATE	TYPE	# PARTICIPANTS	LOCATION	SUBJECT
01/14 – 01/18/19	8 public workshops	>90	Yreka, Weaverville, Willow Creek, Crescent City, Eureka, Ukiah, Fort Bragg, Santa Rosa	NCRP 2018/19 Proposition 1 IRWM Implementation Project Solicitation
TRAININGS — NCRP WATER & WASTEWATER SERVICE PROVIDER OUTREACH & SUPPORT PROGRAM				
05/23/12	Training: RCAC	9	Ukiah	Ethics/Conflict of Interest and Policies Assistance in identifying projects for future grant proposals; Opportunities to discuss individual system needs and opportunities for coordination and sharing with neighboring service providers
05/24/12	Training: RCAC	23	Eureka	Sanitary Surveys Assistance in identifying projects for future grant proposals; Opportunities to discuss individual system needs and opportunities for coordination and sharing with neighboring service providers
8/30/12	Training: RCAC	31	Willow Creek	Small Groundwater System Operation & Maintenance Assistance in identifying projects for future grant proposals; Opportunities to discuss individual system needs and opportunities for coordination and sharing with neighboring service providers
9/5/12	Training: RCAC	23	Fort Bragg	Wastewater Treatment Techniques Assistance in identifying projects for future grant proposals; Opportunities to discuss individual system needs and opportunities for coordination and sharing with neighboring service providers
9/26/12	Training: CRWA	17	Yreka	Budget/capital improvement, asset management, Leak Detection, Utility Management Assistance in identifying projects for future grant proposals; Opportunities to discuss individual system needs and opportunities for coordination and sharing with neighboring service providers
11/7/12	Training: CRWA	19	Yreka	Sampling, Emergency Procedures, Consumer Confidence Reports, Utility Management Assistance in identifying projects for future grant proposals; Opportunities to discuss individual system needs and opportunities for coordination and sharing with neighboring service providers
11/14/12	Training: RCAC	19	Crescent City	Safe Drinking Water Act Assistance in identifying projects for future grant proposals; Opportunities to discuss individual system needs and opportunities for coordination and sharing with neighboring service providers
11/15/12	Training: RCAC	25	McKinleyville	Operations Plan & Emergency Response Plans Assistance in identifying projects for future grant proposals; Opportunities to discuss individual system needs and opportunities for coordination and sharing with neighboring service providers
4/15/14	Training: RCAC and GHD	12	Fortuna	Resources for Project Development, Planning and Funding • Small Community Toolbox Overview and Discussion • Infrastructure and project development training (including how to develop a capital improvement plan and hire a consultant) • Rates training (When and Why to Increase Rates)
4/16/14	Training: RCAC and GHD	17	Crescent City	Resources for Project Development, Planning and Funding Small Community Toolbox Overview and Discussion Infrastructure and project development training (including how to develop a capital improvement plan and hire a consultant) Rates training (When and Why to Increase Rates)
4/22/14	Training: RCAC and GHD	17	Healdsburg	Resources for Project Development, Planning and Funding Small Community Toolbox Overview and Discussion Infrastructure and project development training (including how to develop a capital improvement plan and hire a consultant) Rates training (When and Why to Increase Rates)

DATE	TYPE	# PARTICIPANTS	LOCATION	SUBJECT
4/23/14	Training: RCAC and GHD	13	Ukiah	Resources for Project Development, Planning and Funding Small Community Toolbox Overview and Discussion Infrastructure and project development training (including how to develop a capital improvement plan and hire a consultant) Rates training (When and Why to Increase Rates)
5/7/14	Training: CRWA and GHD	7	Yreka	Project Development, Planning and Funding Small Community Toolbox Overview and Discussion Infrastructure and project development training (including how to develop a capital improvement plan and hire a consultant) Rates training (When and Why to Increase Rates)
5/8/14	Training: CRWA and GHD	7	Weaverville	Project Development, Planning and Funding Small Community Toolbox Overview and Discussion Infrastructure and project development training (including how to develop a capital improvement plan and hire a consultant) Rates training (When and Why to Increase Rates)
CONFERENCES				
11/05	conference presentation	200	San Diego	ACWA
9/07	conference presentation	240	Santa Rosa	CA Planning Commissioners
10/07	regional conference	320	Fortuna	North Coast Conference
11/07	conference presentation	85	Los Angeles	CA Water Policy Conference
05/08	conference presentation	175	San Diego	SWRCB Conference
06/9/10	conference presentation	140	Sacramento	EPA Conference
04/11	conference presentation	60	Sacramento	CARCD Conference
05/11	conference presentation			NCRP Conference: Healthy Watersheds and Vital Human Communities & Techniques for Regional Outreach
10/6/12	conference presentation	64	Sonoma County	Integrated Natural Resources Management Sonoma County Green Infrastructure Initiatives & Integration of Multiple Objectives
10/13	regional conference	168	Fortuna	North Coast Conference
3/12/14	conference presentation	80	San Diego	Watershed Forum
4/2016	regional conference	101	Yreka	Ten Year Celebration of Collaboration & Positive Impact
04/17/17	regional conference	130	Santa Rosa	Integrated Strategies for the North Coast: North Coast as a Source Region: Water, Carbon, Biodiversity & Rural Innovation; Return on investment in rural landscapes and communities
01/13 – 10/14/19	regional conference	146	Eureka	Climate Science Symposium for the North Coast Region
MEETINGS & PRESENTATIONS				
01/04	Presentation	25	Cloverdale	League of California Cities
08/03	outreach	varies	Sacramento	coordinated outreach to NC legislators and staff re: NCRP effort
04/04	outreach	varies	Sacramento	coordinated outreach to NC legislators and staff re: NCRP effort
08/05	outreach	varies	Sacramento	coordinated outreach to NC legislators and staff re: NCRP effort
10/05	Presentation	67	Eureka	American Society of Civil Engineers — Redwood Empire Chapter
8/06 – 10/06	interviews	22	region-wide	Stakeholder and Project Propoent Evaluation of NCRP Plan & NCRP Application Process, NCRP Phase I Plan
02/07	Presentation	23	Gualala	Sea Ranch community
07/08	meetings & presentations	33	Ukiah	Eel-Russian Commission Meetings
09/08	Meeting and presentation	27	Yreka	Siskiyou water/wastewater entities

DATE	TYPE	# PARTICIPANTS	LOCATION	SUBJECT
10/09 – 01/10	>12 conference call meetings	5-16	region-wide	Development of North Coast Energy Independence Program (regional PACE program), California Energy Commission grant proposal. Meetings with county administrators, supervisors, treasurers/auditors.
10/09 – 01/10	>25 conference call meetings	3-16	region-wide	Development of North Coast Energy Efficiency & Conservation Block Grant (NCEECBG). Technical Assistance to eligible cities/counties.
10/09	Meeting	18	Santa Rosa	Sonoma County and North Coast Energy Independence Program (NCEIP) meeting
11/09	BOS Presentation	34	Yreka	Board of Supervisor presentation: NCRP background, NCEIP and NCEECBG
11/09	Meeting	6	Ukiah	North Coast Energy Independence Program: Mendocino and Lake County participation
12/09	BOS presentation	22	Crescent City	Board of Supervisor presentation: NCRP background, NCEIP and NCEECBG
12/09	BOS Presentation	16	Ukiah	Board of Supervisor presentation: NCRP background, NCEIP and NCEECBG
12/09	meeting	8	Sacramento	DWR disadvantaged community wastewater & water supply strategy
04/10	meetings, presentation	15 – 40	Weitchpec, Ukiah	Tribal meetings and presentations: Tribal representation, NCRP partnership & NCRP Plan overview, opportunities for collaboration
4/10	presentation	35	Santa Rosa	Applied Solutions presentation re. integration and collaboration for local governments
06/10	presentation	50	Roseland, OR	Southern Oregon Clean Energy Alliance (SOCEA) presentation: NCRP background, NCEIP and NCEECBG
12/10	meeting	45	Santa Rosa	NCEIP Ecology Action Meeting
12/10	BOS Presentation	65	Sonoma County	Board of Supervisor presentation: NCRP background, NCEIP and accomplishments (PRP Chair)
4/18/11	Tribal Orientation	8	conference call	NCRP presentation and orientation for Tribal representatives
06/11	Roundtable Session	30	Ukiah	Mendocino Futures presentation and panel discussion
9/11 – 12/11	Interviews	11	North Coast	Technical Peer Review Committee formal interviews: NCRP Plan Project Review, Evaluation and Selection Process.
9/11 – 12/11	Interviews	16	North Coast	Project Proponents interviews and public survey: NCRP Plan Project Review, Evaluation and Selection Process
12/11 – 2/12	Interviews	18	North Coast	Policy Review Panel formal interviews re. NCRP: the future direction, opportunities and constraints of the NCRP policy-level criteria for NCRP project selection water management issues/conflicts facing the North Coast region and its individual communities the needs, successful projects, local knowledge, constraints and opportunities for integrating energy independence into the NCRP (see Table 5 Public Outreach & Plan Input Opportunities for participants)
5/12	BOS Presentation	28	Del Norte County	Board of Supervisor presentation: NCRP background and accomplishments
7/12	BOS Presentation	22	Modoc County	Board of Supervisor presentation: NCRP background and accomplishments
10/12	BOS Presentation	34	Mendocino County	Board of Supervisor presentation: NCRP background and accomplishments
12/12	BOS Presentation	34	Siskiyou County	Board of Supervisor presentation: NCRP background and accomplishments
9/25/12	Tribal Council presentation	30	Sherwood Valley Rancheria	NCRP PRP Tribal representative presentation: NCRP background, goals/objectives, accomplishments, Tribal participation/representation; Tribal projects
3/13/13	BOS Presentation	26	Weaverville	Board of Supervisor presentation: NCRP background and accomplishments
3/13 – 6/13	Interviews	42	North Coast	Professional Planner and Technical Staff interviews: Land Use and Water Planning Climate Change Vulnerability and Response Energy Efficiency and Security, Water Management NCRP processes & NCRP Plan integration (see Table 5 Public Outreach & Plan Input Opportunities for participants)
2/4/14	Water Bond Hearing	75	Eureka	NCRP PRP Chair presentation: NCRP background, goals/objectives, accomplishments, Tribal participation/representation; natural/human capitol, support for IRWM program and bond initiatives

DATE	TYPE	# PARTICIPANTS	LOCATION	SUBJECT
2/14/14	SWRCB Board Meetiing	45	Sacramento	SWRCB presentation: NCRP background, goals/objectives, accomplishments, project benefits (Executive Committee)
2/14	US Forest Service meeting	30	Fortuna	NCRP PRP Tribal representative presentation: NCRP background, goals/objectives, accomplishments, Tribal participation/representation; Tribal projects
4/17/14	PRP & TPRC Meeting	38	Yreka	Proposed changes to practices/ policies regarding funding applications and plan development, Sonoma Clean Power Presentation, North Coast Tribal Engagement Process presentation, and panel presentationa dn discussion: Improvements to administration and invoicing of IRWM implementation project contracts. Prop 84 2014 Dorught Project Solicitation and Regional Application, plan schedule, and finalization of NCRP Goals and Objectives. Other NCRP business.
5/1/14	Regional Tribal Operations Committee	65	Santa Rosa	NCRP PRP Chair presentation: NCRP background, goals/objectives, accomplishments, Tribal participation/representation; Tribal projects
5/8/14	Eel Russian River Commission	45	Sonoma County	NCRP overview; Guiding principles; NCRP 2014 Drought Project Solicitation; Upcoming schedule for the NCRP and NCRP Plan
6/2/14	Sonoma County Water Advisory	20	Sonoma County	NCRP overview; NCRP 2014 Drought Project Solicitation; Upcoming schedule for the NCRP and NCRP Plan
10/16/14	NCRP Meeting	29	Fortuna	DWR update on funding, Cal Water Action Plan, AB 52, Tribal consultation for cultural resources, CASGEM legislation. Review of project review process; presentation regarding Tribal outreach, coordination and representation in North Coast region, NCRP nominations and Elections, and other NCRP business.
1/15/15	PRP & TPRC Meeting	26	Ukiah	Discussion of efforts to improve the "project selection and review process." Member nominations and elections, planning grant discussion, Prop 1 Water Bond presentation, committee actions and other NCRP business.
4/16/15	PRP & TPRC Meeting	25	Yreka	Prop 84 2015 IRWM Project Solicitationk NCRP Project Review and Selection Process, Santa Rosa Plain Groundwater Management Plan and DWR Sustainable Groundwater Management Act presentations, planning grant update, NCRP business.
7/2/15	PRP & TPRC Meeting	34	Weaverville	NCRP Vice-Chair nominations and election, draft 2015 NCRP Priority Projects, habitat impacts from cannabis cultivation presentation, Planning Grant update and other NCRP business.
10/15/15	PRP & TPRC Meeting	25	Loleta	Presentation on Native American Governance, review of NCRP Management structure and roles.
1/21/16	PRP & TPRC Meeting	32	Ukiah	Presentations on Prop 1 IRWM Program Guidelines and NCRP Disadvantaged Community Outreach Proposal Application, Storm Water Resource Planning Panel Presentation & Discussion, NCRP Goals & Objectives discussion, other NCRP business.
08/10/16	NCRWQCB meeting presentation	38	Santa Rosa	NCRP Proposition 1 IRWM Funding & Disadvantaged Community Involvement Program
10/21/16	PRP & TPRC Meeting	41	Loleta	NCRP honors and awards, Tribal Ecological Knowledge discussion, other NCRO business.
4/20/17	PRP & TPRC Meeting	33	Healdsburg	NCRP leadership, business, and 2017 NCRP Handbook. Nominations and elections, awards. Other NCRP business.
1/19/18	PRP & TPRC Meeting	46	Ukiah	Presentations: North Coast Resiliency Strategies: Watersheds, Communities & Fire, California Economic Summit description, Russian River Watershed Pilot discussion, Prop 1 IRWM Round 1 Funding solicitation, and other NCRP business.
02/28/18	Legislative and Agency meetings	16	Sacramento	NCRP Chair, Vice Chair and staff meetings with legislative officials and staff, and agencies leaders about the NCRP
4/20/18	PRP & TPRC Meeting	40	Yreka	Presentations: North Coast Resiliency Strategies: Watersheds, Communities & Fire Round 2, other NCRP business.
10/19/18	PRP & TPRC Meeting	76	Weaverville	2018 Fire Season Round Robin: NCRP PRP & TPRC Members. Legislative Updates from Assemblymember Jim Wood, Tom Weseloh, Bruce Ross, and John Driscoll. State agency updates and priorities and discussion of opportunities and priorities for the NCRP.
4/26/19	PRP & TPRC Meeting	42	Yreka	NCRP Nominations and Elections; Leadership Handbook, NCRP Goals and Objectives; NCRP Policies review and updates; NCRP Plan Review and Adoption Process; Regional Forest and Fire Capacity Funding; NASA Fire Evaluation Presentation; NCRP Proposition 1 Round 1 Implementation Funding: Priority Project Selection
monthly	ongoing NCRP Planning updates	35	Santa Rosa	Russian River Watershed Association meetings
monthly	NCRP planning meetings	5 – 9	Conference call	NCRP /NCRP Plan planning and program management
ongoing		Varies	Region-wide	RCDs
ongoing		Varies	Region-wide	NC Tribal governments and EPA Departments
monthly	meetings, conference call	9 – 12	Region-wide	Tribal Engagement and Coordination

DATE	TYPE	# PARTICIPANTS	LOCATION	SUBJECT
ongoing	presentation	Varies	Region-wide	County Board of Supervisor and Tribal Council meetings regarding NCRP updates
ongoing	meetings, conference call	Varies	Region-wide	Technical assistance and support for project proposal development
quarterly	meetings, presentation	Varies	State-wide	ARCCA Regional Collaborative Meetings

Table 5 Public Outreach & Plan Input Opportunities

NORTH COAST PARTNER AND STAKEHOLDER INTERVIEWS		
NAME	**TITLE/ ROLE/ORGANIZATION**	**COUNTY/TRIBAL AREA**
Policy Review Panel — NCRP Governance, Local Water Management, Energy Independence, 2011/12		
Efren Carrillo	County Supervisor, NCRP PRP	Sonoma County
Geri Byrne	County Supervisor, NCRP PRP	Modoc County
Gerry Hemmingsen	County Supervisor, NCRP PRP	Del Norte County
Grace Bennett	County Supervisor, NCRP PRP	Siskiyou County
Isa Mesa Jr.	Environmental Coordinator, NCRP PRP	Redwood Valley Rancheria
Carol Cook	Tribal Council, NCRP PRP	Sherwood Valley Rancheria
Jimmy Smith	County Supervisor, NCRP PRP	Humboldt County
John McCowen	County Supervisor, NCRP PRP	Mendocino County
Judy Morris	County Supervisor, NCRP PRP	Trinity County
Kendall Smith	County Supervisor, NCRP PRP	Mendocino County
Leaf Hillman	Natural Resources Director, NCRP PRP	Karuk Tribe
Marcia Armstrong	County Supervisor, NCRP PRP	Siskiyou County
Roger Jaegel	County Supervisor, NCRP PRP	Trinity County
Ryan Sundberg	County Supervisor, NCRP PRP	Humboldt County
Other Leaders — NCRP Governance, Local Water Management, Energy Independence, 2011/12		
Grant Davis	General Manager, Sonoma County Water Agency	Sonoma County
Javier Silva	Environmental Director, NCRP TPRC	Sherwood Valley Rancheria
Jay Sarina	County Administrator, NCRP PRP	Del Norte County
Zack Larson	Smith River Advisory Council; NCRP TPRC member	Del Norte County
Project Proponent & Public — NCRP Project Evaluation and Selection Process, 2011		
anonymous	on-line surveys — 12 total	North Coast
Lynne Rosselini	Sonoma County Water Agency	Sonoma County
Laurel Marcus	California Land Stewarship Institute	Sonoma Mendocino
David Edmunds	Pinolleville Pomo Nation	Mendocino County
Barry Jarvis	Indian Health Services	Northern Region
Dennis Slota	Mendocino County Water Agency	Mendocino County
Earl Crosby	Karuk Tribe	Karuk Tribe
Kathleen Morgan	Gualala River Watershed Association	Sonoma Mendocino
Lauren Lubowicki	Mattole Restoration Council	Humboldt County
Rebecca Crow	GHD Engineers	Humboldt County
Patty Madigan	Mendocino County RCD	Mendocino County
TPRC — NCRP Project Evaluation and Selection Process, 2011		
Tom Weseloh	Caltrout	Humboldt County
Dale Roberts	Sonoma County Water Agency	Sonoma County
David Van Denover	Weaverville CSD	Trinity County
Patty Madigan	Mendocino County RCD	Mendocino County
Roland Sanford	Mendocino County Water Agency	Mendocino County
Wayne Haydon	California Geological Survey	Sonoma County
Sandra Perez	Five Counties Salmonid Restoration Program; NCRP TPRC member	Trinity County
Koiya Tuttle	Potter Valley Tribe	Mendocino County
Kendall Smith	County Supervisor, NCRP PRP	Mendocino County
Marilyn Seward	City of Etna	Siskiyou County
Kirk Girard	Planning Director	Humboldt County
Counties Departments: Land Use, Climate Change and Water Planning, 2013		
Heidi Kunstal	Building, Planning & Environmental Health	Del Norte County
John Miller	Planning & Building Department	Humboldt County
Hank Seemann	Public Works, Natural Resources Division; NCRP TPRC member	Humboldt County
Steve Dunnicliff	Planning & Building Services	Mendocino County

NORTH COAST PARTNER AND STAKEHOLDER INTERVIEWS		
NAME	**TITLE/ ROLE/ORGANIZATION**	**COUNTY/TRIBAL AREA**
Dennis Slota	Mendocino County Water Agency (part of P&B Services)	Mendocino County
Dave Jensen	Environmental Health Department	Mendocino County
Tom Peters	Land Improvement	Mendocino County
Sean White, General Manager	Russian River Flood Control and Water Conservation Improvement District; NCRP TPRC member	Mendocino County
Greg Plucker	Planning Division Planning Commission	Siskiyou County
Randy Akana	Flood Control and Water Conservation District	Siskiyou County
Ric Costales	Natural Resources Department	Siskiyou County
Scott Waite	Land Development	Siskiyou County
Richard Tinsman	Senior Planner; NCRP TPRC member	Siskiyou County
Terry Barber	Public Health/ Environmental Health	Siskiyou County
Kyla Burton, Environmental Compliance Specialist	Public Works	Siskiyou County
Jennifer Barrett	Planning	Sonoma County
Sandi Potter	Planning	Sonoma County
Pete Parkinson	Permit and Resource Management Department	Sonoma County
Suzanne Smith, ED	Transport Authority/ Regional Climate Protection Authority	Sonoma County
Christine Sosko	Environmental Health	Sonoma County
Dale Roberts	Sonoma County Water Agency; NCRP TPRC member	
Frank Lynch	Planning Department & Planning Commission	Trinity County
Rick Tippett	Transportation	Trinity County
Municipalities: Land Use, Climate Change and Water Planning, 2013		
Larry Oetker—Director	City of Arcata Community Development Department	Arcata
Eugene M. Palazzo — City Manager	City of Crescent City Planning Department	Crescent City
Eric Wier — Director	City of Crescent City Public Works Department	Crescent City
Robert Wall — Director	City of Eureka Community Development	Eureka
Mike Flockhart, Public Works Director	City of Fortuna Public Works Department	Fortuna
Carol Rische	Humboldt Bay Municipal Water District; NCRP TPRC member	Humboldt Bay
David Hull	Humboldt Community Services District	Eureka
Darrin Jenkins	City of Rohnert Park	Rohnert Park
Charley Stump, Director	City of Ukiah Planning and Community Development	Ukiah
Wes Scribner	Weaverville Community Service District	Weaverville
Resource Conservation Districts: Land Use, Climate Change and Water Planning, 2013		
Brittany Heck, ED	Gold Ridge RCD	Sebastopol
Donna Chambers, ED	Humboldt County RDC	Eureka
Janet Olave, ED	Mendocino County RCD	Ukiah
Patty Madigan	Mendocino County RCD; NCRP TPRC member	Ukiah
Earle Cummings, Director	Sotoyome RCD	Santa Rosa
Other Agencies: Land Use, Climate Change and Water Planning, 2013		
Matthew Marshall	Redwood Coast Energy Authority	Eureka /Humboldt County
Dana Boudreau	Redwood Coast Energy Authority	Eureka /Humboldt County
Zack Larson	Smith River Advisory Council; NCRP TPRC member	Del Norte County
Sandra Perez	Five Counties Salmonid Restoration Program; NCRP TPRC member	Del Norte, Humboldt, Mendocino, Siskiyou, Trinity Counties
Propostion 1 NCRP Outreach & Involvement: Tribal Engagement & Economic Opportunity for Disadvantaged Communities		
Key Expert Interviews 2018		
Mark Weller & Heidi Benzonelli	Westside Community Improvement Assocation	Humboldt
Hillarie Beyer	McKinleyville Family Resource Center	Humboldt
Brian Olson	Eureka Community Resource Center	Humboldt
Joyce Hayes	Humboldt Senior Resource	Humboldt
Esther Hutton	Manila Community Resource Ctr/Redwood Coast Montessori	Humboldt
Jennifer Kalt	Humboldt Baykeeper	Humboldt
Susan Seaman	Arcata Economic Development Corporation	Humboldt
Amanda Mager	City of Blue Lake	Humboldt
Justin McDonald	Arcata Fire Disrict	Humboldt
Greg Orsini	McKinleyville community services district	Humboldt
Valen Castellano	Big Lagoon CSD	Humboldt
Melissa Kraemer	CA Coastal Commission	Humboldt

NORTH COAST PARTNER AND STAKEHOLDER INTERVIEWS		
NAME	**TITLE/ ROLE/ORGANIZATION**	**COUNTY/TRIBAL AREA**
Becky Price Hall	City of Trinidad	Humboldt
Chris Drop	Manila CSD	Humboldt
Aldaron Laird	Trinity Associates, Humboldt Bay Municipal Water District	Humboldt
Larry Glass	NorthCoast Environmental Center	Humboldt
John Friedenbach	HBMWD	Humboldt
Sean Robertson	Humboldt Bay Fire District	Humboldt
Andrew Slack	Save the Redwoods League	Humboldt
Larry Oetker	Humboldt Bay Harbor, Recreation and Conservation District	Humboldt
Laurel Marcus	CA Land Stewardship Institute	Mendocino
Heidi Kunstal & Rosanna Bower	Del Norte County	Del Norte
Doug Kern	Mendocino Land Trust	Mendocino
Kathleen Morgan	Gualala River Watershed Council	Mendocino
April Newlander & Tasha McKee	Sanctuary Forest	Humboldt
Nacole Sutterfield, Jon Olson	City of Crescent City	Del Norte
Nick Goulette	Watershed Center	Trinity
Wes Scribner	Weaverville Community Services District	Trinity
Mark Lancaster, Sandra Perez	Five Counties Salmonid Conservation Program (5Cs)	Trinity
2018 Disadvantaged Community Water and Wastewater Treatment Operator Survey		
	City of Healdsburg	Sonoma
	Mountain View Mobile Estates, LLC	Sonoma
	Riverside CSD	Humboldt
	Six Acres Water Company	Sonoma
	Weott C.S.D.	Humboldt
	Albion Mutual Water Company	Mendocino
	Beach Creek MH Park	Humboldt
	Big Lagoon CSD	Humboldt
	Big Lagoon Park Water Co.	Humboldt
	Blue Lake, City of	Humboldt
	Boulevard Heights Mutual Water	Sonoma
	Burnt Ranch Estates Mutual Water Co.	Trinity
	Butte Court Mobile Home Park	Del Norte
	Cal Ore Trail Mobile Estates	Siskiyou
	Callahan Water District	Siskiyou
	Calpella County Water District	Mendocino
	Caspar South Service Company	Mendocino
	Cazadero Water Company, Inc.	Sonoma
	City of Arcata	Humboldt
	City of Cotati	Sonoma
	City of Fortuna	Humboldt
	City of Rohnert Park	Sonoma
	City of Santa Rosa	Sonoma
	Cloverdale, City of	Sonoma
	Covelo C.S.D.	Mendocino
	Covington Mill Mwc-Division B	Trinity
	Crescent City, City of	Del Norte
	Del Norte County Community Service Area	Del Norte
	Dorris, City of	Siskiyou
	Eureka, City of	Humboldt
	Fieldbrook Glendale C.S.D.	Humboldt
	Fort Bragg Municipal Imp Distrct	Mendocino

NORTH COAST PARTNER AND STAKEHOLDER INTERVIEWS		
NAME	TITLE/ ROLE/ORGANIZATION	COUNTY/TRIBAL AREA
	Fort Bragg, City of	Mendocino
	Gasquet C.S.D.	Del Norte
	Grenada Sanitary District	Siskiyou
	Hills Ranch Mutual Water Company	Mendocino
	Holly Ranch Village	Mendocino
	Hopland Public Utility District	Mendocino
	Humboldt Bay MWD	Humboldt
	Humboldt C.S.D.	Humboldt
	Humboldt County Rid #1, Shelter Cove POTW	Humboldt
	Hunter Valley CSD	Del Norte
	Indian Creek Trailer Park	Trinity
	Jacoby Creek CSD — Combined with City of Arcata	Humboldt
	Jedsmith Homeowners Assn.	Del Norte
	Journey's End Mobile Home Park	Sonoma
	Lake Shastina C.S.D	Siskiyou
	Las Palmas Mobile Home Park	Del Norte
	Laytonville County Water District	Mendocino
	Lewiston Community Services District	Trinity
	Lewiston Park MWC	Trinity
	Loleta C.S.D.	Humboldt
	Manila Community Services Dist.	Humboldt
	Mckinleyville C.S.D.	Humboldt
	Meadow Estates Mutual	Mendocino
	Midway RV Park	Humboldt
	Miranda C.S.D.	Humboldt
	Mobile Home Estates	Sonoma
	Montair Subdivision Homeowners Association	Siskiyou
	Myers Flat M.W.S. Inc.	Humboldt
	North Gualala Water Company	Mendocino
	Odd Fellows Recreation Club	Sonoma
	Orleans Mutual Water Co.	Humboldt
	Palomino Estates M.W.C.	Humboldt
	Pine Grove Trailer Park	Del Norte
	Pine Mountain Mutual Water Co.	Mendocino
	Point Cabrillo Highlands	Mendocino
	Point of View Mutual Water Co	Mendocino
	Redcrest Water Works	Humboldt
	Redwood Heights Water Association	Sonoma
	Redwood Park C.S.D.	Del Norte
	Redwood Valley County Water District	Mendocino
	Reservation Ranch	Del Norte
	Rio Dell, City of	Humboldt
	River Estates Mutual Water Company	Mendocino
	Round Valley CWD	Mendocino
	Rush Creek Mutual Water System	Trinity
	Russian River County Sanitation District	Sonoma
	Sawyers Bar County Water District	Siskiyou

NORTH COAST PARTNER AND STAKEHOLDER INTERVIEWS		
NAME	TITLE/ ROLE/ORGANIZATION	COUNTY/TRIBAL AREA
	Seawood Estates Mutual Water	Humboldt
	Sebastopol, City of	Sonoma
	Seymour's Mutual Water System	Trinity
	Shasta View Heights Owners Association	Siskiyou
	Shorelands Road & Water Company	Mendocino
	Siskiyou Co. Service Area #5/Carrick (Functionally Part of City of Weed's Water System)	Siskiyou
	Sonoma County Mutual Water Company	Sonoma
	Sonoma County Water Agency	Sonoma
	South Cloverdale Water Company	Sonoma
	State Line RV Park	Modoc
	Sunset Park Community	Sonoma
	Surfwood Mutual Water Corporation	Mendocino
	Sweetwater Springs CWD — Guerneville	Sonoma
	Sweetwater Springs CWD — Monte Rio	Sonoma
	Tennant C.S.D.	Siskiyou
	Treasure Creek Woods Mwc	Trinity
	Trinity Co. W.W. Dist #1	Trinity
	Trinity Knolls Mutual Water Company	Trinity
	Tulelake, City of	Siskiyou
	Ukiah, City of	Mendocino
	Upper Russian River Water Agency Mendocino County Russian River Flood Control and Water Conservation District	Mendocino
	Weaverville C.S.D.	Trinity
	Weed, City of	Siskiyou
	West Park Properties	Del Norte
	West Water Company (PUC)	Sonoma
	Westhaven C.S.D.	Humboldt

APPENDIX C. REGION DESCRIPTION

Table 6 Summary of North Coast Region Key Attributes

ATTRIBUTE	DESCRIPTION
Total Area	50,246 sq. km. (19,400 square miles; 12,424,617 acres)
Proportion of California (%)	Approximately 12%
Length of coastline	547 km. (340 miles)
Counties in Region (all or portions)	10: Del Norte, Humboldt, Trinity, Mendocino; large parts of Siskiyou and Sonoma; small portions of Glenn, Lake, Marin, and Modoc
Counties in NCRP (all or portions)	7: Del Norte, Humboldt, Mendocino, Modoc, Siskiyou, Sonoma, Trinity
Watershed Management Areas	6: Eel River, Humboldt Bay, Klamath River, North Coast Rivers, Russian/Bodega, and Trinity River
Drainage Basins	2: Klamath River Basin (5 Hydrologic Units HUs) and North Coastal Basin (9 HUs)
Hydrologic Units (HUs)	14: Klamath, Rogue, Smith, Trinity, Winchuck (=Klamath River Basin); Bodega, Cape Mendocino, Eel, Eureka Plain, Mad River, Mendocino Coast, Redwood Creek, Russian, and Trinidad (=North Coastal Basin) HUs
Tribes/ Tribal Lands	Yurok (most populous Tribe); Hoopa and Round Valley Reservations (two largest in area); others including but not limited to Karuk, Paiute, Pomo, Tolowa, and Wiyot; (256,280 acres)
Land Ownership (% Region area)	Private/ Other (50.20%), Federal (44.24%), State (2.43%), Non-Profit (0.85%), Special District (0.07%), County (0.06%), City (0.08%), Tribal Lands (2.06%)
Total Population (2000, 2010, and 2015)	The population of the entire North Coast Region was approximately 644,000 in 2000 (DWR 2005) and 675,845 in 2010 (US Census) and 679,741 in 2015 (American Community Survey 2015).
Percent of State Population	Approximately 2%
Most Populous Counties (2010)	Sonoma: 515,968, Humboldt: 133,138
Least Populous Counties (2010)	Modoc: 9,547 (total population, including area outside of NC Region; Trinity: 13,442.
Population Change (2013–2050)	Recent model predictions by the Department of Water Resources (DWR 2013) indicate that the regional population is expected to grow to between 763,300 and 1,185,600 by the year 2050
Highest Population Density (persons per sq. mi.)	Sonoma (307 persons/mi2), Humboldt has approximately 37 people per square mile
Lowest Population Density (persons per sq. mi.)	Modoc (1), Trinity (4)
Median Age Range	41 (Humboldt) to 50 (Trinity); average median age = 45
Range of Education Attainment (bachelor's degree or higher)	15% (Del Norte) to Sonoma (33%)
Range in Median Household Income (2016)	$35,270 (Trinity) to $66,833 (Sonoma)
Tribal Population (percent in 2010 census)	4.0% Region total; range 2.2% (Sonoma) to 8.8% (Del Norte)
Disadvantaged and Severely Disadvantaged (DAC, SDAC) Population	44% of Region total (2015) 36% of Region total (2010)
Economically Distressed Area (2016)	93.4% of Region total (11,598,962 acres)
Severely Disadvantaged Area (2016)	49.81% of Region total (6,188,842 acres)
DAC and SDAC Area (2016)	90.2% of Region total (11,204,991 acres)
DAC and SDAC Area (2010)	84% of Region total (10,464,758 acres)
Major Economic Sectors	Tourism, recreation, logging, service (health, education), timber milling, aggregate mining, commercial/ sport fisheries, sheep/ beef/ dairy production, vineyards, wineries, wildlife/ resource management
Land Use Types (% cover)	Conifer forest (60.28%), hardwood forest/ woodland (14.97%), shrub/ brush rangeland (10.54%), cropland/ pasture (3.57%), barren (0.86%), rural development (0.71%), non-forested wetland (0.48%), residential (0.1%), commercial/ service/ transportation/ communication/ other built (0.05%)
Land Cover Types (% cover)	Conifer forest/ woodland (60.31%), hardwood forest/ woodland (15.01%), herbaceous rangeland (7.26%), shrub (10.5%), herbaceous (7.3%), agriculture (3.57%), water/wetland (1.65%), barren/other (0.86%), urban (0.72%)
Total Length of Rivers and Streams	34,586 kilometers (21,491 miles)
Groundwater Basins and Subbasins	64
Designated Beneficial Uses of Water for Hydrologic Units	28: Includes agricultural, municipal/ domestic, fisheries, flood attenuation, and recreation in bays, estuaries, minor coastal streams, ocean waters, wetlands, inland surface waters, and groundwaters, Tribal tradition and culture, Tribal subsistence fishing, and subsistence fishing
Marine Managed Areas/ Critical Coastal Areas	21: Includes 19 Marine Protected Areas, 8 State Water Quality Protection Areas that are Areas of Special Biological Significance (CCAs may include designated "impaired" streams below)
303(d)-listed "Impaired" Streams (2016)	32,667 kilometers (20,298 miles) total stream length (94% of stream length)
National Wilderness Preservation System Areas	11 totaling 1,073,735 acres
Plant and Animal Species Documented for the Region	526 species

ATTRIBUTE	DESCRIPTION
Listed (State/ Federal) Endangered and Threatened Plant and Animal Species Documented for the Region	86 threatened, endangered, or candidate species (34 plants, 52 animals)
Protected Lands Percent Cover	Approximately 49%

Table 7 Land Owner Types of the North Coast Region

OWNERSHIP TYPE	ACREAGE (%), 2007	ACREAGE (%), 2013
City	2,214.9 (0.02%)	5,387.75 (0.02%)
County	3,757.9 (0.03%)	4,567.39 (0.03%)
Tribal	—	256,280 (2.01%)
Federal	5,743,166.6 (46.23%)	5,732,223.11 (46.23%)
Non-Profit	24,118.3 (0.19%)	62,622.42 (0.19%)
Special District	5,429.9 (0.04%)	8,804.68 (0.07%)
State	282,597.7 (2.27%)	291,877.01 (2.27%)
Private/Other	6,362,931.8 (51.21%)	6,317,931.75 (51.21%)

Source: California Protected Areas Database (CPAD — www.calands.org)

Table 8 Municipalities & Census Designated Places of the North Coast Region

COUNTY	CITY/ TOWN NAME	MUNICIPALITY OR CDP	POPULATION (2010)
Del Norte			28,610
	Crescent City	Incorporated municipality	7,643
Humboldt			134,623
	Alderpoint	Census-designated place	
	Arcata	Incorporated municipality	17,231
	Blue Lake	Incorporated municipality	
	Eureka	Incorporated municipality	27,919
	Ferndale	Incorporated municipality	
	Fortuna	Incorporated municipality	11,926
	Garberville	Census-designated place	
	McKinleyville	Census-designated place	15,177
	Orick	Census-designated place	
	Redway	Census-designated place	
	Rio Dell	Incorporated municipality	
	Scotia	Census-designated place	850
	Trinidad	Incorporated municipality	
Mendocino			87,841
	Fort Bragg	Incorporated municipality	7,273
	Gualala	Census-designated place	
	Laytonville	Census-designated place	
	Mendocino	Census-designated place	
	Point Arena	Incorporated municipality	
	Ukiah	Incorporated municipality	16,075
	Willits	Incorporated municipality	
Siskiyou			44,900
	Dorris	Incorporated municipality	
	Etna	Incorporated municipality	
	Fort Jones	Incorporated municipality	
	Hornbrook	Census-designated place	
	Montague	Incorporated municipality	
	Tulelake	Incorporated municipality	
	Weed	Incorporated municipality	

COUNTY	CITY/ TOWN NAME	MUNICIPALITY OR CDP	POPULATION (2010)
	Yreka	Incorporated municipality	7,765
Sonoma			483,878
	Cotati	Incorporated municipality	7,265
	Healdsburg	Incorporated municipality	11,254
	Rohnert Park	Incorporated municipality	40,971
	Santa Rosa	Incorporated municipality	167,815
	Sebastopol	Incorporated municipality	7,379
	Windsor	Incorporated municipality	26,801
Trinity			13,786

Table 9 Land Cover Types of the North Coast Region

TYPE	ACRES NORTH COAST REGION	PERCENT OF REGION
Agriculture	444,089.70	3.57
Barren/Other	107,291.68	0.86
Conifer Forest	7,143,268.13	57.49
Conifer Woodland	350,371.74	2.82
Hardwood Forest	1,771,367.86	14.26
Hardwood Woodland	92,812.37	0.75
Herbaceous	907,293.36	7.3
Shrub	1,310,707.48	10.55
Urban	89,839.43	0.72
Water	145,468.46	1.17
Wetland	60,243.89	0.48

Source: California Department of Forestry and Fire Protection (CALFIRE)

Table 10 Land Use Types of the North Coast Region

LAND USE	ACRES NORTH COAST REGION	PERCENT NORTH COAST REGION
Barren	106,265.78	0.86
Bays and Estuaries	24.463169	0.0002
Commercial and Services	1,262.74	0.01
Conifer Forest	7,488,345.60	60.28
Cropland and Pasture	443,562.85	3.57
Hardwood Forest	1,860,305.72	14.97
Herbaceous Rangeland	901443.10	7.26
Lakes	134,826.53	1.09
Nonforested Wetland	60,035.73	0.48
Other Urban or Built-up Land	468.80	0.0038
Residential	12,844.50	0.1
Rural Development	88,387.65	0.71
Shrub and Brush Rangeland	1,309,724.06	10.54
Streams and Canals	7,950.75	0.06
Transportation, Communications, and Utilities	4,641.78	0.04
Water	2,666.71	0.02

Source: California Department of Forestry and Fire Protection (CALFIRE)

APPENDIX D. TRIBAL PROFILE

North Coast Tribes are separate and independent sovereign nations within the territorial boundaries of the United States. The sovereignty of Tribes has been acknowledged in the U.S. Constitution. This sovereignty is inherent and flows from the pre-constitutional and extra-constitutional governance of the Tribe. Early federal policy and U.S. Supreme Court case law recognizes that Tribes retain the inherent right to govern within political boundaries (Worcester v. Georgia (1832) and that power to interact with Tribes is vested in the federal government. (Cherokee Nation v. Georgia (1831). This established governmental structure recognizes the sovereign and political independence of Tribal nations and its members. This right is also recognized by the State of California. Pursuant to the Executive Order B-10-11, the State "recognizes and reaffirms the inherent right of these Tribes to exercise sovereign authority of their members and territory."

The North Coast is the ancestral territory of North Coast Tribes. The majority of the North Coast Tribes have an inherent responsibility for managing their ancestral territories whether they currently have the capacity to or not. Therefore, North Coast Tribes' jurisdiction goes beyond the gathering, fishing, and hunting rights that each individual Tribal member retains. Each North Coast Tribes exerts their jurisdictional authority according to their own traditional policies, laws, mandates and capacity.

The North Coast Region has a significantly higher percentage of Native residents (4%) than the state average (1.7%; US Census 2010). Thirty-two North Coast Tribal Nations are represented in the North Coast. Tribal lands totaling more than 250,000 acres are distributed throughout the North Coast.

Table 11 Native Tribal Lands of the North Coast Region

NAME	TYPE	AREA (SQ. METER)	ACRES
Bear River Band — Rohnerville	Rancheria	107,905	27
Cahto Indian Tribe — Laytonville	Rancheria	788,833	195
Cher-Ae Heights Indian Community — Trinidad	Rancheria	271,924	67
Cloverdale Rancheria of Pomo Indians	Rancheria	19,262	5
Coast Indian Community of Yurok Indians — Resighini	Rancheria	930,640	230.0
Coast Miwok/S. Pomo — Federated Indians of Graton	Rancheria	215,112	53.2
Coyote Valley Band of Pomo Indians — Coyote Valley	Reservation	254,678	63
Guidiville Rancheria	Rancheria	76,281	19
Hoopa Valley Tribe	Reservation	355,983,910	87,966
Hopland Band of Pomo Indians	Rancheria	115,588	29
Karuk — Karuk Happy Camp #2	Reservation	723,579	179
Karuk — Karuk-Happy Camp #1	Reservation	8,067	2
Karuk — Karuk-Yreka	Reservation	43,281	11
Karuk — Former SAC-196, 198 PDA's	Reservation	3,215	1
Karuk — Karuk Orleans Horn Property	Reservation	341,335	84
Karuk — Orleans Karuk Tribal Office	Reservation	18,855	5
Karuk Tribe — Karuk-Happy Camp Res'n	Reservation	8,969	2
Kashia Band of Pomo Indians — Stewarts Point	Rancheria	174,566	43
Manchester Band of Pomo Indians	Rancheria	1,519,250	375
Smith River	Rancheria	547,090	135
Elk Valley	Rancheria	360,902	89
Blue Lake	Rancheria	127,046	31
Pit River Tribe — XL Ranch	Reservation	2,600,716	643
Pomo Indians — Sherwood Valley	Rancheria	1,183,167	292
Pomo Indians — Potter Valley	Rancheria	70,966	18
Pomo Indians — Redwood Valley	Rancheria	327,299	81
Pomo Indians — Pinoleville	Rancheria	432,874	107
Pomo Indians — Dry Creek	Rancheria	326,346	81
Quartz Valley Indian Community	Reservation	2,486,697	615
Round Valley Indian Tribes	Reservation	439,018,462	108,484
Smith River Indians — Big Lagoon	Rancheria	30,358	8
Wiyot Indians — Table Bluff	Rancheria	59,832	15

NAME	TYPE	AREA (SQ. METER)	ACRES
Yurok Tribe	Reservation	227,952,683	56,328
Total		**1,037,129,688**	**256,280**

Source: CalTrans & Bureau of Indian Affairs 2012

Table 12 Native Tribes of the North Coast Region

TRIBAL NATIONS OF THE NORTH COAST REGION
Bear River Band of Rohnerville Rancheria
Big Lagoon Rancheria
Blue Lake Rancheria
Cher-Ae Heights Indian Community of the Trinidad Rancheria
Cahto Tribe of Laytonville Rancheria
Cloverdale Rancheria of Pomo Indians
Coyote Valley Band of Pomo Indians
Dry Creek Rancheria Band of Pomo Indians
Elk Valley Rancheria
Federated Indians of Graton Rancheria
Guidiville Rancheria
Habematolel Pomo of Upper Lake
Hoopa Valley Tribe
Hopland Band of Pomo Indians of the Hopland Rancheria
The Karuk Tribe
Kashia Band of Pomo Indians of the Stewarts Point Rancheria
Klamath Tribes (Klamath, Modoc & Yahooskin)
Lytton Rancheria of California
Manchester Band of Pomo Indians of the Manchester Rancheria
Mishewal Wappo Tribe of Alexander Valley
Nor-Rel-Muk Nation
Pinoleville Pomo Nation
Pit River Tribe
Potter Valley Tribe
Quartz Valley Indian Community of the Quartz Valley Reservation
Redwood Valley Rancheria
Resighini Rancheria
Round Valley Indian Tribes/Covelo Indian Community
Shasta Indian Nation
Shasta Nation
Sherwood Valley Rancheria of Pomo Indians
Smith River Rancheria
Winnemem Wintu Tribe
Wiyot Tribe
The Yokayo Tribe of Indians
The Yurok Tribe
Source: North Coast Resource Partnership 2014

APPENDIX E. COUNTY PROFILE

For the sake of presenting a comprehensive suite of descriptive data, the following analyses include information for counties in the Region that are not currently members of the NCRP/ signatories to the NCRP MoMU (i.e. Glenn, Marin, and Lake which account for just 2.2% of the Region area; Lake County is a signatory to the MoMU, but is not a participating member of the NCRP.)

Table 13 County Size and Relative Proportion of the North Coast Region

COUNTY	ENTIRE COUNTY AREA (ACRE)	COUNTY AREA IN NORTH COAST REGION (ACRE)	PERCENT OF COUNTY	PERCENT OF NORTH COAST REGION
Del Norte	649,371.60	649,371.60	100.0%	5.2%
Glenn	849,231.02	54,337.81	6.4%	0.4%
Humboldt	2,293,383.36	2,293,383.36	100.0%	18.5%
Lake	851,668.60	193,022.40	22.7%	1.6%
Marin	335,916.36	22,740.98	6.8%	0.2%
Mendocino	2,246,050.43	2,246,050.43	100.0%	18.1%
Modoc	2,690,175.61	751,456.09	27.9%	6.0%
Siskiyou	4,065,123.79	3,328,853.31	81.9%	26.8%
Sonoma	1,016,012.50	832,651.03	82.0%	6.7%
Trinity	2,052,349.97	2,052,349.97	100.0%	16.5%
TOTAL		**12,424,216.98**		**100.0%**

Source: US Census 2010

Table 14 Land Owner Types of North Coast Counties

COUNTY	LANDOWNER	ACRES
Del Norte		
	Private Other	153,734.66
	City	38.08
	County	259.051
	Federal	442,190.83
	State	52,617.07
Glenn		
	Private Other	1,970.48
	Federal	5,2456.33
Humboldt		
	Private Other	1,698,232.62
	City	1,751.46
	County	800.13
	Federal	506,596.89
	Non Profit	1,127.06
	Special District	459.15
	State	84,818.91
Lake		
	Private Other	27,950.39
	Federal	164,348.90
	State	79.70
Marin		
	Private Other	22,700.65
	Non Profit	0.18
Mendocino		
	Private Other	1,808,411.54
	City	121.45
	County	11.193
	Federal	299,637.38
	Non Profit	41,926.07
	Special District	115.68
	State	95,553.44

COUNTY	LANDOWNER	ACRES
Modoc		
	Private Other	127,252.08
	County	1.92
	Federal	623,956.90
	State	245.047
Siskiyou		
	Private Other	1,231,791.24
	City	461.67
	County	2.67
	Federal	2,062,364.32
	Non Profit	5,828.82
	Special District	1,441.81
	State	2,5483.58
Sonoma		
	Private Other	750,969.68
	City	3,014.84
	County	3,475.93
	Federal	2,3306.82
	Non Profit	1,3740.19
	Special District	6,755.76
	State	32,264.61
Trinity		
	Private Other	494,521.67
	County	16.50
	Federal	1,557,358.49
	Special District	32.27
	State	814.55

Source: California Protected Areas Database (CPAD — www.calands.org)

Table 15 Groundwater Basins of North Coast Counties

COUNTY	GROUNDWATER BASINS	SUB-BASINS
Del Norte		
	1-1 Smith River Plain	
	1-14 Lower Klamath River Valley	
	1-25 Prairie Creek Area	
Humboldt		
	1-10 Eel River Valley	
	1-14 Lower Klamath River Valley	
	1-25 Prairie Creek Area	
	1-26 Redwood Creek Area	
	1-27 Big Lagoon Area	
	1-28 Mattole River Valley	
	1-29 Honeydew Town Area	
	1-30 Pepperwood Town Area	
	1-31 Weott Town Area	
	1-32 Garberville Town Area	
	1-33 Larabee Valley	
	1-34 Dinsmores Town Area	
	1-7 Hoopa Valley	
	1-8.01 Mad River Valley	1-8.01 Dows Prairie School Area
	1-8.02 Mad River Valley	1-8.02 Mad River Lowland
	1-9 Eureka Plain	
Lake		
	1-48 Gravelly Valley	
Marin		
	1-59 Wilson Grove Formation Highlands	
Mendocino		
	1-11 Covelo Round Valley	
	1-12 Laytonville Valley	
	1-13 Little Lake Valley	
	1-19 Anderson Valley	
	1-20 Garcia River Valley	
	1-21 Fort Bragg Terrace Area	
	1-37 Cottoneva Creek Valley	
	1-38 Lower Laytonville Valley	
	1-39 Branscomb Town Area	
	1-40 Ten Mile River Valley	
	1-41 Little Valley	
	1-42 Sherwood Valley	
	1-43 Williams Valley	
	1-44 Eden Valley	
	1-45 Big River Valley	
	1-46 Navarro River Valley	
	1-49 Annapolis Ohlson Ranch Fm Highlands	
	1-51 Potter Valley	
	1-52 Ukiah Valley	
	1-53 Sanel Valley	
	1-56 McDowell Valley	
	1-61 Fort Ross Terrace Deposits	
Modoc		
	1-2.01 Klamath River Valley	1-2.01 Tulelake
	1-22 Fairchild Swamp Valley	
Siskiyou		
	1-15 Happy Camp Town Area	
	1-16 Seiad Valley	
	1-17 Bray Town Area	
	1-18 Red Rock Valley	
	1-2.01 Klamath River Valley	1-2.01 Tulelake
	1-2.02 Klamath River Valley	1-2.02 Lower Klamath
	1-3 Butte Valley	
	1-4 Shasta Valley	Shasta Valley
	1-5 Scott River Valley	
Sonoma		
	1-49 Annapolis Ohlson Ranch Farm Highlands	
	1-50 Knights Valley	
	1-54.01 Alexander Valley	1-54.01 Alexander Area
	1-54.02 Alexander Valley	1-54.02 Cloverdale Area
	1-55.01 Santa Rosa Valley	1-55.01 Santa Rosa Plain
	1-55.02 Santa Rosa Valley	1-55.02 Healdsburg Area
	1-55.03 Santa Rosa Valley	1-55.03 Rincon Valley
	1-57 Bodega Bay Area	
	1-59 Wilson Grove Formation Highlands	
	1-60 Lower Russian River Valley	
	1-61 Fort Ross Terrace Deposits	
	2-19 Kenwood Valley	
Trinity		
	1-34 Dinsmores Town Area	
	1-35 Hyampom Valley	
	1-36 Hettenshaw Valley	
	1-6 Hayfork Valley	
	1-62 Wilson Point Area	

Source: California Department of Water Resources

Table 16 Land Cover Types of North Coast Counties

COUNTY	LAND COVER TYPE	ACRES
Del Norte		
	Agriculture	10,628.80
	Barren/Other	8,510.29
	Conifer Forest	487,921.47
	Hardwood Forest	77,299.17
	Hardwood Woodland	14.46
	Herbaceous	5,401.47
	Shrub	46,848.97
	Urban	5,521.78
	Water	5,482.20
	Wetland	1,195.36
Glenn		
	Barren/Other	124.98
	Conifer Forest	47,658.70
	Hardwood Forest	3,150.19
	Herbaceous	1,191.58
	Shrub	2,229.93
	Water	8.90
	Wetland	61.60
Humboldt		
	Agriculture	45,241.74
	Barren/Other	23,829.80
	Conifer Forest	1,524,873.63
	Hardwood Forest	359,476.27
	Hardwood Woodland	22,806.12
	Herbaceous	223,703.23
	Shrub	57,672.81
	Urban	19,441.99
	Water	14,456.18
	Wetland	2226.15
Lake		
	Barren/Other	996.99
	Conifer Forest	106,502.63
	Hardwood Forest	27,644.72
	Hardwood Woodland	3,680.15
	Herbaceous	3,554.28
	Shrub	47,464.78
	Water	2,122.29
	Wetland	404.31
Marin		
	Agriculture	1,911.02
	Barren/Other	23.57
	Conifer Forest	9.34
	Hardwood Forest	78.28
	Hardwood Woodland	683.86
	Herbaceous	19,074.16
	Shrub	589.56
	Urban	64.49
	Water	196.37
	Wetland	73.390
Mendocino		
	Agriculture	50,811.56
	Barren/Other	11,058.47
	Conifer Forest	1,134,790.82
	Hardwood Forest	637,072.97
	Hardwood Woodland	27,779.26
	Herbaceous	233,775.61
	Shrub	131,354.10
	Urban	13,277.94
	Water	5,560.26
	Wetland	233.51
Modoc		
	Agriculture	47,977.17
	Barren/Other	980.08
	Conifer Forest	123,428.92
	Conifer Woodland	180,084.51
	Hardwood Forest	17.12
	Herbaceous	6,263.46
	Shrub	342,761.69
	Urban	9.56
	Water	42,876.60
	Wetland	7,050.29
Siskiyou		
	Agriculture	187,325.83
	Barren/Other	36,332.70
	Conifer Forest	1,941,716.03
	Conifer Woodland	170,262.10
	Desert Shrub	2.67
	Hardwood Forest	188,799.85
	Hardwood Woodland	648.94
	Herbaceous	207,459.24
	Shrub	496,447.33
	Urban	5,614.96
	Water	45,896.69
	Wetland	46,830.07
Sonoma		
	Agriculture	99,451.46
	Barren/Other	4,450.07
	Conifer Forest	206,174.03
	Hardwood Forest	242,044.82
	Hardwood Woodland	29,422.74
	Herbaceous	160,894.71
	Shrub	38,626.23
	Urban	44,364.40
	Water	7,804.20
	Wetland	243.52
Trinity		
	Agriculture	742.12
	Barren/Other	20,984.51
	Conifer Forest	1,570,185.87
	Conifer Woodland	25.13
	Hardwood Forest	235,784.25
	Hardwood Woodland	7,776.84
	Herbaceous	45,974.75
	Shrub	146,710.96
	Urban	1,544.29
	Water	21,064.79
	Wetland	1,925.70

Source: California Department of Forestry and Fire Protection CALFIRE

Table 17 Land Use Types of North Coast Counties

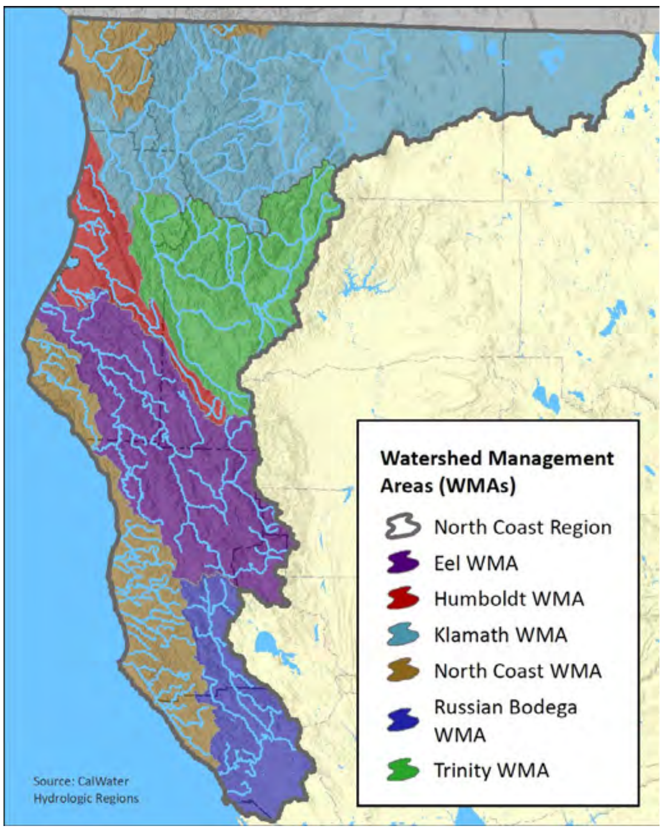
COUNTY	LAND USE	ACRES
Del Norte		
	Barren	8,285.01
	Commercial and Services	87.62
	Conifer Forest	487,409.75
	Cropland and Pasture	10,575.65
	Hardwood Forest	77,041.41
	Herbaceous Rangeland	5,056.09
	Lakes	3,077.47
	Nonforested Wetland	1,191.36
	Other Urban or Built-up Land	2.22
	Residential	1,043.02
	Rural Development	5,460.18
	Shrub and Brush Rangeland	46,808.94
	Streams and Canals	1040.57
	Transportation, Communications, and Utilities	380.51
Glenn		
	Water	1,364.16
	Barren	124.98
	Conifer Forest	47,658.70
	Hardwood Forest	3,150.19
	Herbaceous Rangeland	1,191.58
	Lakes	8.90
	Nonforested Wetland	61.60
	Shrub and Brush Rangeland	2,229.93
Humboldt		
	Barren	23,570.04
	Bays and Estuaries	24.46
	Commercial and Services	445.67
	Conifer Forest	1,522,566.31
	Cropland and Pasture	45,192.59
	Hardwood Forest	381,311.42
	Herbaceous Rangeland	221,390.35
	Lakes	9,014.01
	Nonforested Wetland	2,179.67
	Other Urban or Built-up Land	58.49
	Residential	4,829.70
	Rural Development	18,960.51
	Shrub and Brush Rangeland	57,526.70
	Streams and Canals	5,103.91
	Transportation, Communications, and Utilities	1,240.28
	Water	313.80
Lake		
	Barren	989.65
	Commercial and Services	22.69
	Conifer Forest	106,477.28
	Hardwood Forest	31,283.50
	Herbaceous Rangeland	3,532.70
	Lakes	2,122.29
	Nonforested Wetland	403.42
	Other Urban or Built-up Land	79.39
	Residential	32.47
	Shrub and Brush Rangeland	4,7426.75
Marin		
	Barren	23.57
	Conifer Forest	9.34
	Cropland and Pasture	1,911.02
	Hardwood Forest	762.14
	Herbaceous Rangeland	19,071.93
	Lakes	1,96.37
	Nonforested Wetland	73.39
	Rural Development	64.49
	Shrub and Brush Rangeland	589.56
	Transportation, Communications, and Utilities	2.22
Mendocino		
	Barren	10,989.97
	Commercial and Services	64.49
	Conifer Forest	1,134,264.20
	Cropland and Pasture	50,688.13
	Hardwood Forest	664,278.02
	Herbaceous Rangeland	233,046.60
	Lakes	5,191.08
	Nonforested Wetland	227.29
	Other Urban or Built-up Land	89.18
	Residential	1,308.33
	Rural Development	13,070.23
	Shrub and Brush Rangeland	131,338.09
	Streams and Canals	329.14
	Transportation, Communications, and Utilities	789.72
	Water	40.03
Modoc		
	Barren	980.08
	Commercial and Services	38.47
	Conifer Forest	303,460.28
	Cropland and Pasture	47,900.66
	Hardwood Forest	17.12
	Herbaceous Rangeland	6,263.46
	Lakes	42,876.60
	Nonforested Wetland	7,042.72
	Other Urban or Built-up Land	1.33
	Residential	54.26
	Rural Development	9.56
	Shrub and Brush Rangeland	342,637.15
	Transportation, Communications, and Utilities	167.68
Siskiyou		
	Barren	3,6024.46
	Commercial and Services	435.89
	Conifer Forest	2,111,430.16
	Cropland and Pasture	187,155.25
	Hardwood Forest	189,276.43
	Herbaceous Rangeland	206,740.25
	Lakes	44,543.65
	Nonforested Wetland	46,698.63
	Other Urban or Built-up Land	95.41
	Residential	760.80
	Rural Development	5,203.76
	Shrub and Brush Rangeland	495,987.42
	Streams and Canals	404.53
	Transportation, Communications, and Utilities	1,631.25
	Water	948.50
Sonoma		

COUNTY	LAND USE	ACRES
	Barren	4,366.23
	Commercial and Services	87.62
	Conifer Forest	205,042.50
	Cropland and Pasture	99,397.42
	Hardwood Forest	269,688.65
	Herbaceous Rangeland	159,197.19
	Lakes	6,748.94
	Nonforested Wetland	234.85
	Other Urban or Built-up Land	135.66
	Residential	4,470.31
	Rural Development	44,110.65
	Shrub and Brush Rangeland	38,579.31
	Streams and Canals	1,055.03
	Transportation, Communications, and Utilities	361.61
	Water	0.22
Trinity		
	Barren	20,911.56
	Commercial and Services	80.28
	Conifer Forest	1,570,020.41
	Cropland and Pasture	742.12
	Hardwood Forest	243,496.60
	Herbaceous Rangeland	45,952.06
	Lakes	21,047.22
	Nonforested Wetland	1,922.81
	Other Urban or Built-up Land	7.12
	Residential	345.60
	Rural Development	1,508.27
	Shrub and Brush Rangeland	146,599.10
	Streams and Canals	17.57
	Communications and Utilities	68.50

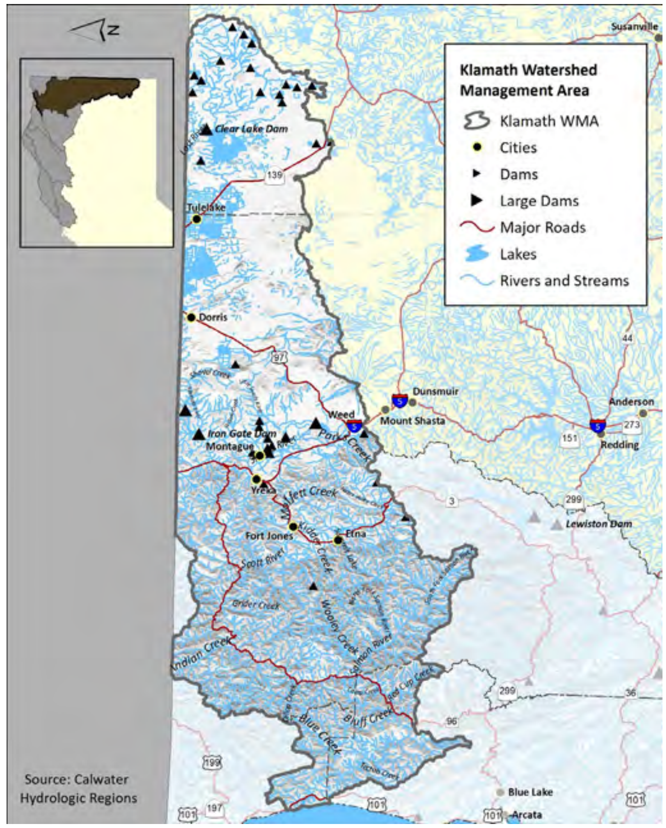
Source: California Department of Forestry and Fire Protection CALFIRE

APPENDIX F. WATERSHED MANAGEMENT AREA PROFILE

Following are descriptions of each Watershed Management Area (WMA, as defined by the SWRCB WMI); see Watershed Management Areas Map. Where possible, the WMA profiles describe of a range of surface and groundwater conditions and examples of some water-related issues that have been identified by local stakeholders. Tables that summarize select Region attributes at the WMA (basin) level follow these descriptions.



Klamath Watershed Management Area



The Klamath WMA has been divided into three sub-basins: Lower Klamath, Middle Klamath and the Upper Klamath and includes the hydrologic basins of the Klamath, Lower Klamath, Salmon River, Middle Klamath, Scott River, Shasta River, Upper Klamath, Butte Valley and Lost River. The Klamath River and its estuary are designated as a Critical Coastal Area.

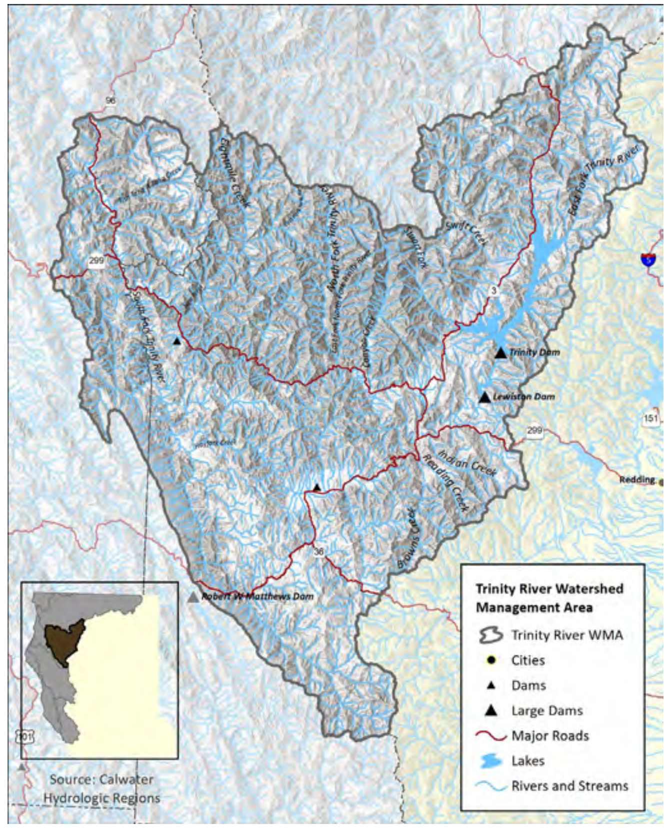
The Lower Klamath sub-watershed includes the Klamath River and its tributaries downstream from the Scott River, excluding the Trinity River. It covers 2,564 square miles and includes the Salmon and Blue Rivers and the Klamath River delta/estuary (NCRWQCB 2005). This sub-watershed contains mountainous terrain that has historically supported the silvicultural economy of the small communities along the Lower Klamath River. Limited mining activities also occurred in the Region historically. Salmon fishing has been important in the Region since the occupation by the Karuk and Yurok Tribes, which have their ancestral communities along the River. Today, recreational fishing joins traditional fishing as an important part of the area's economic and social structure.

The Middle Klamath basin encompasses the portion of the Klamath River and tributaries between the confluence of the Klamath and Scott Rivers and Iron Gate Dam including the mainstem of the Klamath River and the Shasta and

Scott River watersheds. The basin covers 2,850 square miles (NCRWQCB 2005). Both the Shasta and Scott Rivers receive water from precipitation and snowmelt. The small towns in the watershed, including Etna, Fort Jones, and Callahan, have historically had a silvicultural and agricultural economic base. In the 1800's, the alluvial plains were mined extensively and more recently, channeling for flood control has altered the morphological characteristics of these systems. Yreka and Weed contain the largest populations in this sub-watershed.

The Upper Klamath basin encompasses the area upstream of the Iron Gate Dam. Only a small part of this area is located in California. The primary sub-watershed in California is the Lost River watershed, which covers approximately 1,689 square miles and includes the Clear Lake Reservoir (NCRWQCB 2005). The area around Clear Lake is characterized by high desert streams and is sparsely settled. Land uses in the California portion of the basin are primarily crop agriculture, grazing, and lands administered for the 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. In addition, the Irongate fish hatchery has an NPDES permit, which has a stipulated minimum flow requirement.

Trinity River Watershed Management Area



The Trinity River WMA 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 reservations to its confluence with the Klamath River (NCRWQCB 2005). Much of the WMA is prone to seismically induced landslides, especially during winter months when soils are saturated. Additionally, inner valley gorges are considered highly unstable. Groundwater resources are relatively plentiful throughout the WMA, 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.

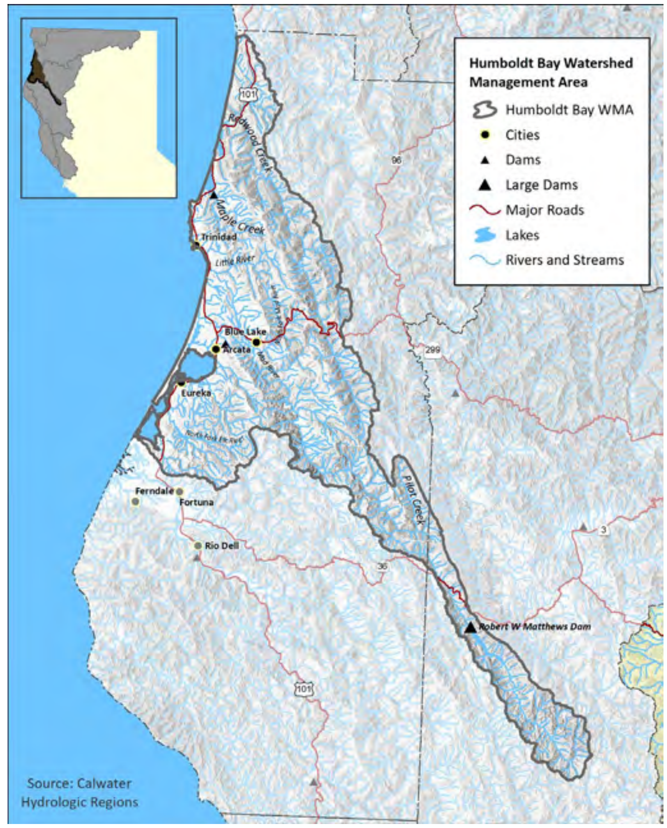
The Trinity River watershed is primarily rural with human populations centered near Trinity Center, Weaverville, Lewiston, Hayfork and Hyampom. Timber harvest has traditionally been a large factor in the economy on both federal and private land. The US Forest Service (USFS) and the Bureau of Land Management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

Trinity WMA; of the remaining 20 percent, about half are industrial timberlands (NCRWQCB 2005).

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 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 (*Salmo trutta*).

Water quality in the 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 dredging causes sedimentation, especially in the mainstem and canyon areas, and legacy effects from historic gold mining include acid mine drainage and mercury pollution.

Humboldt Bay Watershed Management Area



The Humboldt Bay WMA encompasses waterbodies that drain to the Pacific Ocean from Humboldt Bay north to Redwood Creek. The major river systems in the WMA are the Mad River and Redwood Creek; other waterbodies include Humboldt Bay and Mad River Slough, and 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. Redwood Creek, the Kelpbeds at Trinidad Head, and the Mad River are the Critical Coastal Areas that occur in this WMA (NCRWQCB, 2005). The streams support production of anadromous salmonids, including steelhead and cutthroat trout, coho and Chinook salmon.

Mad River

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 the bay. 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 and rural residential areas are scattered throughout the WMA. The majority of the population lives in the Humboldt Bay area cities of Arcata and Eureka.

The Mad River is 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 the 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 contaminated with heavy metals, petroleum products, and pentachlorophenols (PCPs). The waterfront is now undergoing redevelopment and decontamination efforts.

Redwood Creek

Redwood Creek flows into the Pacific Ocean near the town of Orick and is located about 35 miles north of Eureka. Redwood Creek drains a 285-mi2 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 (*O. clarki*) and resident fish species (RNSP 1997). The watershed also provides domestic water supplies to rural communities and recreational opportunities. At the coast, Redwood Creek discharges into a designated Water Quality Protection Area (formerly known as Areas of Special Biological Significance) (SWRCB 2001, SWRCB 2003) and a Critical Coastal Area (CCC 2003).

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, and provide 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 seemly conflicting interests. The watershed is home to pioneering work in watershed restoration and erosion control.

The 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 (RNSP 2001). Located along the coast, the small town of Orick is the only municipality in the watershed and has a population of about 315 people (HC 2003). Orick is located in the valley, relatively isolated from other north coast 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 (DWR 2003). Orick is located in the valley. Orick is the major socioeconomic center in the watershed. It is located along U.S. Highway 101 and is the southern gateway to Redwood National and State Parks.

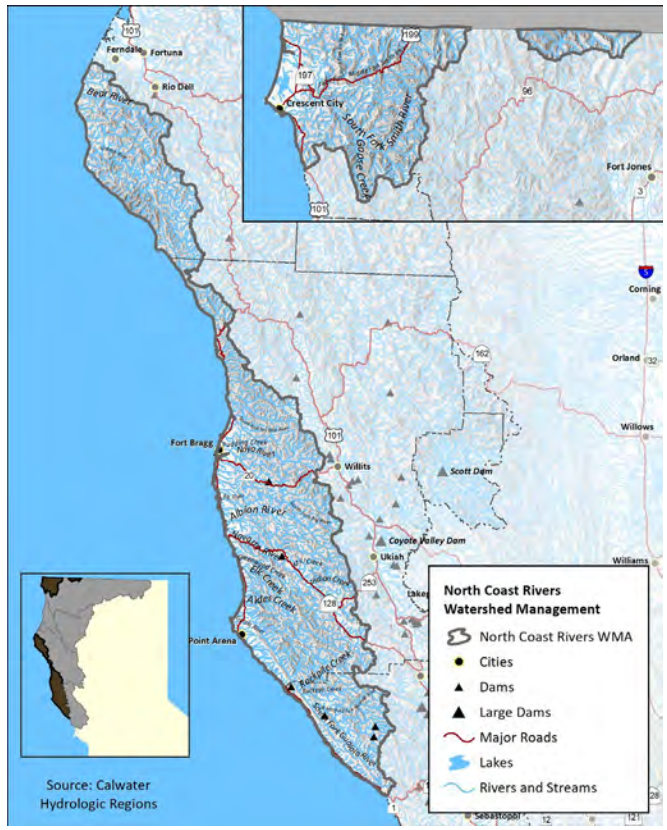
Redwood National Park and Prairie Creek Redwoods State Park are located in the lower part of the Redwood Creek basin. This sub basin has been extensively researched and is considered a "reference watershed" that displays nearly pristine conditions, and is home to significant old growth stands of coast 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.

Eel River Watershed Management Area

The Eel River WMA encompasses roughly 3,684 square miles (NCRWQCB, 2005). 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 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. The Eel River is designated as a Critical Coastal Area.

In the west, the river meanders on a coastal plain and is joined by the Salt River. Several dairies are located on the coastal plain, as well as several small towns. Other communities in the watershed include Scotia, Garberville, Laytonville, and Willits. In many of the alluvial valleys, surface and groundwater 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. Recently, reviving the railroad has been discussed, but the costs may outweigh the benefits (NCRWQCB 2005). The rail line has negatively impacted water quality. The Eel River WMA is a well-known recreation destination with numerous state and private campgrounds along its length; beneficial uses include both water contact and non-contact uses such as swimming and boating. The river also supports a large recreational fishing industry; it is the third largest producer of salmon and steelhead in the State of California (NCRWQCB 2005). Due to the erodible soils, steep terrain, and land use history, there is significant concern for the viability of this anadromous fishery resource.

North Coast Rivers Watershed Management Area



The North Coast rivers not included in other WMAs are included in this grouping. The major watersheds south of the Oregon border include the Smith River, 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 (NCRWQCB, 2005). The twelve Critical Coastal Areas in the North Coast WMA 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.

Mattole River

The headwaters of the Mattole River begin in Mendocino County, and it flows north 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, and commercial timber companies own 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 (*Oncorhynchus mykiss*), and brook lamprey (*Ichthyomyzon fossor*); other species include the southern torrent salamander (*Rhyacotriton variegatus*) and tailed frog (*Ascaphus truei*).

Ten Mile River

The Ten Mile River watershed covers approximately 120 square miles (NCRWQCB 2005). 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 level and 3,205 feet (NCRWQCB 2005). 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 70 inches per year while about 40 inches per year occurs in the eastern part of the watershed (NCRWQCB 2005).

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 cold water 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 (NCRWQCB 2005).

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 (NCRWQCB 2005). 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 (NCRWQCB 2005). 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 Rivers 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 (NCRWQCB 2005). The Big River is designated a Critical Coastal Area.

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 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. 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 (NCRWQCB 2005).

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.

Albion River

The Albion River watershed drains approximately 43 square miles (NCRWQCB 2005). 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 (NCRWQCB 2005). 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 50 to 55 inches to the east at Willits (NCRWQCB 2005). 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. The Albion River estuary has been designated as a Critical Coastal Area.

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 (NCRWQCB 2005). 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. The Navarro River watershed is the largest coastal basin in Mendocino County. Rainfall averages about 40 inches per year at Philo and mostly occurs between December and March (NCRWQCB 2005). The Navarro River is a designated Critical Coastal Area.

Land-uses in the watershed include silviculture (70%), rangeland (25%), and agriculture (5%) with a small percentage devoted to rural residential development (NCRWQCB 2005). 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 (NCRWQCB 2005).

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 percent as Timber Production Zone (TPZ) land, and approximately 50 smaller landowners own the rest of the land within the watershed (NCRWQCB 2005). 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 (NCRWQCB 2005). 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 watershed contains the Garcia River and the Kelpbeds at Saunders Reef Critical Coastal Areas.

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 entire watershed is privately owned by multiple owners (NCRWQCB 2005). 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 to Sonoma County in a north-south direction, reaching the ocean at the town of Gualala. The watershed contains mostly mountainous terrain; 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 (NCRWQCB 2005).

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 (NCRWQCB 2005). 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 the towns of Sea Ranch and Gualala. The watershed supports an anadromous fishery that includes coho salmon.

Russian/Bodega Watershed Management Area

The Russian/Bodega WMA includes the Russian River and Bodega hydrologic units including the Bodega Harbor, Salmon Creek, Americano Creek, and Stemple Creek watersheds.

Russian River Hydrologic Unit

The Russian River hydrologic unit (HU) encompasses 1,485 square miles in Mendocino and Sonoma counties. It is bounded by the coast ranges to the east and west. The mainstem is 110 miles long and flows from north of Ukiah southward through Redwood Valley to its confluence with Mark West Creek, where it turns west, passes through the coast range, and empties into the Pacific Ocean (NCRWQCB 2005). 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.

The reservoirs that provide flood protection and water supply storage include Lake Sonoma (Warm Springs Dam) on 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 for the purpose of power production provides considerable benefit to the overall water storage in Lake Mendocino. The Russian River hydrologic unit supplies drinking water for more than 600,000 people in Sonoma and northern Marin counties. It also provides water for agricultural, municipal, and industrial purposes.

Bodega Hydrologic Unit

The Bodega HU contains streams with headwaters in the Coast Range that enter the Pacific Ocean south of the Russian River. Salmon, Americano, and Stemple Creeks and their associated estuaries are the main waterbodies in this HU. 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 HU. Because of the Mediterranean climate, summertime flows are often non-existent in Americano and Stemple Creeks, while Salmon Creek flow is low but sustained. Each of these watersheds have estuary area, 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. Both of these estuaries as well as the Bodega Marine Life Refuge are designated Critical Coastal Areas.

Table 18 Land Owner Types of North Coast WMAs

WMA NAME	LAND OWNER	ACRES
Eel Watershed Management Area	Private Other	1,567,965.96
	City	251.53
	County	247.95
	Federal	711,027.69
	Non Profit	1,091.79
	Special District	107.12
	State	75,370.61
Humboldt Watershed Management Area	Private Other	492,869.19
	City	1,548.39
	County	518.80
	Federal	203,748.23
	Non Profit	35.26
	Special District	443.02
	State	19,647.80
Klamath Watershed Management Area	Private Other	1,603,741.62
	City	461.67
	County	4.589
	Federal	2,865,237.28
	Non Profit	5,828.82
	Special District	1,441.81
	State	27,568.19
North Coast Watershed Management Area	Private Other	1,228,591.74
	City	61.06
	County	762.29
	Federal	484,439.96
	Non Profit	45,443.82
	Special District	8.56
	State	140,189.78
Russian Bodega Watershed Management Area	Private Other	940216.02
	City	3064.84
	County	3017.26
	Federal	52058.89
	Non Profit	10222.72
	Special District	6755.76
	State	28286.07
Trinity Watershed Management Area	Private Other	484,154.22
	County	16.50
	Federal	1,415,711.06
	Special District	48.40
	State	814.55

Source: California Protected Areas Database (CPAD — www.calands.org)

Table 19 Groundwater Basins of North Coast WMAs

WMA NAME	GROUNDWATER BASINS	SUB-BASINS
Eel WMA	1-10 Eel River Valley	
	1-11 Covelo Round Valley	
	1-12 Laytonville Valley	
	1-13 Little Lake Valley	
	1-30 Pepperwood Town Area	
	1-31 Weott Town Area	
	1-32 Garberville Town Area	
	1-33 Larabee Valley	
	1-34 Dinsmores Town Area	
	1-36 Hettenshaw Valley	
	1-38 Lower Laytonville Valley	
	1-39 Branscomb Town Area	
	1-42 Sherwood Valley	
	1-43 Williams Valley	
	1-44 Eden Valley	
	1-48 Gravelly Valley	
	1-9 Eureka Plain	
Humboldt WMA	1-10 Eel River Valley	
	1-25 Prairie Creek Area	
	1-26 Redwood Creek Area	
	1-27 Big Lagoon Area	
	1-8.01 Mad River Valley	1-8.01 Dows Prairie School
	1-8.02 Mad River Valley	1-8.02 Mad River Lowland
	1-9 Eureka Plain	
Klamath WMA	1-14 Lower Klamath River Valley	
	1-15 Happy Camp Town Area	
	1-16 Seiad Valley	
	1-17 Bray Town Area	
	1-18 Red Rock Valley	
	1-2.01 Klamath River Valley	1-2.01 Tule Lake
	1-2.02 Klamath River Valley	1-2.02 Lower Klamath
	1-22 Fairchild Swamp Valley	
	1-25 Prairie Creek Area	
	1-3 Butte Valley	
	1-4 Shasta Valley	Shasta Valley
	1-5 Scott River Valley	
North Coast WMA	1-1 Smith River Plain	
	1-10 Eel River Valley	
	1-14 Lower Klamath River Valley	
	1-19 Anderson Valley	
	1-20 Garcia River Valley	
	1-21 Fort Bragg Terrace Area	
	1-28 Mattole River Valley	
	1-29 Honeydew Town Area	
	1-37 Cottoneva Creek Valley	
	1-40 Ten Mile River Valley	
	1-41 Little Valley	
	1-45 Big River Valley	
	1-46 Navarro River Valley	
	1-49 Annapolis Ohlson Ranch Fm Highlands	
	1-61 Fort Ross Terrace Deposits	

WMA NAME	GROUNDWATER BASINS	SUB-BASINS
Russian Bodega WMA	1-50 Knights Valley	
	1-51 Potter Valley	
	1-52 Ukiah Valley	
	1-53 Sanel Valley	
	1-54.01 Alexander Valley	1-54.01 Alexander Area
	1-54.02 Alexander Valley	1-54.02 Cloverdale Area
	1-55.01 Santa Rosa Valley	1-55.01 Santa Rosa Plain
	1-55.02 Santa Rosa Valley	1-55.02 Healdsburg Area
	1-55.03 Santa Rosa Valley	1-55.03 Rincon Valley
	1-56 Mcdowell Valley	
	1-57 Bodega Bay Area	
	1-59 Wilson Grove Formation Highlands	
	1-60 Lower Russian River Valley	
	1-61 Fort Ross Terrace Deposits	
	2-19 Kenwood Valley	
Trinity WMA	1-35 Hyampom Valley	
	1-6 Hayfork Valley	
	1-62 Wilson Point Area	
	1-7 Hoopa Valley	

Source: California Department of Water Resources

Table 20 Land Cover Types of North Coast WMAs

WMA NAME	TYPE (WHR13)	ACRES
Eel WMA	Agriculture	4,4630.38
	Barren/Other	20,522.82
	Conifer Forest	1,254,520.47
	Hardwood Forest	576,268.21
	Hardwood Woodland	22,453.41
	Herbaceous	260,219.18
	Shrub	158,792.88
	Urban	6,423.81
	Water	10,638.37
	Wetland	1,551.63
Humboldt WMA	Agriculture	12,300.08
	Barren/Other	6,488.08
	Conifer Forest	518,240.01
	Hardwood Forest	84,656.35
	Hardwood Woodland	3,622.55
	Herbaceous	46,478.47
	Shrub	26,508.74
	Urban	13,763.20
	Water	5,476.64
	Wetland	1,250.96
Klamath WMA	Agriculture	235,705.75
	Barren/Other	39,668.59
	Conifer Forest	2,376,493.04
	Conifer Woodland	350,346.61
	Desert Shrub	2.67
	Hardwood Forest	270,506.61
	Hardwood Woodland	9,220.3909
	Herbaceous	216,940.50
	Shrub	853,362.52
	Urban	5,954.11
	Water	92,522.38
	Wetland	53,520.52
North Coast WMA	Agriculture	19,178.90
	Barren/Other	17,262.32
	Conifer Forest	1,326,623.44
	Hardwood Forest	276,261.01
	Hardwood Woodland	9,672.07
	Herbaceous	161,341.05
	Shrub	72,113.42
	Urban	9,296.67
	Water	5,930.09
	Wetland	1,700.86
Russian Bodega WMA	Agriculture	131,002.27
	Barren/Other	3,908.77
	Conifer Forest	148,084.68
	Hardwood Forest	365,092.12
	Hardwood Woodland	39,326.77
	Herbaceous	209,169.89
	Shrub	84,953.47
	Urban	51,733.82
	Water	10,012.78
	Wetland	316.91
Trinity WMA	Agriculture	1,272.31
	Barren/Other	19,441.10
	Conifer Forest	1,519,306.48
	Conifer Woodland	25.13
	Hardwood Forest	198,583.56
	Hardwood Woodland	8,517.19
	Herbaceous	13,144.28
	Shrub	114,976.45
	Urban	2,667.82
	Water	20,888.21
	Wetland	1,903.01

Source: California Department of Forestry and Fire Protection CALFIRE

Table 21 Land Use Types of North Coast WMAs

WMA	LAND USE	ACRES
Eel WMA	Barren	20,421.63
	Commercial and Services	118.09
	Conifer Forest	1,253,917.79
	Cropland and Pasture	44,592.13
	Hardwood Forest	598,239.24
	Herbaceous Rangeland	259,458.15
	Lakes	8,081.96
	Nonforested Wetland	1,550.74
	Other Urban or Built-up Land	132.55
	Residential	1,145.10
	Rural Development	6,266.13
	Shrub and Brush Rangeland	158,742.40
	Streams and Canals	2,556.40
	Transportation, Communications, Utilities	798.83

WMA	LAND USE	ACRES
Humboldt WMA	Barren	6,331.51
	Bays and Estuaries	24.46
	Commercial and Services	305.57
	Conifer Forest	516,429.07
	Cropland and Pasture	12,281.85
	Hardwood Forest	87,538.78
	Herbaceous Rangeland	44,656.40
	Lakes	4,720.50
	Nonforested Wetland	1,205.14
	Other Urban or Built-up Land	33.14
	Residential	4,076.23
	Rural Development	13,444.07
	Shrub and Brush Rangeland	26,365.96
	Streams and Canals	687.19
	Transportation, Communications, Utilities	640.71
	Water	44.48
Klamath WMA	Barren	39284.74
	Commercial and Services	547.53
	Conifer Forest	2726162.70
	Cropland and Pasture	235458.67
	Hardwood Forest	279509.28
	Herbaceous Rangeland	216200.82
	Lakes	87952.88
	Nonforested Wetland	53378.19
	Other Urban or Built-up Land	96.74
	Residential	825.74
	Rural Development	5527.56
	Shrub and Brush Rangeland	852774.07
	Streams and Canals	3062.57
	Transportation, Communications, Utilities	1955.27
	Water	1506.93
North Coast WMA	Barren	17,057.72
	Commercial and Services	90.96
	Conifer Forest	1,325,779.68
	Cropland and Pasture	19,100.62
	Hardwood Forest	285,652.87
	Herbaceous Rangeland	160,648.74
	Lakes	4,656.45
	Nonforested Wetland	1,693.96
	Other Urban or Built-up Land	103.19
	Residential	1622.80
	Rural Development	9207.49
	Shrub and Brush Rangeland	72065.61
	Streams and Canals	158.34
	Transportation, Communications, and Utilities	426.10
	Water	1115.30

WMA	LAND USE	ACRES
Russian Bodega WMA	Barren	3,820.26
	Commercial and Services	94.29
	Conifer Forest	146,923.12
	Cropland and Pasture	130,857.27
	Hardwood Forest	402,336.18
	Herbaceous Rangeland	207,386.07
	Lakes	8,957.75
	Nonforested Wetland	308.24
	Other Urban or Built-up Land	73.39
	Residential	4,826.81
	Rural Development	51,339.96
	Shrub and Brush Rangeland	84,906.55
	Streams and Canals	1,055.03
	Transportation, Communications, and Utilities	716.55
Trinity WMA	Barren	19,349.92
	Commercial and Services	106.30
	Conifer Forest	1,519,133.24
	Cropland and Pasture	1272.31
	Hardwood Forest	207,029.36
	Herbaceous Rangeland	13,092.91
	Lakes	20,456.99
	Nonforested Wetland	1,899.45
	Other Urban or Built-up Land	29.80
	Residential	347.82
	Rural Development	2,602.44
	Shrub and Brush Rangeland	114,869.48
	Streams and Canals	431.22
	Transportation, Communications, and Utilities	104.30

Source: California Department of Forestry and Fire Protection CALFIRE

APPENDIX G. NORTH COAST REGION PROTECTED AREAS

Table 22 Protected Area Listing

AGENCY/ ENTITY NAME	UNIT NAME	LOCATION
California Academy of Sciences	Pepperwood Ranch Natural Preserve	Sonoma
California Dept. of Fish & Wildlife	Atascadero Creek Ecological Reserve	Sonoma
California Dept. of Fish & Wildlife	Bracut Tidelands	Humboldt
California Dept. of Fish & Wildlife	Butte Valley WA	Siskiyou
California Dept. of Fish & Wildlife	Cedar Point	Siskiyou
California Dept. of Fish & Wildlife	Cemetery Hole FA	Trinity
California Dept. of Fish & Wildlife	China Point ER	Siskiyou
California Dept. of Fish & Wildlife	Crescent City Marsh WA	Del Norte
California Dept. of Fish & Wildlife	Deadwood Hole FA	Trinity
California Dept. of Fish & Wildlife	Eel River WA	Humboldt
California Dept. of Fish & Wildlife	Eel River--Rio Dell FA	Humboldt
California Dept. of Fish & Wildlife	Elk Creek Wetlands WA	Del Norte
California Dept. of Fish & Wildlife	Fay Slough WA	Humboldt
California Dept. of Fish & Wildlife	Grass Lake WA	Siskiyou
California Dept. of Fish & Wildlife	Harrison Grade Serpentine	Sonoma
California Dept. of Fish & Wildlife	Healdsburg FA	Sonoma
California Dept. of Fish & Wildlife	Horseshoe Ranch WA	Siskiyou
California Dept. of Fish & Wildlife	Indian Creek PA	Trinity
California Dept. of Fish & Wildlife	Irongate FH	Siskiyou
California Dept. of Fish & Wildlife	Klamath River FA	Siskiyou
California Dept. of Fish & Wildlife	Klamathon Station	Siskiyou
California Dept. of Fish & Wildlife	Laguna De Santa Rosa ER	Sonoma
California Dept. of Fish & Wildlife	Laguna Wildlife Area	Sonoma
California Dept. of Fish & Wildlife	Lake Earl WA	Del Norte
California Dept. of Fish & Wildlife	Lewiston FA	Trinity
California Dept. of Fish & Wildlife	Little Butte ER	Mendocino
California Dept. of Fish & Wildlife	Little Red Mountain ER	Mendocino
California Dept. of Fish & Wildlife	Luffenholtz Creek FA	Humboldt
California Dept. of Fish & Wildlife	Mad River FH	Humboldt
California Dept. of Fish & Wildlife	Mad River Slough WA	Humboldt
California Dept. of Fish & Wildlife	Mattole River ER	Mendocino
California Dept. of Fish & Wildlife	Mill Creek	Mendocino
California Dept. of Fish & Wildlife	Mud Lake WA	Siskiyou
California Dept. of Fish & Wildlife	Noyo River FA	Mendocino
California Dept. of Fish & Wildlife	Owl Creek ER	Humboldt
California Dept. of Fish & Wildlife	Pebble Beach FA	Del Norte
California Dept. of Fish & Wildlife	Samoa Peninsula PA	Humboldt
California Dept. of Fish & Wildlife	Shasta River FA	Siskiyou
California Dept. of Fish & Wildlife	Shasta Valley WA	Siskiyou
California Dept. of Fish & Wildlife	Sheepy Ridge WA	Siskiyou
California Dept. of Fish & Wildlife	Smith River FA	Del Norte
California Dept. of Fish & Wildlife	South Fork Eel River FA	Humboldt
California Dept. of Fish & Wildlife	South Kibesillah Gulch FA	Mendocino
California Dept. of Fish & Wildlife	South Spit Humboldt Bay	Humboldt
California Dept. of Fish & Wildlife	Table Bluff ER	Humboldt
California Dept. of Fish & Wildlife	Theiller Sebastopol Meadowfoam ER	Sonoma
California Dept. of Fish & Wildlife	Trinity River FA	Trinity
California Dept. of Fish & Wildlife	WAukell Creek WA	Del Norte
California Dept. of Fish & Wildlife	Yorkville ER	Mendocino
California Dept. of Fish & Wildlife	Yreka Screen Shop	Siskiyou
CDF/ CAL FIRE	Ellen Pickett State Forest	Trinity
CDF/ CAL FIRE	Jackson Demonstration State Forest	Mendocino
California Dept of Parks & Recreation	Admiral William Standley State Recreation Area	Mendocino
California Dept of Parks & Recreation	Annadel State Park	Sonoma
California Dept of Parks & Recreation	Armstrong Redwoods State Reserve	Sonoma
California Dept of Parks & Recreation	Austin Creek State Recreation Area	Sonoma
California Dept of Parks & Recreation	Benbow Lake State Recreation Area	Humboldt
California Dept of Parks & Recreation	Bothe-Napa Valley State Park	Sonoma
California Dept of Parks & Recreation	Caspar Headlands State Beach	Mendocino
California Dept of Parks & Recreation	Caspar Headlands State Natural Reserve	Mendocino
California Dept of Parks & Recreation	Del Norte Redwoods State Park	Del Norte
California Dept of Parks & Recreation	Fort Humboldt SHP	Humboldt
California Dept of Parks & Recreation	Fort Ross State Historic Park	Sonoma
California Dept of Parks & Recreation	Greenwood State Beach	Mendocino
California Dept of Parks & Recreation	Grizzly Creek Redwoods State Park	Humboldt
California Dept of Parks & Recreation	Harry A. Merlo State Recreation Area	Humboldt
California Dept of Parks & Recreation	Hendy Woods State Park	Mendocino
California Dept of Parks & Recreation	Humboldt Lagoons State Park	Humboldt
California Dept of Parks & Recreation	Humboldt Redwoods State Park	Humboldt
California Dept of Parks & Recreation	Jedediah Smith Redwoods State Park	Del Norte
California Dept of Parks & Recreation	John B. Dewitt Redwoods State Reserve	Humboldt
California Dept of Parks & Recreation	Jug Handle State Reserve	Mendocino
California Dept of Parks & Recreation	Kruse Rhododendron State Reserve	Sonoma
California Dept of Parks & Recreation	Little River State Beach	Humboldt
California Dept of Parks & Recreation	MacKerricher State Park	Mendocino
California Dept of Parks & Recreation	Mailliard Redwoods State Reserve	Mendocino
California Dept of Parks & Recreation	Manchester State Park	Mendocino
California Dept of Parks & Recreation	Mendocino Headlands State Park	Mendocino
California Dept of Parks & Recreation	Montgomery Woods State Reserve	Mendocino
California Dept of Parks & Recreation	Navarro River Redwoods State Park	Mendocino
California Dept of Parks & Recreation	Patrick's Point State Park	Humboldt
California Dept of Parks & Recreation	Pelican State Beach	Del Norte
California Dept of Parks & Recreation	Point Cabrillo Light Station	Mendocino
California Dept of Parks & Recreation	Prairie Creek Redwoods State Park	Humboldt
California Dept of Parks & Recreation	Reynolds Wayside Campgrounds	Mendocino
California Dept of Parks & Recreation	Richardson Grove State Park	Humboldt
California Dept of Parks & Recreation	Robert Louis Stevenson State Park	Sonoma
California Dept of Parks & Recreation	Russian Gulch State Park	Mendocino
California Dept of Parks & Recreation	Salt Point State Park	Sonoma
California Dept of Parks & Recreation	Schooner Gulch State Beach	Mendocino
California Dept of Parks & Recreation	Sinkyone Wilderness State Park	Mendocino
California Dept of Parks & Recreation	Smithe Redwoods State Reserve	Mendocino
California Dept of Parks & Recreation	Sonoma Coast State Beach	Sonoma
California Dept of Parks & Recreation	Standish-Hickey State Recreation Area	Mendocino
California Dept of Parks & Recreation	Sugar Loaf Ridge State Park	Sonoma
California Dept of Parks & Recreation	Tolowa Dunes State Park	Del Norte
California Dept of Parks & Recreation	Trinidad State Beach	Humboldt
California Dept of Parks & Recreation	Van Damme State Park	Mendocino
California Dept of Parks & Recreation	Weaverville Joss House State Historic Park	Trinity
California State Coastal Conservancy	Santa Rosa Plain Vernal Pool ER	Sonoma
California State Lands Commission	California State Lands Commission	Trinity
California State University, Sonoma	Fairfield Osborn Preserve	Sonoma
Cloverdale, City of	Cloverdale River Park	Sonoma
Cotati, City of	Helen Putnam Park	Sonoma
Cotati, City of	Kotate Park	Sonoma

AGENCY/ ENTITY NAME	UNIT NAME	LOCATION
Cotati, City of	La Plaza Park	Sonoma
Cotati, City of	Sunflower Park	Sonoma
Cotati, City of	Veterans Park	Sonoma
Healdsburg, City of	Badger Park and Community Garden	Sonoma
Healdsburg, City of	Gibbs Park	Sonoma
Healdsburg, City of	Healdsburg Rec Park	Sonoma
Healdsburg, City of	Plaza Park	Sonoma
Healdsburg, City of	Railroad Park	Sonoma
Land Trust of Napa County	McCord	Sonoma
Other State	Other State	Siskiyou
Rohnert Park, City of	Alicia Park	Sonoma
Rohnert Park, City of	Benicia Park	Sonoma
Rohnert Park, City of	Caterpillar Park	Sonoma
Rohnert Park, City of	Colegio Vista Park	Sonoma
Rohnert Park, City of	Dorotea Park	Sonoma
Rohnert Park, City of	Eagle Park	Sonoma
Rohnert Park, City of	Golis Park	Sonoma
Rohnert Park, City of	Honeybee Park	Sonoma
Rohnert Park, City of	Ladybug Park	Sonoma
Rohnert Park, City of	Magnolia Park	Sonoma
Rohnert Park, City of	Rainbow Park	Sonoma
Rohnert Park, City of	San Simeon Park	Sonoma
Rohnert Park, City of	Sunrise Park	Sonoma
Santa Rosa, City of	A Place to Play Park	Sonoma
Santa Rosa, City of	Alpha Farm	Sonoma
Santa Rosa, City of	Bellevue Ranch	Sonoma
Santa Rosa, City of	Bicentennial Park	Sonoma
Santa Rosa, City of	Brendon Park	Sonoma
Santa Rosa, City of	Brown Farm	Sonoma
Santa Rosa, City of	Brush Creek Park	Sonoma
Santa Rosa, City of	Coffey Park	Sonoma
Santa Rosa, City of	Colgan Creek Park	Sonoma
Santa Rosa, City of	DeMeo Park	Sonoma
Santa Rosa, City of	DeTurk Park	Sonoma
Santa Rosa, City of	Doyle Park	Sonoma
Santa Rosa, City of	Dutch Flohr Park	Sonoma
Santa Rosa, City of	Eastside Park	Sonoma
Santa Rosa, City of	Finley Community Center	Sonoma
Santa Rosa, City of	Fir Ridge Park	Sonoma
Santa Rosa, City of	Fountain Grove Park	Sonoma
Santa Rosa, City of	Francis Nielsen Ranch	Sonoma
Santa Rosa, City of	Franklin Park	Sonoma
Santa Rosa, City of	Fremont Park	Sonoma
Santa Rosa, City of	Galvin Park	Sonoma
Santa Rosa, City of	Haydn Village Park	Sonoma
Santa Rosa, City of	Hidden Valley Park	Sonoma
Santa Rosa, City of	Howarth Park	Sonoma
Santa Rosa, City of	Humboldt Park	Sonoma
Santa Rosa, City of	Jacobs Park	Sonoma
Santa Rosa, City of	Jennings Park	Sonoma
Santa Rosa, City of	Julliard Park	Sonoma
Santa Rosa, City of	Kelly Farm	Sonoma
Santa Rosa, City of	Live Oak Park	Sonoma
Santa Rosa, City of	Martin Luther King Park	Sonoma
Santa Rosa, City of	Matanzas Park	Sonoma
Santa Rosa, City of	Mesquite Park	Sonoma
Santa Rosa, City of	North Park	Sonoma
Santa Rosa, City of	Northwest Community Park	Sonoma
Santa Rosa, City of	Oak Lake Green Park	Sonoma
Santa Rosa, City of	Olive Park	Sonoma
Santa Rosa, City of	Palm Terrace	Sonoma

AGENCY/ ENTITY NAME	UNIT NAME	LOCATION
Santa Rosa, City of	Paulin Creek Preserve	Sonoma
Santa Rosa, City of	Pear Blossom Park	Sonoma
Santa Rosa, City of	Peter Springs Park	Sonoma
Santa Rosa, City of	Peterson Lane Park	Sonoma
Santa Rosa, City of	Pioneer Park	Sonoma
Santa Rosa, City of	Rae Park	Sonoma
Santa Rosa, City of	Red Hawk Park	Sonoma
Santa Rosa, City of	Rincon Ridge Park	Sonoma
Santa Rosa, City of	Rincon Valley Community Park	Sonoma
Santa Rosa, City of	Rinconada Park	Sonoma
Santa Rosa, City of	Sebastopol Railroad	Sonoma
Santa Rosa, City of	Skyhawk Parks	Sonoma
Santa Rosa, City of	Sonoma Avenue Park	Sonoma
Santa Rosa, City of	South Davis Park	Sonoma
Santa Rosa, City of	Southwest Community Park	Sonoma
Santa Rosa, City of	Steele Lane Park	Sonoma
Santa Rosa, City of	Stone Farm	Sonoma
Santa Rosa, City of	Strawberry Park	Sonoma
Santa Rosa, City of	Tanglewood Park	Sonoma
Santa Rosa, City of	Upper Brush Creek Park	Sonoma
Santa Rosa, City of	Village Green Park	Sonoma
Santa Rosa, City of	West Park	Sonoma
Santa Rosa, City of	Youth Community Park	Sonoma
Sebastopol, City of	Ives Park	Sonoma
Sebastopol, City of	Laguna Youth Park	Sonoma
Sebastopol, City of	Spooner Park	Sonoma
Sebastopol, City of	Willard Libby Park	Sonoma
Sonoma County Agricultural Preservation & Open Space District (SCAPOSD)	Bath/Watt	Sonoma
SCAPOSD	Cloverdale City Park	Sonoma
SCAPOSD	Carrington Ranch	Sonoma
SCAPOSD	Clover Springs	Sonoma
SCAPOSD	Coopers Grove	Sonoma
SCAPOSD	Cramer	Sonoma
SCAPOSD	Cresta	Sonoma
SCAPOSD	Furber Park	Sonoma
SCAPOSD	Haroutunian	Sonoma
SCAPOSD	Haroutunian – North	Sonoma
SCAPOSD	Ho	Sonoma
SCAPOSD	Hood Mountain Regional Park	Sonoma
SCAPOSD	Indian Valley	Sonoma
SCAPOSD	Jacobs Ranch	Sonoma
SCAPOSD	Keegan & Coppin	Sonoma
SCAPOSD	Nunes	Sonoma
SCAPOSD	Oken	Sonoma
SCAPOSD	Quailbrook Ranch	Sonoma
SCAPOSD	San Francisco Archdiocese	Sonoma
SCAPOSD	San Francisco Archdiocese II	Sonoma
SCAPOSD	Skiles	Sonoma
SCAPOSD	Tarman Park	Sonoma
SCAPOSD	Taylor Moutain Ranch	Sonoma
SCAPOSD	Van Alstyne	Sonoma
SCAPOSD	Wilroth – Donation	Sonoma
SCAPOSD	Wright Hill Ranch	Sonoma
SCAPOSD	Young – Armos	Sonoma
Sonoma County Regional Parks Dept	Andersen	Sonoma
Sonoma County Regional Parks Dept	Crane Creek	Sonoma
Sonoma County Regional Parks Dept	Doran Park	Sonoma
Sonoma County Regional Parks Dept	Doran Regional Park	Sonoma
Sonoma County Regional Parks Dept	Foothill Oaks	Sonoma

AGENCY/ ENTITY NAME	UNIT NAME	LOCATION
Sonoma County Regional Parks Dept	Gualala Point	Sonoma
Sonoma County Regional Parks Dept	Healdsburg Beach	Sonoma
Sonoma County Regional Parks Dept	Maddux Ranch Regional Park	Sonoma
Sonoma County Regional Parks Dept	Moms Beach	Sonoma
Sonoma County Regional Parks Dept	Pinnacle Gulch	Sonoma
Sonoma County Regional Parks Dept	Ragle Ranch	Sonoma
Sonoma County Regional Parks Dept	Sea Ranch Trail Access	Sonoma
Sonoma County Regional Parks Dept	Shiloh Ranch	Sonoma
Sonoma County Regional Parks Dept	Soda Springs	Sonoma
Sonoma County Regional Parks Dept	Sonoma Mountain Woodlands	Sonoma
Sonoma County Regional Parks Dept	Spring Lake Park	Sonoma
Sonoma County Regional Parks Dept	Spud Pt Marina	Sonoma
Sonoma County Regional Parks Dept	Steelhead Beach	Sonoma
Sonoma County Regional Parks Dept	Stillwater Cove Regional Park	Sonoma
Sonoma County Regional Parks Dept	Sunset Beach	Sonoma
Sonoma County Regional Parks Dept	Treadwell	Sonoma
Sonoma County Regional Parks Dept	Unity	Sonoma
Sonoma County Regional Parks Dept	Watson School/Wayside Park	Sonoma
Sonoma County Regional Parks Dept	West County Trail	Sonoma
Sonoma County Regional Parks Dept	Westside Park	Sonoma
Sonoma County Regional Parks Dept	Wohler Bridge Fishing Access	Sonoma
Sonoma County Water Agency	Hanson Aggregates	Sonoma
Sonoma County Water Agency	SCWA	Sonoma
Sonoma Land Trust	Freezeout Redwoods	Sonoma
Sonoma Land Trust	Laufenberg Ranch	Sonoma
Sonoma Land Trust	Little Black Mountain	Sonoma
Sonoma Land Trust	Spring Lake Regional Park	Sonoma
Sonoma Land Trust	White Rock Preserve	Sonoma
Sonoma Land Trust	Wild Turkey Hill	Sonoma
The Conservation Fund, California	Big River Salmon Creek	Mendocino
The Nature Conservancy	Nelson	Siskiyou
The Nature Conservancy	Pygmy Forest	Mendocino
The Nature Conservancy	Sonoma Mountain Ranch	Sonoma
US Army Corps of Engineers	Lake Sonoma Recreation Area	Sonoma
US Army Corps of Engineers	Lake Sonoma Wildlife Mgt Area	Sonoma
US Bureau of Land Management	BLM	Trinity
UD Bureau of Land Management	Modoc National Forest	Siskiyou
US Bureau of Land Management	The Geysers	Sonoma
US Fish & Wildlife Service	Clear Lake National Wildlife Refuge	Modoc
US Fish & Wildlife Service	Humboldt Bay NWR	Humboldt
US Fish & Wildlife Service	Lower Klamath National Wildlife Refuge	Siskiyou
US Fish & Wildlife Service	Ma-le'l Dunes Cooperative Management Area	Humboldt
US Fish & Wildlife Service	Tule Lake National Wildlife Refuge	Siskiyou
US Forest Service	Klamath National Forest	Siskiyou
US Forest Service	Mendocino National Forest	Trinity
US Forest Service	Rough River	Siskiyou
US Forest Service	Shasta-Trinity National Forest	Trinity
US Forest Service	Six Rivers National Forest	Trinity
US National Park Service	Lava Beds National Monument	Siskiyou
US National Park Service	Redwood National Park	Humboldt
US National Park Service	Whiskeytown-Shasta-Trinity NRA	Shasta
University of California	Bodega Marine Reserve	Sonoma
Windsor, Town of	Acorn Park	Sonoma
Windsor, Town of	Esposti Park	Sonoma
Windsor, Town of	Hiram Lewis Park	Sonoma
Windsor, Town of	Keiser Park	Sonoma
Windsor, Town of	Lakewood Meadows Park	Sonoma
Windsor, Town of	Los Robles Park	Sonoma
Windsor, Town of	Michael Hall Park	Sonoma
Windsor, Town of	Mitchell Park	Sonoma
Windsor, Town of	Old Vineyard Park	Sonoma
Windsor, Town of	Pleasant Oak Park	Sonoma
Windsor, Town of	Pueblo Viejo Park	Sonoma
Windsor, Town of	Robbins Park	Sonoma
Windsor, Town of	Sutton Park	Sonoma
Windsor, Town of	Vintage Oaks Park	Sonoma
Windsor, Town of	Wilson Ranch Soccer Park	Sonoma

California Protected Areas Database (CPAD) www.calands.org

Table 23 Marine Managed Areas

CCA (TOTAL 21)	MPA (TOTAL 42)	ASBS/ SWQPA (TOTAL 8)
Klamath River	Pyramid Point SMCA	Redwood National Park
Redwood National & State Parks	Point St. George Reef Offshore SMCA	Trinidad Head
Redwood Creek	Southwest Seal Rock SC	Kings Range
Kelp Beds at Trinidad Head	Castle Rock SC	Jughandle Cove
Mad River	False Klamath Rock SC	Saunders Reef
Eel River	Reading Rock SMCA	Del Mar Landing
Mattole River	Reading Rock SMR	Gerstle Cove
King Range National Conservation Area	Samoa SMCA	Bodega
Pudding Creek	South Humboldt Bay SMRNA	
Noyo River	Sugar Loaf Island SC	
Pygmy Forest Ecological Staircase	South Cape Mendocino SMR	
Big River	Steamboat Rock SC	
Albion River	Mattole Canyon SMR	
Navarro River	Sea Lion Gulch SMR	
Garcia River	Big Flat SMCA	
Kelp Beds at Saunders Reef	Double Cone Rock SMCA	
Del Mar Landing	Rockport Rocks SC	
Gerstle Cove	Vizciano Rock SC	
Bodega Marine Life Refuge	Ten Mile SMR	
Estero Americano	Ten Mile Beach SMCA	
Estero de San Antonio	Ten Mile Estuary SMCA	
	Mac Kerricher SMCA	
	Point Cabrillo SMR	
	Russian Gulch SMCA	
	Big River Estuary SMCA	
	Van Damme SMCA	
	Navarro River Estuary SMCA	
	Point Arena SMR	
	Point Arena SMCA	
	Sea Lion Cove SMCA	
	Saunders Reef SMCA	
	Del Mar Landing SMR	
	Stewarts Point SMCA	
	Stewarts Point SMR	
	Salt Point SMCA	
	Gerstle Cove SMR	
	Russian River SMRMA	
	Russian River SMCA	
	Bodega Head SMR	
	Bodega Head SMCA	
	Estero Americano SMRMA	
	Estero de San Antonio SMRMA	

Source: California Coastal Commission, California Department of Fish and Wildlife, and State Water Resources Control Board

Table 24 Beneficial Uses of Water in the North Coast Region, 2019

Beneficial Uses of Water in the North Coast Region, 2019 table presents the designated "beneficial uses "of waters as assigned by the North Coast Regional Water Quality Control Board to the Region's waterbodies (NCRWQCB 2011). The basis for the discussion of beneficial water uses, which follows, is Section 13050(f) of California's Porter-Cologne Water Quality Control Act, which states:

> *"Beneficial uses" of the waters of the state that may be protected against water quality degradation include, but are not necessarily limited to, domestic, municipal, agricultural, and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves."*

In 1972, the State Water Board adopted a uniform list of beneficial uses, including descriptions, to be applied throughout all basins of the State. This list was updated in 1996, with additions for the North Coast Region in 2011[2]. Waterbodies with designated actual or potential beneficial uses include all major streams (i.e. Hydrologic Units, HU), minor coastal streams, ocean waters, bays, saline wetlands, freshwater wetlands, estuaries, and groundwater. The beneficial uses of any specifically identified waterbody generally apply to all its tributaries.

BENEFICIAL USE	DEFINITION
Agricultural Supply (AGR)	Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.
Aquaculture (AQUA)	Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.
Cold Freshwater Habitat (COLD)	Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
Commercial and Sport Fishing (COMM)	Uses of water for commercial, recreational (sport) collection of fish, shellfish, or other aquatic organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.
Estuarine Habitat (EST)	Uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).
Flood Peak Attenuation /Flood Water Storage (FLD)	Uses of riparian wetlands in flood plain areas and other wetlands that receive natural surface drainage and buffer its passage to receiving waters.
Freshwater Replenishment (FRSH)	Uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).
Groundwater Recharge (GWR)	Uses of water for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.
Hydropower Generation (POW)	Uses of water for hydropower generation.
Industrial Process Supply (PRO)	Uses of water for industrial activities that depend primarily on water quality.
Industrial Service Supply (IND)	Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well repressurization.
Inland Saline Water Habitat (SAL)	Uses of water that support inland saline water ecosystems including, but not limited to, preservation or enhancement of aquatic saline habitats, vegetation, fish, or wildlife, including invertebrates.
Marine Habitat (MAR)	Uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).
Migration of Aquatic Organisms (MIGR)	Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.
Municipal and Domestic Supply (MUN)	Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.
Tribal Tradition and Culture (CUL)	Uses of water that support the cultural, spiritual, ceremonial, or traditional rights or LIFEWAYS of CALIFORNIA NATIVE TRIBES, including, but not limited to: navigation, ceremonies, or fishing, gathering, or consumption of natural aquatic resources, including fish, shellfish, vegetation, and materials.
Navigation (NAV)	Uses of water for shipping, travel, or other transportation by private, military or commercial vessels.
Non-Contact Water Recreation (REC-2)	Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

2 In addition to the beneficial uses identified on the statewide list, the following uses have been identified in this Region: Three wetland beneficial uses, recognizing the value of protecting these unique waterbodies: Wetland Habitat (WET); Water Quality Enhancement (WQE); and Flood Peak Attenuation/ Flood Water Storage (FLD). The Native Cultural (CUL) use and Subsistence Fishing (FISH) use have been added, identifying the traditional and cultural uses of waters within the Region. See the North Coast Basin Plan (NCRWQCB 2016, Table 2-1) for a full listing of North Coast beneficial uses by waterbody type and HU.

BENEFICIAL USE	DEFINITION
Preservation of Areas of Special Biological Significance (ASBS)	Includes marine life refuges, ecological reserves and designated areas of special biological significance, such as areas where kelp propagation and maintenance are features of the marine environment requiring special protection.
Rare, Threatened, or Endangered Species (RARE)	Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered.
Shellfish Harvesting (SHELL)	Uses of water that support habitats suitable for the collection of filter- feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sports purposes.
Spawning, Reproduction, and/or Early Development (SPWN)	Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.
Subsistence Fishing (SUB)	Uses of water involving the non-commercial catching or gathering of natural aquatic resources, including fish and shellfish, for consumption by individuals, households, or communities, to meet needs for sustenance.
Tribal Subsistence Fishing (T-SUB)	Uses of water involving the non-commercial catching or gathering of natural aquatic resources, including fish and shellfish, for consumption by individuals, households, or communities of California Native Tribes to meet needs for sustenance.
Warm Freshwater Habitat (WARM)	Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
Water Contact Recreation (REC-1)	Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white-water activities, fishing, or use of natural hot springs.
Water Quality Enhancement (WQE)	Uses of waters, including wetlands and other waterbodies, that support natural enhancement or improvement of water quality in or downstream of a waterbody including, but not limited to, erosion control, filtration and purification of naturally occurring water pollutants, streambank stabilization, maintenance of channel integrity, and siltation control.
Wetland Habitat (WET)	Uses of water that support natural and man-made wetland ecosystems, including, but not limited to, preservation or enhancement of unique wetland functions, vegetation, fish, shellfish, invertebrates, insects, and wildlife habitat.
Wildlife Habitat (WILD)	Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

Table 25 Wild & Scenic Rivers

NORTH COAST WILD & SCENIC RIVERS			
Albion River	Eel River, Middle Fork	Mill Creek	Smith River
Albion River, The Lagoon	Eel River, North Fork	Monkey Creek	Smith River (Middle Fork)
Bear Creek	Eel River, South Fork	Muzzleloader Creek	Smith River, Middle Fork
Black Butte River	Eightmile Creek	Myrtle Creek	Smith River, North Fork
Blackhawk Creek	Goose Creek	New River	Smith River, North Fork Tributary
Buck Creek	Gordon Creek	Packsaddle Creek	Smith River, South Fork
Bummer Lake Creek	Griffin Creek	Patrick Creek	South Fork Rowdy Creek
Canthook Creek	Gualala River	Prescott Fork	South Siskiyou Fork
Cold Creek	Hardscrabble Creek	Quartz Creek	Still Creek
Coon Creek	Harrington Creek	Rock Creek	Stony Creek
Craigs Creek	High Plateau Creek	Rowdy Creek	Trinity River
Diamond Creek	Hurdygurdy Creek	Salmon River	Trinity River, North Fork
Diamond Creek, North Fork	Jones Creek	Salmon River, North Fork	Trinity River, South Fork
Dominie Creek	Kelly Creek	Salmon River, South Fork	Van Duzen River
East Fork Goose Creek	Klamath River	Savoy Creek	West Branch Mill Creek
East Fork Mill Creek	Knopti Creek	Scott River	West Fork Patrick Creek
East Fork Patrick Creek	Little Jones Creek	Shelly Creek	Williams Creek
Eel River	Little Mill Creek	Siskiyou Fork Smith River	Wooley Creek

Source: California Department of Fish and Wildlife

Table 26 Impaired Streams that Flow Directly to Wild & Scenic Rivers

NORTH COAST IMPAIRED STREAMS FLOWING INTO WILD & SCENIC RIVERS			
Albion River	Devils Elbow Creek	Little North Fk	Rodeo Creek
Alder Gulch	Division Creek	Laurel Creek	Salmon Creek
Ash Creek	Don Juan Creek	Limestone Gulch	Salmon River
Beaver Creek	Dona Creek	Little Bogus Creek	Salmon River, N Fk
Big French Creek	Doolittle Creek	Little Ferry Creek	Salmon River, S Fk
Black Butte River	Dora Creek	Little Grider Creek	Scott River
Blue Rock Creek	Dutch Creek	Little Mingo Creek	Steinacher Creek
Browns Creek	Dutton Creek	Little Rock Creek	Salmon Creek
Butter Creek	Eel River	Little Twin Creek	Salt Creek
Badger Creek	Eel River, M Fk	Logan Gulch	Sand Bank Creek
Baldy Creek	Eel River, N Fk	Lousy Creek	Sandy Bar Creek
Barker Creek	Eel River, S Fk	Low Gap Creek	Sawmill Creek
Bear Canyon	Elk Creek	Lumgrey Creek	Sawmill Gulch
Bear Creek	Eltapom Creek	Mill Creek	Smith Creek
Beaver Creek	Eddy Gulch	Maxwell Creek	Sniktaw Creek
Big Bar Creek	Elder Creek	Mccann Creek	Snipe Gulch
Big Creek	Fish Creek	Mcguffy Creek	Somes Creek
Big Ferry Creek	Fly Creek	Mckinney Gulch	Sulphur Glade Creek
Black Oak Creek	Fox Creek	Meamber Creek	Surprise Creek
Bloody Nose Creek	Franklin Gulch	Meamber Gulch	Surveyors Canyon
Bluff Creek	Grass Valley Creek	Middle Creek	Swiss Gulch
Boulder Gulch	Gualala River	Mill Creek	Tenmile Creek
Bridge Creek	Gualala River, N Fk	Mills Creek	Thompson Creek
Brock Creek	Garvey Gulch	Mingo Creek	Trinity River
Bull Creek	Grapevine Creek	Mitchell Creek	Trinity River, N Fk
Burger Creek	Horse Creek	Mowry Creek	Trinity River, S Fk
Cold Creek	Hostler Creek	Muddy Gulch Creek	Tatu Creek
Cable Creek	Hale Creek	New River	Thomas Creek
Cape Horn Creek	Hawkins Creek	Negro Creek	Tish Tang A Tang Creek
Caraway Creek	Hayshed Creek	North Fork Gulch	Tom Martin Creek
Carr Creek	Hicks Gulch	O-Farrill Gulch	Townsend Gulch
Carson Gulch	Hogshed Creek	Oak Flat Creek	Truss Creek
Cave Creek	Hotelling Gulch	Pacific Ocean	Tunnel Creek
China Creek	Howards Gulch	Pat Ford Creek	Tuttle Creek
China Gulch	Hudson Creek	Pelletreau Creek	Van Duzen River
Cody Creek	Indian Creek	Plummer Creek	Willow Creek
Coleman Creek	Icebox Creek	Pothole Creek	Wooley Creek
Connick Creek	Independence Creek	Prairie Creek	Walker Creek
Coon Creek	Jack Of Hearts Creek	Printer Gulch	Walker Gulch
Cronan Gulch	Jackass Gulch	Queatchumpah Creek	White Hawk Creek
Croy Gulch	Jennings Gulch	Rancheria Creek	Whitney Creek
Cummings Creek	Johnson Creek	Rattlesnake Creek	Wilson Creek
Deadwood Creek	Klamath River	Red Mountain Creek	Wilson Gulch
Deep Creek	Kinsman Creek	Robinson Creek	Woodman Creek
Deep Gulch	Kirkham Creek	Rocky Basin Creek	Yager Creek
Deer Creek	Knownothing Creek	Rocky Glen Creek	

Source: California Department of Fish and Wildlife, Environmental Protection Agency

Table 27 National Wilderness Preservation System Areas

NAME	ACREAGE
Chanchelulla Wilderness	5,705
Lava Beds Wilderness	28,058
Marble Mountain Wilderness	221,161
Mount Shasta Wilderness	14,859
North Fork Wilderness	7,978
Red Buttes Wilderness	18,070
Russian Wilderness	11,065
Siskiyou Wilderness	154,751
Snow Mountain Wilderness	9,037
Trinity Alps Wilderness	499,894
Yolla Bolly-Middle Eel Wilderness	103,155
TOTAL	1,073,735 acres

Source: Bureau of Land Management

Table 28 Threatened & Endangered Species

LATIN BINOMIAL	COMMON NAME	LISTED STATUS
Canis lupus	Gray wolf	Federally listed as Endangered State listed as Endangered
Pekania pennanti	Pacific fisher	Candidate for Federal listing: proposed Threatened
Ambystoma californiense (Sonoma population)	California tiger salamander	Federally listed as Endangered
Ambystoma californiense	California tiger salamander	Federaly listed as Threatened statewide
Falco peregrinus anatum	American peregrine falcon	Delisted — previously listed
Eucyclogobius newberryi	tidewater goby	Federally listed as Endangered
Fritillaria gentneri	Gentner's fritillary	Federally listed as Endangered
Lasthenia conjugens	Contra Costa goldfields	Federally listed as Endangered
Howellia aquatilis	water howellia	Federally listed as Threatened
Acipenser medirostris	green sturgeon	Federally listed as Threatened
Alopecurus aequalis var. sonomensis	Sonoma alopecurus	Federally listed as Endangered
Aplodontia rufa nigra	Point Arena mountain beaver	Federally listed as Endangered
Charadrius alexandrinus nivosus	western snowy plover	Federally listed as Threatened
Branta hutchinsii leucopareia	cackling (=Aleutian Canada) goose	Delisted — previously listed
Rana boylii	Foothill yello-legged frog	State listed as Special Concern
Rana draytonii	California red-legged frog	Federally listed as Threatened
Rana pretiosa	Oregon spotted frog	Federally listed as Threatened
Thlaspi californicum	Kneeland Prairie pennycress	Federally listed as Endangered
Trifolium amoenum	showy rancheria clover	Federally listed as Endangered
Speyeria zerene myrtleae	Myrtle's silverspot buttefly	Federally listed as Endangered
Speyeria zerene hippolyta	Oregon silverspot buttefly	Federally listed as Threatened
Speyeria zerene behrensii	Behren's silverspot butterfly	Federally listed as Endangered
Lycaeides argyrognomon lotis	lotis blue butterfly	Federally listed as Endangered
Oncorhynchus mykiss	steelhead — central California coast ESU	Federally listed as Threatened
Oncorhynchus mykiss	steelhead — northern California ESU	Federally listed as Threatened
Oncorhynchus tshawytscha	chinook salmon — California coastal ESU	Federally listed as Threatened
Lupinus tidestromii	Tidestrom's lupine	State listed as Endangered Federally listed as Endangered
Cirsium ciliolatum	Ashland thistle	State listed as Endangered
Trifolium trichocalyx	Monterey clover	State listed as Endangered Federally listed as Endangered
Arctostaphylos densiflora	Vine Hill manzanita	State listed as Endangered
Gratiola heterosepala	Boggs Lake hedge-hyssop	State listed as Endangered
Chasmistes brevirostris	shortnose sucker	State listed as Endangered Federally listed as Endangered
Empidonax traillii brewsteri	little willow flycatcher	State listed as Endangered — species and all subspecies
Clarkia imbricata	Vine Hill clarkia	State listed as Endangered Federally listed as Endangered
Eryngium constancei	Loch Lomond button-celery	State listed as Endangered Federally listed as Endangered
Arabis macdonaldiana	Mcdonald's rock-cress	State listed as Endangered Federally listed as Endangered
Chorizanthe valida	Sonoma spineflower	State listed as Endangered Federally listed as Endangered
Deltistes luxatus	Lost River sucker	State listed as Endangered Federally listed as Endangered
Limnanthes vinculans	Sebastopol meadowfoam	State listed as Endangered Federally listed as Endangered
Fritillaria roderickii	Roderick's fritillary	State listed as Endangered
Delphinium bakeri	Baker's larkspur	State listed as Endangered Federally listed as Endangered
Layia carnosa	beach layia	State listed as Endangered Federally listed as Endangered
Coccyzus americanus occidentalis	western yellow-billed cuckoo	State listed as Endangered Federal listed as Threatened (Western DPS)
Syncaris pacifica	California freshwater shrimp	State listed as Endangered Federally listed as Endangered
Astragalus agnicidus	Humboldt milk-vetch	State listed as Endangered
Blennosperma bakeri	Sonoma sunshine	State listed as Endangered Federally listed as Endangered

LATIN BINOMIAL	COMMON NAME	LISTED STATUS
Sidalcea oregana ssp. valida	Kenwood Marsh checkerbloom	State listed as Endangered Federally listed as Endangered
Silene campanulata campanulata	Red Mountain catchfly	State listed as Endangered
Eriogonum alpinum	Trinity buckwheat	State listed as Endangered
Dichanthelium lanuginosum var. thermal	Geysers dichanthelium	State listed as Endangered
Navarretia leucocephala ssp. plieantha	many-flowered navarretia	State listed as Endangered Federally listed as Endangered
Eriogonum kelloggii	Kellogg's buckwheat	State listed as Endangered Federal 'species of concern'
Rallus longirostris obsoletus	California Ridgeway's rail	State listed as Endangered Federally listed as Endangered
Lilium pardalinum ssp. pitkinense	Pitkin Marsh lily	State listed as Endangered Federally listed as Endangered
Phlox hirsuta	Yreka phlox	State listed as Endangered Federally listed as Endangered
Oncorhynchus kisutch	coho salmon — central California coast ESU	State listed as Endangered Federally listed as Endangered
Castilleja uliginosa	Pitkin Marsh Indian paintbrush	State listed as Endangered
Strix nebulosa	great gray owl	State listed as Endangered
Carex albida	white sedge	State listed as Endangered Federally listed as Endangered
Haliaeetus leucocephalus	bald eagle	State listed as Endangered Federally Delisted
Orcuttia tenuis	slender Orcutt grass	State listed as Endangered Federally listed as Threatened
Lilium occidentale	western lily	State listed as Endangered Federally listed as Endangered
Lasthenia burkei	Burke's goldfields	State listed as Endangered Federally listed as Endangered
Cordylanthus tenuis ssp. capillaris	Pennell's bird's-beak	State listed as Rare Federally listed as Endangered
Limnanthes bakeri	Baker's meadowfoam	State listed as Rare
Delphinium luteum	golden larkspur	State listed as Rare Federally listed as Endangered
Blennosperma nanum var. robustum	Point Reyes blennosperma	State listed as Rare
Bensoniella oregona	Bensoniella	State listed as Rare
Calamagrostis foliosa	leafy reed grass	State listed as Rare
Arctostaphylos bakeri ssp. bakeri	Baker's manzanita	State listed as Rare
Eriastrum tracyi	Tracy's eriastrum	State listed as Rare
Calochortus persistens	Siskiyou mariposa-lily	State listed as Rare Federal 'species of concern'
Arctostaphylos bakeri ssp. Sublaevis	The Cedars manzanita	State listed as Rare
Chorizanthe howellii	Howell's spineflower	State listed as Threatened Federally listed as Endangered
Spirinchus thaleichthys	longfin smelt	State listed as Threatened
Monadenia infumata setosa	Trinity bristle snail	State listed as Threatened
Pleuropogon hooverianus	North Coast semaphore grass	State listed as Threatened
Plethodon stormi	Siskiyou Mountains salamander	State listed as Threatened
Plethodon asupak	Scott Bar salamander	State listed as Threatened
Oncorhynchus kisutch	coho salmon — southern Oregon / northern California ESU	State listed as Threatened Federally listed as Threatened
Riparia riparia	bank swallow	State listed as Threatened
Vulpes vulpes necator	Sierra Nevada red fox	State listed as Threatened
Lupinus milo-bakeri	Milo Baker's lupine	State listed as Threatened
Buteo swainsoni	Swainson's hawk	State listed as Threatened
Gulo gulo	California wolverine	State listed as Threatened
Grus canadensis tabida	greater sandhill crane	State listed as Threatened
Astragalus claranus	Clara Hunt's milk-vetch	State listed as Threatened Federally listed as Endangered

Source: National Oceanic Atmospheric Administration and US Fish & Wildlife Service

Table 29 Critical Habitats of the North Coast Region (Non-Salmonid)

COMMON SPECIES NAME	CLASSIFICATION	UNIT NAME	SPECIES NAME
Baker's larkspur	Endangered	Coleman Valley	Delphinium bakeri
Black Abalone	Endangered	North Coast Region — Coast of Sonoma County and south	Haliotis cracherodii
California Red-legged Frog	Threatened	MRN-1	Rana draytonii
California Red-legged Frog	Threatened	MRN-2	Rana draytonii
California Red-legged Frog	Threatened	SON-1	Rana draytonii
California Red-legged Frog	Threatened	SON-2	Rana draytonii
California Tiger Salamander	Endangered	Santa Rosa Plain	Ambystoma californiense
Contra costa goldfields	Endangered	Manchester Beach	Lasthenia conjugens
Pacific Eulachon/ Smelt	Threatened	Klamath River	Thaleichthys pacificus
Pacific Eulachon/ Smelt	Threatened	Mad River	Thaleichthys pacificus
Pacific Eulachon/ Smelt	Threatened	Redwood Creek	Thaleichthys pacificus
Green Sturgeon	Species of Concern	Elk River	Acipenser medirostris
Green Sturgeon	Species of Concern	Freshwater Creek	Acipenser medirostris
Green Sturgeon	Species of Concern	Humboldt Bay	Acipenser medirostris
Green Sturgeon	Species of Concern	Jacoby Creek	Acipenser medirostris
Green Sturgeon	Species of Concern	North Coast Region Coastal Waters	Acipenser medirostris

COMMON SPECIES NAME	CLASSIFICATION	UNIT NAME	SPECIES NAME
Kneeland penny-cress	Endangered	Mad River Basin	Noccaea fendleri ssp. californicum
Leatherback	Endangered	North Coast Region South of point Arena	Dermochelys coriacea
Lost River Sucker	Endangered	Lost River Basin	Deltistes luxatus
Marbled murrelet	Threatened	North Coast region	Brachyramphus marmoratus
Northern Spotted Owl	Threatened	East Cascades South	Strix occidentalis caurina
Northern Spotted Owl	Threatened	Interior California Coast	Strix occidentalis caurina
Northern Spotted Owl	Threatened	Klamath East	Strix occidentalis caurina
Northern Spotted Owl	Threatened	Klamath West	Strix occidentalis caurina
Northern Spotted Owl	Threatened	Redwood Coast	Strix occidentalis caurina
Stellar Sea Lion	Endangered	Sugarloaf Island	Eumetopias jubatus
Tidewater Goby	Endangered	Big Lagoon	Eucyclogobius newberryi
Tidewater Goby	Endangered	Davis Lake/Manchester State Park Ponds	Eucyclogobius newberryi
Tidewater Goby	Endangered	Eel River	Eucyclogobius newberryi
Tidewater Goby	Endangered	Estero Americano	Eucyclogobius newberryi
Tidewater Goby	Endangered	Estero De San Antonio	Eucyclogobius newberryi
Tidewater Goby	Endangered	Humboldt Bay	Eucyclogobius newberryi
Tidewater Goby	Endangered	Lake Earl/Talawa	Eucyclogobius newberryi
Tidewater Goby	Endangered	Pudding Creek	Eucyclogobius newberryi
Tidewater Goby	Endangered	Salmon Creek	Eucyclogobius newberryi
Tidewater Goby	Endangered	Stone Lagoon	Eucyclogobius newberryi
Tidewater Goby	Endangered	Tenmile River	Eucyclogobius newberryi
Tidewater Goby	Endangered	Virgin Creek	Eucyclogobius newberryi
Western snowy plover	Threatened	Clam Beach/Little River	Charadrius alexandrinus nivosus
Western snowy plover	Threatened	Eel River Gravel Bars	Charadrius alexandrinus nivosus
Western snowy plover	Threatened	Eel River North Spit/Beach	Charadrius alexandrinus nivosus
Western snowy plover	Threatened	Eel River South Spit/Beach	Charadrius alexandrinus nivosus
Western snowy plover	Threatened	Gold Bluffs Beach	Charadrius alexandrinus nivosus
Western snowy plover	Threatened	Humboldt Bay South Spit	Charadrius alexandrinus nivosus
Western snowy plover	Threatened	Humboldt Lagoons	Charadrius alexandrinus nivosus
Western snowy plover	Threatened	Lake Earl	Charadrius alexandrinus nivosus
Western snowy plover	Threatened	MacKerricher Beach	Charadrius alexandrinus nivosus
Western snowy plover	Threatened	Mad River	Charadrius alexandrinus nivosus
Western snowy plover	Threatened	Manchester Beach	Charadrius alexandrinus nivosus
Yellow larkspur	Endangered	Bodega Bay	Delphinium luteum
Yellow larkspur	Endangered	Estero Americano	Delphinium luteum
Yellow larkspur	Endangered	Estero de San Antonio	Delphinium luteum

Source: US Environmental Protection Agency and CDFW

Table 30 Critical Habitat for Marbled Murrelet in North Coast Counties

COUNTY	ACREAGE
Del Norte	116,859
Humboldt	410,249
Mendocino	99,929
Siskiyou	48,495
Sonoma	11,505
Total	687,023

Source: National Oceanic Atmospheric Administration and United States Fish & Wildlife Service

Table 31 Critical Habitats of Salmonids in the North Coast Region

BASIN	STREAM NAME
COHO CRITICAL HABITAt	
TBD (NOAA)	TBD
CHINOOK CRITICAL HABITAT	
Albion River	Albion River Estuary, Albion and North Fork Albion
Bear River	Bear River mainstem, South Fork Bear River, Bear River estuary, Bear River mainstem
Big River	Big River Estuary, Big River
Eel River	Anderson Creek, Atwell Creek, Baechtel Creek, Bear Creek, Bear Creek, Bear Pen Creek, Bear Wallow Creek, Bell Springs Creek, Berry Creek, Bloody Run, Bond Creek, Bridge Creek, Broaddus Creek, Brock Creek, Bull Creek, Burger Creek, Burger Creek, Butler Creek, Cahto Creek, Canoe Creek, Carson Creek, Cave Creek, Chadd Creek, Chamise Creek, China Creek- trib to Redwood Creed, Connick Creek, Corner Creek, Cow Creek- Trib of Bull Creek, Cox Creek, Cummings Creek, Cuneo Creek- Trib of Bull Creek, Davis Creek, Dean Creek, Dutch Charlie Creek, Dutch Henry Creek, East Branch South Fork, Eel River Estuary, Eel River, Elk Creek, Fiedler (Fielder) Creek, Fish Creek, Foster Creek, Grapewine Creek, Grub Creek, Haehl Creek, Harper Creek- Trib of Bull Creek, Hartsook Creek, Hely Creek, Hollow Tree Creek, Hoover Creek, Howe Creek, Huckleberry Creek, Indian Creek, Jack of Hearts Creek, Jewett Creek, Jones Creek, Jordan Creek, Kekawaka Creek, Kenny Creek, Larabee Creek, Lawrence Creek, Leggett Ck, Little Sproul Creel, Long Branch Creek, Long Valley Creek, Low Gap Creek, Mainstem Dobbyn Creek, mainstem Eel River, McCoy Creek, Michael's Creek, Middle Fork Eel River, Middle Fork Yager Creek, Mill Creek, Mill Creek-Trib of Bull Creek, Miller Creek-trib to Redwood Creek, Monument Creek, Moody Creek, Mud Creek, Murphy Creek, North Fork Dobbyn Creek, North Fork Eel mainstem, North Fork Yager Creek, Outlet Creek, Piercy Creek, Pollock Creek — trib to Redwood Ck, Poor Mans Creek, Price Creek, Rattlesnake Creek, Redwood Creek, Rock Creek, Rocktree Creek, Ryan Creek, Salmon Creek, Scott Creek, Seely Creek, Shaw Creek, Short Creek, Somerville Creek-tributary to Redwood Creek, South Fork Dobbyn Creek, South Fork Eel River, South Fork Redwood Creek, South Fork Salmon River, Spoul Creek, Squaw Creek, Standley Creek, Streeter Creek, String Creek, Strongs Creek, Ten Mile Creek, Tom Long Creek, Tomki Creek, Tostin Creek, Turner Creek, Twin Rocks Creek, unnamed trib to Eel near McCann, Upp Creek, Upper Van Duzen Mainstem, Van Duzen mainstem lower 2 miles, Warden Creek, West Fork Sproul Creek, Wheelbarrow Creek, Wildcat Creek, Williams Creek, Willits Creek, Wilson Creek, Woodman Creek, Yager Creek
Elk River	Bridge Creek, Dunlap Gulch, Elk River, North Branch of the North Fork, North Fork Elk River, South Branch of the North Fork, South Fork
Freshwater Creek	Little Freshwater, Lower Freshwater Creek, Ryan Creek, South Fork Freshwater Creek, Upper Freshwater Creek,
Garcia River	Garcia River, Garcia River Estuary
Jacoby Creek	Gannon Slough, Lower Jacoby Creek, Middle and Upper Jacoby Creek
Little River	Carson Creek aka South Fork Little River, Little River, Lower South Fork Little River, Railroad Creek, Upper South Fork Little River
Mad River	Black Creek, Black Dog Creek, Cannon Creek (aka Canon Creek), Dry Creek, Lindsay Creek, Mad River, Maple Creek, Mill Creek, North Fork Mad River, North Fork Mad River, Squaw Creek, Sullivan Gulch, Unt, Warren Creek
Maple Creek	Maple Creek, North Fork of Maple Creek
Mattole River	Bear Creek, Blue Slide Creek, Bridge Creek, Conklin Creek, Dry Creek, East Fork Honeydew Creek, East Fork of the North Fork, Estuary, Eubanks Creek, Eubanks Creek, Gilham Creek, Grindstone Creek, Honeydew Creek, Mattole Canyon, Mattole Canyon, Mattole River mainstem, McGinnis Creek, McKee Creek, Mill Creek, North Fork Bear Creek, North Fork Bear Creek, North Fork, Oil Creek, Rattlesnake Creek, South Fork Bear Creek, Squaw Creek, Thompson Creek, Thompson Creek, Unnamed tributary to North Fork Bear Creek, Upper Mattole River, Upper Mattole River, Upper North Fork, Westlund Creek, Woods creek, Yew Creek
Noyo River	North Fork Noyo River, Noyo River Estuary, Noyo River, South Fork Noyo River
Redwood Creek (Humboldt)	Boyes Creek, Bridge Creek, Brown Creek, Emerald (Harry Weir), Godwood, Lacks Creek, Larry Dam Creek, Little Lost Man Creek, Lost Man Creek, Lower Redwood Creek, May Creek, McArthur Creek, Minor Creek, North Fork Lost Man Creek, Prairie Creek, Redwood Creek, Tom McDonald
Russian River	Austin Creek, Canyon Reach of Mainstem, Dry Creek, Feliz Creek, Forsythe Creek, Lower Mainstem, Mainstem at Mirabel, Mainstem in Alexander Valley, Mainstem in Ukiah Valley, Mark West Creek, Middle Reach of Mainstem, West Branch of Mainstem
Salmon Creek (Humboldt)	Salmon Creek (Humboldt)
Ten Mile River	Middle Fork Ten Mile River, North Fork Ten Mile River, South Fork Ten Mile River, Ten Mile River and North Fork Ten Mile River, Ten Mile River Estuary
Wages Creek	Wages Creek
STEELHEAD CRITICAL HABITAT	
Ash Creek	Ash Creek
Austin Creek	Austin Creek at Cazadero, Austin Creek mainstem, Bear Pen Creek, Conshea Creek, Devil Creek, Kidd Creek, Lower Black Rock Creek, Lower East Austin Creek, Lower Gilliam Creek, Lower Gray Creek, Lower Mainstem, Lower Thompson Creek, Lower Ward Creek, Mainstem between Ward and Bear Pen, Red Slide Creek, Saint Elmo Creek, Schoolhouse Creek, Sulphur Creek, Upper Austin Creek, Upper East Austin Creek, Upper Gilliam Creek, Upper Gray Creek, Upper Ward Creek, Ward Creek
Big Sulphur	Alder Creek, Anna Belcher, Big Sulphur Creek, Frasier, Humming Bird Creek, Little Sulphur Creek, Lovers Gulch, Squaw Creek, North Branch Little Sulphur Creek, Upper Little Sulphur Creek
Crocker Creek	Crocker Creek
Dry Creek	Angel Creek, Crane Creek, Dry Creek, Dutcher Creek, Felta, Foss Creek, Grape Creek, Mill Creek, North Slough Creek, Palmer Creek, Pena, Redwood Log, Salt Creek, Upper Pena Creek, Wallace, Wine Creek, Woods Creek
Dutch Bill Creek	Baumert Springs, Dutch Bill Creek, Duvoul Creek, Grub Creek, Lancel Creek, North Fork Lancel Creek
Edwards	Edwards
Estero Americano	Ebabias Creek, Estero Americano
Fife Creek	Fife Creek

BASIN	STREAM NAME
Forsythe Creek	Bakers Creek, Eldridge, Forsythe Creek, Jack Smith Creek, Mill Creek, Seward
Freezeout Creek	Freezeout Creek, Unnamed Tributary
Gill	Gill, South Fork Gill
Gird	Gird,
Green Valley Creek	Atascadero Creek, Green Valley Creek, Mainstem Green Valley, Purrington Creek, unnamed trib to Atascadero Creek
Hobson Creek	Hobson Creek,
Hulbert Creek	Hulbert Creek,
Jenner Gulch	Jenner Gulch,
Laguna de Santa Rosa	Laguna De Santa Rosa,
Maacama	Bear, Bidwell, Bluegum, Briggs, Coon Creek, Franz, Ingalls, Kellog Creek, Little Briggs, Maacama, Maacama, McDonnell Creek, Mill Stream, Redwood, Redwood, Yellowjacket
Mariposa	Mariposa
Mark West Creek	Humbug Creek, Lower Pruit Creek, Mark West Creek, Middle reach of Windsor Creek, Pool Creek, Upper Mark West Creek, Upper Pool Creek, Upper Pruit Creek, Windsor Creek
Miller Creek	Miller Creek, Unnamed tributary
Oat Valley Creek	Oat Valley Creek
Pieta Creek	Pieta Creek
Pocket Canyon	Mays Canyon, Pocket Canyon
Porter Creek	Porter Creek,
Russian River	Canyon Reach of Mainstem, Lower Mainstem, Mainstem Alexander Valley, Mainstem at Dry Creek, Mainstem in Ukiah Valley, Mainstem near Healdsburg, Russian River, West Branch Russian River
Salmon Creek	Coleman Valley Creek, Faye Creek, Finley Creek, Salmon Creek, Tannery Creek
Salt Hollow	Salt Hollow Creek
Sausal	Sausal
Sheep House Creek	Sheep House Creek
Smith Creek	Smith Creek
Ward Creek	Big Oat Creek, Blue Jay Creek, Pole Mountain Creek, Spring Creek
Willow Creek	Willow Creek

Source: National Oceanic Atmospheric Administration and United States Fish & Wildlife Service

APPENDIX H. HYDROLOGY

Table 32 Hydrologic Units of the North Coast Region

HU NAME	HA NAME	HSA NAME
Bodega	Bodega Harbor	Bodega Bay
		Bodega Head
	Estero Americano	na
	Estero San Antonio	na
	Salmon Creek	na
Cape Mendocino	Capetown	na
	Mattole River	na
	Oil Creek	na
Eel River	Lower Eel River	Ferndale
		Larabee Creek
		Scotia
	Middle Fork Eel River	Black Butte River
		Eden Valley
		Round Valley
		Wilderness
		Sequoia
		Spy Rock
	North Fork Eel River	na
	South Fork Eel River	Benbow
		Laytonville
		Weott
	Upper Main Eel River	Lake Pillsbury
		Outlet Creek
		Tomki Creek
	Van Duzen River	Bridgeville
		Hydesville
		Yager Creek
Eureka Plain	na	na
Klamath River	Butte Valley	Bray
		Macdoel — Dorris
		Tennant
	Lost River	Boles
		Clear Lake
		Mt. Dome
		Tule Lake
	Lower Klamath River	Klamath Glen
		Orleans
	Middle Klamath River	Beaver Creek
		Copco Lake
		Happy Camp
		Hornbrook
		Iron Gate
		Seiad Valley
		Ukonom
	Salmon River	Cecilville
		Lower Salmon
		Sawyers Bar
		Wooley Creek
	Scott River	Scott Bar
		Scott Valley
	Shasta Valley	na
Mad River	Blue Lake	na
	Butler Valley	na
	North Fork Mad River	na
	Ruth	na
Mendocino Coast	Albion River	na
	Big River	na
	Garcia River	na
	Gualala River	Buckeye Creek
		Gualala
		North Fork
		Rockpile Creek
		Wheatfield Fork
	Navarro River	na
	Noyo River	na
	Point Arena	Alder Creek
		Brush Creek
		Elk Creek
		Greenwood Creek
	Rockport	Ten Mile River
		Usal Creek
		Wages Creek
	Russian Gulch	na
Redwood Creek	Beaver	na
	Lake Prairie	na
	Orick	na
Rogue River	Applegate River	na
	Illinois River	na
Russian River	Lower Russian River	Austin Creek
		Guerneville
	Middle Russian River	Geyserville
		Laguna
		Mark West
		Santa Rosa
		Sulphur Creek
		Warm Springs
	Upper Russian River	Coyote Valley
		Forsythe Creek
		Ukiah
Smith River	Lower Smith River	Mill Creek
		Rowdy Creek
		Smith River Plain
	Middle Fork Smith River	na
	North Fork Smith River	na
	South Fork Smith River	na
	Wilson Creek	na
Trinidad	Big Lagoon	na
	Little River	na
Trinity River	Lower Trinity River	Burnt Ranch
		Helena
		Hoopa
		New River
		Willow Creek
	Middle Trinity River	Douglas City
		Weaver Creek
	South Fork Trinity River	Corral Creek
		Forest Glen
		Grouse Creek
		Hayfork Valley
		Hyampom

HU NAME	HA NAME	HSA NAME
	Upper Trinity River	na
Winchuck River	na	na

Source: California Interagency Watershed Mapping Committee (DWR) a.k.a. CalWater

Table 33 Rivers & Streams of the North Coast Region

The Table below lists major named streams of the Region, organized by basin Watershed Management Area (i.e. basin). The total length of streams in the Region is approximately 34,586 km. (21,491 mi.). The total length of streams in each WMA (basin) is indicated in the table. Included is the subset of streams and tributaries that are designated 303(d) listed streams, meaning they are considered "impaired" due to water quality issues (NCRWQCB 2016). Approximately 85% of the Region's streams are listed impaired, due primarily to temperature and sediment.

WMA (TOTAL KM. STREAMS)	STREAMS IN THE WMA BOUNDARY
Eel River (8,350)	Chamise Creek, Estell Creek, Little Van Duzen River, Pine Creek, Tom Long Creek **303d Listed Streams** Anderson Creek, Black Butte River, Cedar Creek, Cold Creek, Dobbyn Creek, East Branch South Fork Eel River, East Fork North Fork Eel River, Eel River, Elk Creek, Indian Creek, Larabee Creek, Lawrence Creek, Middle Fork Eel River, Mill Creek, Mitchell Creek, North Fork Eel River, North Fork Middle Fork Eel River, Outlet Creek, Rattlesnake Creek, Salt River, South Fork Eel River, Spanish Creek, Tomki Creek, West Fork North Fork Eel River, West Fork Van Duzen River, Williams Creek
Humboldt Bay (2,260)	Little River, Little South Fork Elk River, Lower North Fork Mad River, Lower South Fork Little River, Maple Creek, North Branch North Fork Elk River, North Fork Elk River, South Branch North Fork Elk River, South Fork Elk River, South Fork Little River, South Fork Mad River, Upper South Fork Little River, West Fork North Fork Elk River **303d Listed Streams** Boulder Creek, East Fork North Fork Mad River, Elk River, Mad River, North Fork Mad River, Pilot Creek, Redwood Creek
Klamath River (9,056)	East Branch Lost River, East Fork Scott River, Lost River, Right Hand North Fork Salmon River, Saint Claire Creek **303d Listed Streams** Blue Creek, Bluff Creek, Bogus Creek, Boise Creek, Camp Creek, Deadwood Creek, Dillon Creek, East Fork South Fork Salmon River, Grider Creek, Gumboot Creek, Kidder Creek, Klamath River, Little North Fork Salmon River, Little Shasta River, Little South Fork Salmon River, Moffett Creek, North Fork Salmon River, Noyes Valley Creek, Parks Creek, Red Cup Creek, Roach Creek, Salmon River, Scott River, Seiad Creek, Shackleford Creek, Shasta River, Shovel Creek, South Fork Salmon River, South Fork Scott River, Summit Lake, Tectah Creek, Thompson Creek, Tully Creek, Willow Creek, Wooley Creek
North Coast Rivers (6,082)	Alder Creek, Applegate River, Bear River, Butte Fork Applegate River, Coon Creek, Diamond North Fork North Fork Smith River, Goose Creek, Greenwood Creek, Hare Creek, Little North Fork Big River, Little North Fork of South Fork Albion River, Middle Fork Applegate River, Middle Fork of North Fork Noyo River, Middle Fork Smith River, North Fork Albion River, North Fork Smith River, Prescott Fork South Fork Smith River, Siskiyou Fork Smith River, Smith River, South Branch North Fork Navarro River, South Fork Albion River, South Fork Bear River, South Fork Siskiyou Fork Smith River, South Fork Smith River, South Fork Winchuck River, Upper North Fork Mattole River **303d Listed Streams** Albion River, Big River, Buckeye Creek, Dougherty Creek, East Branch North Fork Big River, East Branch North Fork Mattole River, Garcia River, Gualala River, Little North Fork Gualala River, Little North Fork Navarro River, Little North Fork Noyo River, Little North Fork Ten Mile River, Mattole River, Middle Fork Ten Mile River, Navarro River, North Fork Big River, North Fork Garcia River, North Fork Gualala River, North Fork Mattole River, North Fork Navarro River, North Fork North Fork Navarro River, North Fork Noyo River, North Fork of South Fork Noyo River, North Fork Ten Mile River, Noyo River, Pudding Creek, Robinson Creek, Rockpile Creek, South Fork Big River, South Fork Garcia River, South Fork Gualala River, South Fork Noyo River, South Fork Ten Mile River, Ten Mile River, Wheatfield Fork Gualala River
Russian River/ Bodega Bay (3,270)	Fife Creek, Morrison Creek, Porter Creek, Salmon Creek **303d Listed Streams** Big Sulphur Creek, Dry Creek, East Austin Creek, East Fork Russian River, Forsythe Creek, Franz Creek, Green Valley Creek, Little Sulphur Creek, Pieta Creek, Russian River, Sausal Creek, York Creek
Trinity River (5,567)	Grizzly Creek, Little Trinity River **303d Listed Streams** Browns Creek, Canyon Creek, East Fork New River, East Fork North Fork Trinity River, East Fork South Fork Trinity River, East Fork Trinity River, Eightmile Creek, Hayfork Creek, Mumbo Creek, New River, North Fork Trinity River, Reading Creek, South Fork East Fork New River, South Fork Trinity River, Stuart Fork, Swift Creek, Tish Tang Creek, Trinity River

Source: US Environmental Protection Agency (2011 list) and California Department of Fish & Wildlife

Table 34 Water Resources & Water Use for North Coast Region Basins

Adapted from NCRWQCB 2011

HYDROLOGIC UNIT (HU) OR AREA (HA)	WATER RESOURCE USES	WATER SUPPLY SOURCES	SURFACE WATER INFRASTRUCTURE DEVELOPMENT	GROUNDWATER AREAS *(DWR DEFINED)*	GROUNDWATER INFRASTRUCTURE DEVELOPMENT
KLAMATH BASIN					
Butte Valley HA	Domestic, irrigation, water table balance	Irrigation of 28,000 acres; excess pumped to Meiss Lake into Klamath River	No significant development/	(3) Bray Town, Butte Valley, Red Rock Valley	Groundwater pumping
Lost River Valley HA	Domestic (ground), irrigation, managed wildlife habitat (surface)	Surface water diversions including via Klamath River (OR) and Lost River	Klamath Project (Bureau of Reclamation) irrigates 233,625 acres in CA/OR via Clear Lake Reservoir, Tule Lake, Lower Klamath Lake Sump; excess pumped to OR (Tule Lake Irrigation Dist. Area) for use in CA/OR	(4) Fairchild Swamp, Klamath River Valley, Modoc Plateau Pleistocene Area, Modoc Plateau Recent Volcanic Area	Groundwater pumping (domestic)
HA-Lower Klamath HA	Domestic, agricultural	Surface water diversions, groundwater	No significant development	(1) Lower Klamath River Valley	Groundwater pumping (domestic, agricultural)
Middle Klamath HA	Domestic, agricultural, power generation	Surface water diversions, groundwater, springs	Four Pacific Power & Light Co. hydroelectric reservoirs in Upper and Middle Klamath: John Boyle Dam (OR), Copco #1, #2, and Iron Gate; further major development prohibited (Wild & Scenic Rivers Act)	(2) Happy Camp Town Area, Seiad Valley	Groundwater pumping
Salmon River HA	Domestic (surface)	Surface water diversions, springs	No significant development	None	No significant development
Scott River HA	Domestic, agricultural (33,000 acres irrigated)	Surface water diversions, groundwater, springs	No significant development	(1) Scott River Valley	Groundwater pumping (increases for irrigation have prompted adjudication)
Shasta Valley HA	Domestic, agricultural (primarily surface)	Surface water diversions, springs	48,000 acres irrigated by Montague Water Conservation District (14,000) and other irrigation districts	(1) Shasta Valley	Groundwater pumping, increasingly for domestic and agricultural
Smith River HA	Domestic, agricultural, industrial from surface and ground	Surface water diversions	No significant development	(1) Smith River Plain	Groundwater pumping
Trinity River HA	Domestic, agricultural, industrial, power generation, intraregional water export	Surface water diversions incl. via CVP, groundwater, springs	Trinity River Division of Central Valley Project (largest in Klamath Basin): Trinity Dam, Clair Engle Lake, Lewiston Reservoir; some to Sacramento Valley; further major development prohibited (Wild & Scenic Rivers Act)	(3) Hayfork Valley, Hoopa Valley, Hyampton Valley	Groundwater pumping
NORTH COASTAL BASIN					
Bodega Harbor HA	Domestic	Groundwater	No significant development	(1) Bodega Bay Area	No significant development
Cape Mendocino HA	Domestic	Groundwater	No significant development	(2) Honeydew Town Area, Mattole River Valley	Groundwater pumping (domestic)
Eel River HA	Municipal, power generation, interregional export	Surface water diversions, groundwater; considered "water surplus" unit	80,700 acre-ft. Lake Pillsbury, Scott Dam, Van Arsdale Dam, Potter Valley Tunnel provide power and water to Russian River unit; Willits' water from James River via reservoirs	(15) Valley/ Town Areas: Dinsmore, Eden Eel River, Garberville, Gravelly, Hettenshaw, Larabee, Laytonville, Little Lk, Lower Laytonville, Pepperwood, Round, Sherwood, Weott, Williams	Groundwater pumping

HYDROLOGIC UNIT (HU) OR AREA (HA)	WATER RESOURCE USES	WATER SUPPLY SOURCES	SURFACE WATER INFRASTRUCTURE DEVELOPMENT	GROUNDWATER AREAS *(DWR DEFINED)*	GROUNDWATER INFRASTRUCTURE DEVELOPMENT
Eureka Plain HA	Municipal, industrial, surface storage	Surface water diversion, groundwater; "sufficient to meet current projections"	48,030 acre-ft. Ruth Reservoir on Mad River exports water to Eureka Plain subbasin	Eel River/ Salmon Creek Area, Jacoby Creek/ Freshwater Creek Areas	Groundwater pumping
Mad River HA	Municipal, industrial, surface storage	Surface water diversion, groundwater; "sufficient to meet current projections"	48,030 acre-ft. Ruth Reservoir on Mad River exports water to Eureka Plain subbasin	Eel River/ Salmon Creek Area, Jacoby Creek/ Freshwater Creek Areas	Groundwater pumping
Redwood Creek HA	Domestic, agricultural	Surface water diversion, groundwater	No significant development	(3) Big Lagoon, Prairie Creek Area, Redwood Creek Valley	Groundwater pumping
Mendocino Coast HA	Domestic (ground), agricultural (surface, ground)	Surface water diversion, groundwater; "reaching existing capacity"	No significant development	(11) Town Area/ Valley: Annapolis Ohlson Ranch Formation Highlands Big River, Branscomb, Gualala River, Little, Fort Bragg Terrace, Ten Mile River,	Groundwater pumping (domestic)
Russian River	Domestic/ municipal (ground: Rhonert Park, Santa Rosa, Sebastopol, Ukiah, Windsor), agricultural, industrial, E-generation, local export	70,000 af from Lake Mendocino and 212,000 af from Lake Sonoma; power generated at both dams; "sufficient to meet currently projected demands for the foreseeable future"	Lake Mendocino (122,500 af) stores Eel River and East Fork Russian River water via Coyote Dam, and Lake Sonoma (381,000 af) stores Dry Creek water via Warm Springs Dam; water also exported to Marin Co.	Numerous, incl: Potter, Ukiah, Sanel, MacDowell, Cloverdale, Alexander Valley & Area, Healdsburg, Santa Rosa Plain & Valley, Kenwood/ Rincon, Lower RR, Sebastopol Merced Highlands	Groundwater pumping (domestic/ municipal)
Trinidad HU	Domestic, agricultural	Surface water diversion, groundwater; "sufficient to meet currently projected demands for the foreseeable future"	No significant development	(3) Big Lagoon, Prairie Creek Area, Redwood Creek Valley	Groundwater pumping

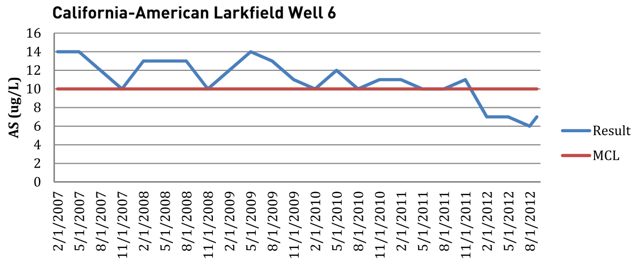
Source: North Coast Regional Water Quality Board (NCRWQCB) 2011 — North Coast "Basin Plan"

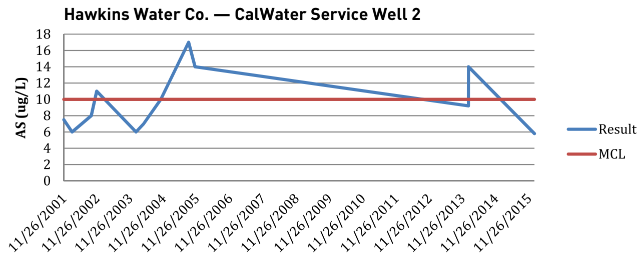
Table 35 AB 1249 Groundwater Contaminants on the North Coast

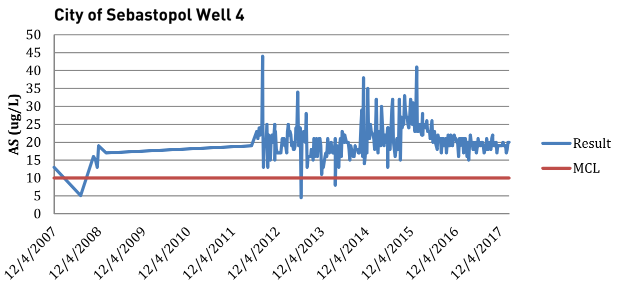
The table and charts below document North Coast contaminant exceedences of state mandated concentration limits for chemicals of concern to DWR: arsenic and nitrate. See Water Quality Section 2.3.8 for descriptive text and information related to chromium 6 (hexavalent chromium) and perchlorate. These charts were developed in 2018 using SWRCB's online mapping tool, available on the Groundwater Ambient Monitoring and Assessment Program (GAMA) website. For the most up-to-date information, please refer to the GAMA website.

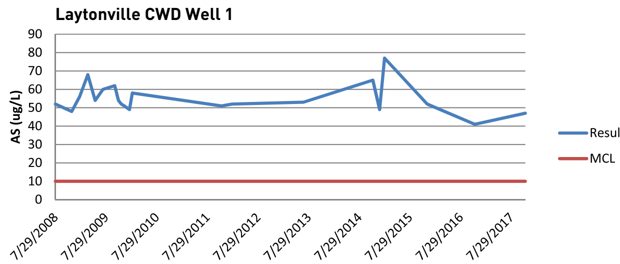
NAME	CONTAMINANT	COUNTY
California-American Larkfield Well 6	Arsenic	Sonoma
City of Sebastopol Well 4	Arsenic	Sonoma
City of Sebastopol Well 5	Arsenic	Sonoma
City of Sebastopol Well 9	Arsenic	Sonoma
Delores Lane Water System Well 1	Arsenic	Sonoma
Hawkins Water Co. — CalWater Service Well 2	Arsenic	Sonoma
Laytonville CWD Well 1	Arsenic	Sonoma
Laytonville CWD Well 6	Arsenic	Sonoma
Loch Haven MWC Well 1	Arsenic	Sonoma
Loch Haven MWC Well 2	Arsenic	Sonoma
Mount Weske Estates Well 1	Arsenic	Sonoma
Shamrock MHP Well 1	Arsenic	Sonoma
Shamrock MHP Well 3	Arsenic	Sonoma
Western Mobile Home Park Well 6	Arsenic	Sonoma
Valley Ford Water Association Well 1	Nitrate NO3	Sonoma
Valley Ford Water Association Well 2	Nitrate N & Nitrate NO3	Sonoma
Valley Ford Water Association Well 3	Nitrate N & Nitrate NO3	Sonoma

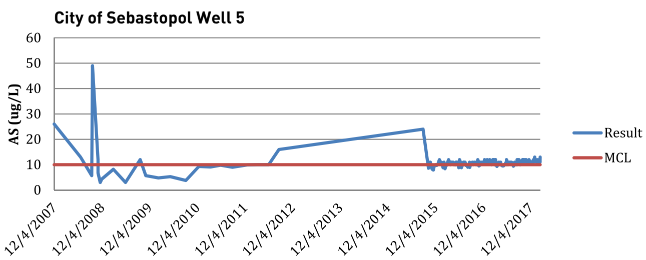
ARSENIC

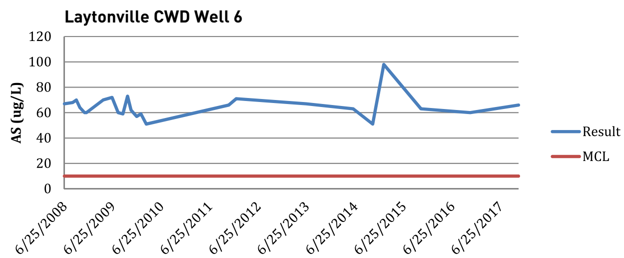

California-American Larkfield Well 6
AS (ug/L)
0
2
4
6
8
10
12
14
16
2/1/2007
5/1/2007
8/1/2007
11/1/2007
2/1/2008
5/1/2008
8/1/2008
11/1/2008
2/1/2009
5/1/2009
8/1/2009
11/1/2009
2/1/2010
5/1/2010
8/1/2010
11/1/2010
2/1/2011
5/1/2011
8/1/2011
11/1/2011
2/1/2012
5/1/2012
8/1/2012
Result
MCL

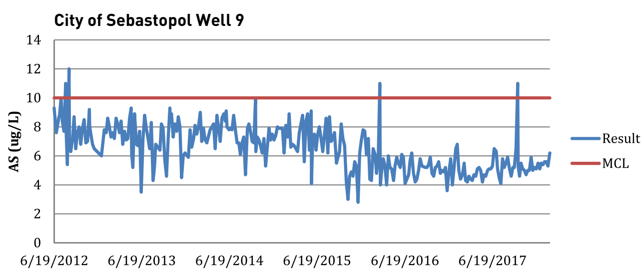

Hawkins Water Co. — CalWater Service Well 2
AS (ug/L)
0
2
4
6
8
10
12
14
16
18
11/26/2001
11/26/2002
11/26/2003
11/26/2004
11/26/2005
11/26/2006
11/26/2007
11/26/2008
11/26/2009
11/26/2010
11/26/2011
11/26/2012
11/26/2013
11/26/2014
11/26/2015
Result
MCL

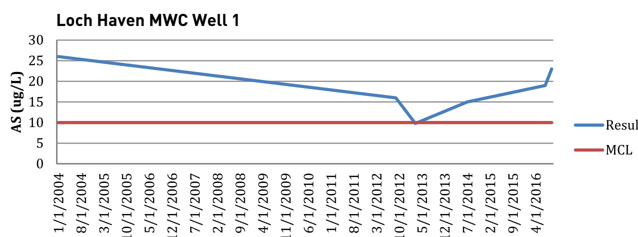

City of Sebastopol Well 4
AS (ug/L)
0
5
10
15
20
25
30
35
40
45
50
12/4/2007
12/4/2008
12/4/2009
12/4/2010
12/4/2011
12/4/2012
12/4/2013
12/4/2014
12/4/2015
12/4/2016
12/4/2017
Result
MCL

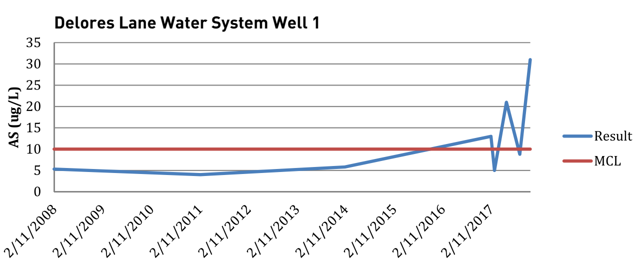

Laytonville CWD Well 1
AS (ug/L)
0
10
20
30
40
50
60
70
80
90
7/29/2008
7/29/2009
7/29/2010
7/29/2011
7/29/2012
7/29/2013
7/29/2014
7/29/2015
7/29/2016
7/29/2017
Result
MCL

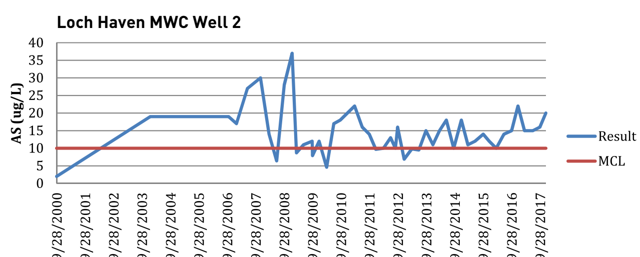

City of Sebastopol Well 5
AS (ug/L)
0
10
20
30
40
50
60
12/4/2007
12/4/2008
12/4/2009
12/4/2010
12/4/2011
12/4/2012
12/4/2013
12/4/2014
12/4/2015
12/4/2016
12/4/2017
Result
MCL


Laytonville CWD Well 6
AS (ug/L)
0
20
40
60
80
100
120
6/25/2008
6/25/2009
6/25/2010
6/25/2011
6/25/2012
6/25/2013
6/25/2014
6/25/2015
6/25/2016
6/25/2017
Result
MCL


City of Sebastopol Well 9
AS (ug/L)
0
2
4
6
8
10
12
14
6/19/2012
6/19/2013
6/19/2014
6/19/2015
6/19/2016
6/19/2017
Result
MCL


Loch Haven MWC Well 1
AS (ug/L)
0
5
10
15
20
25
30
1/1/2004
8/1/2004
3/1/2005
10/1/2005
5/1/2006
12/1/2006
7/1/2007
2/1/2008
9/1/2008
4/1/2009
11/1/2009
6/1/2010
1/1/2011
8/1/2011
3/1/2012
10/1/2012
5/1/2013
12/1/2013
7/1/2014
2/1/2015
9/1/2015
4/1/2016
Result
MCL


Delores Lane Water System Well 1
AS (ug/L)
0
5
10
15
20
25
30
35
2/11/2008
2/11/2009
2/11/2010
2/11/2011
2/11/2012
2/11/2013
2/11/2014
2/11/2015
2/11/2016
2/11/2017
Result
MCL


Loch Haven MWC Well 2
AS (ug/L)
0
5
10
15
20
25
30
35
40
9/28/2000
9/28/2001
9/28/2002
9/28/2003
9/28/2004
9/28/2005
9/28/2006
9/28/2007
9/28/2008
9/28/2009
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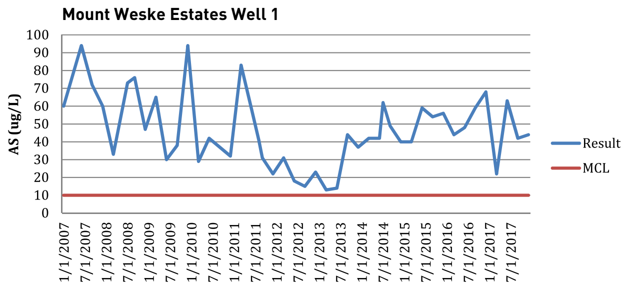
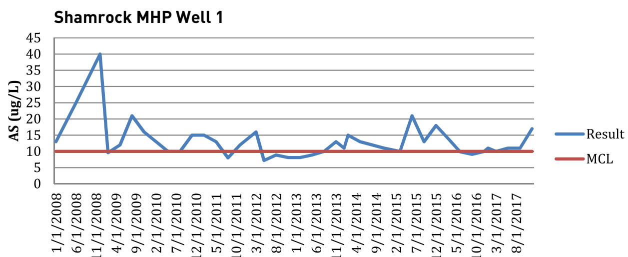
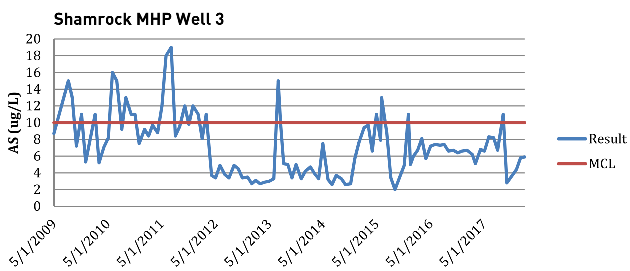
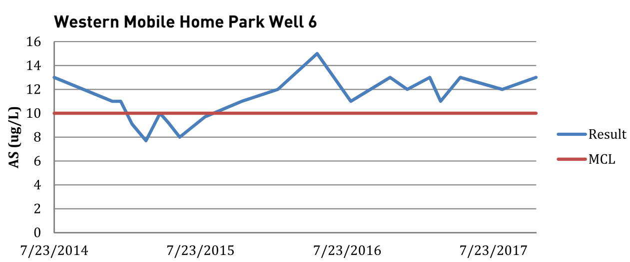
9/28/2017
Result
MCL

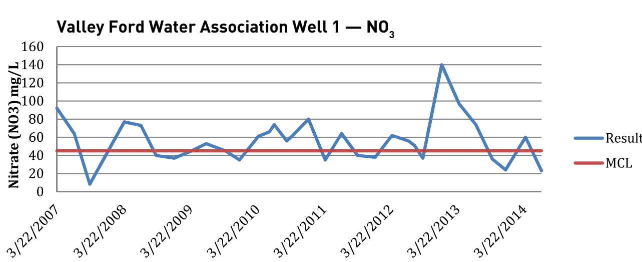


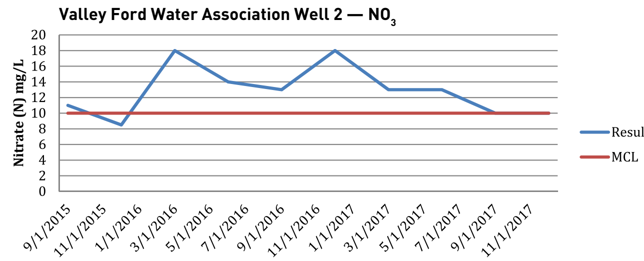


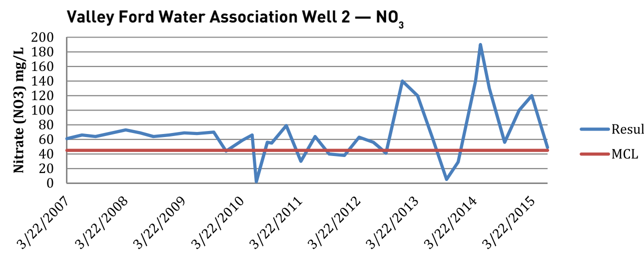


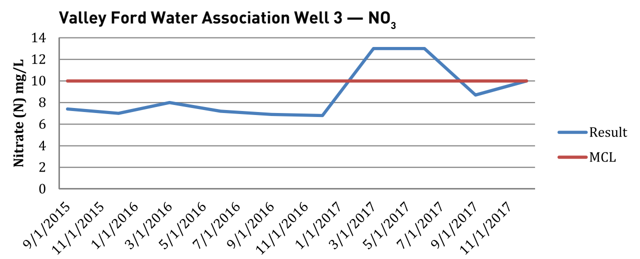
NITRATE N (MCL = 10 MG/L) & NITRATE NO_3 (MCL = 45MG/L)











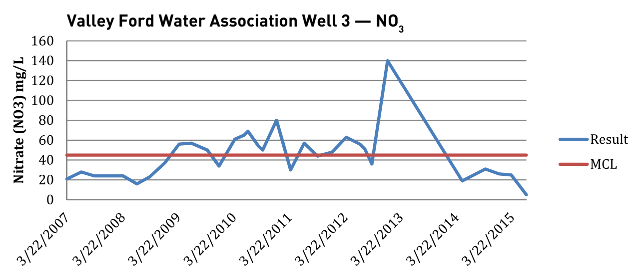


Table 36 Disadvantaged Communitiy Water & Wastewater Service Providers

The table below presents Tribal systems and economically disadvantaged community public water suppliers and wastewater treatment operators in the North Coast Region.

WATER SUPPLY AND/ OR WASTEWATER SERVICE PROVIDER	LOCATION
Bertsch-Oceanview CSD	Del Norte County
Big Rock CSD	Del Norte County
Butte Court Mobile Home Park	Del Norte County
Crescent City Water District	Del Norte County
Del Norte County Community Service Area	Del Norte County
Gasquet CSD	Del Norte County
HRC CSD	Del Norte County
Hunter Valley CSD	Del Norte County

WATER SUPPLY AND/ OR WASTEWATER SERVICE PROVIDER	LOCATION
JedSmith Homeowners' Association	Del Norte County
Klamath CSD (Del Norte Community Development)	Del Norte County
Las Palmas Mobile Home Park	Del Norte County
Pine Grove Trailer Park	Del Norte County
Redwood Park CSD	Del Norte County
Reservation Ranch	Del Norte County
Smith River CSD	Del Norte County
West Park Properties	Del Norte County
Yurok Tribe	Del Norte/ Humboldt County
Alderpoint CWD	Humboldt County
Beach Creek Mobile Home Park	Humboldt County
Big Lagoon CSD	Humboldt County
Big Lagoon Park Water Co.	Humboldt County
Briceland CSD	Humboldt County
Carlotta CSD	Humboldt County
City Of Arcata	Humboldt County
City Of Blue Lake WSA	Humboldt County
City Of Eureka WSA	Humboldt County
City Of Ferndale	Humboldt County
City Of Fortuna WSA	Humboldt County
City Of Rio Dell	Humboldt County
City Of Trinidad	Humboldt County
Ferndale Del Oro Water Company	Humboldt County
Fieldbrook CSD	Humboldt County
Garberville Sanitary District	Humboldt County
Garberville Water Company	Humboldt County
Hoopa Valley Tribe	Humboldt County
H umboldt CSD	Humboldt County
Humboldt Bay MWD	Humboldt County
Humboldt County RID #1, Shelter Cove POTW	Humboldt County
Loleta CSD	Humboldt County
Manila CSD	Humboldt County
McKinleyville CSD	Humboldt County
Midway RV Park	Humboldt County
Mill Creek MWC	Humboldt County
Miranda CSD	Humboldt County
Moonstone Heights MWA	Humboldt County
Myers Flat MWS	Humboldt County
Orick CSD	Humboldt County
Orleans CSD	Humboldt County
Orleans Mutual Water Company	Humboldt County
Palmer Creek CSD	Humboldt County
Palomino Estates MWC	Humboldt County
Phillipsville CSD	Humboldt County
Redcrest Water Works	Humboldt County
Redway CSD	Humboldt County
Riverside CSD	Humboldt County
Riverbend Mobile Home Park	Humboldt County
Scotia CSD	Humboldt County
Seawood Estates Mutual Water	Humboldt County
Waddington WW	Humboldt County
Weott CSD	Humboldt County
Westhaven CSD	Humboldt County
Willow Creek CSD	Humboldt County
Albion Mutual Water Company	Mendocino County
Anderson Valley CSD	Mendocino County
Big River Vista MWC	Mendocino County
Branscomb MWC	Mendocino County
Brooktrails Township CSD	Mendocino County
Calpella CWD	Mendocino County
Caspar South Service Company	Mendocino County
Covelo CSD	Mendocino County
Covelo Mobile Home Park	Mendocino County
Creekside Cabins & RV Resort	Mendocino County
Dolphin Isle Marina	Mendocino County
Elk County Water District	Mendocino County
Fort Bragg Municipal Improvement District	Mendocino County
Hills Ranch Mutual Water Company	Mendocino County
Holly Ranch Village	Mendocino County
Hopland Public Utility District	Mendocino County
Irish Beach Water District	Mendocino County
Lake View Mutual Water Co.	Mendocino County
Laytonville County WD	Mendocino County
Little Lake Mobile Home Park	Mendocino County
Meadow Estates Mutual	Mendocino County
Mendocino City CSD	Mendocino County
Millview County Water District	Mendocino County
North Gualala Water Company	Mendocino County
Pine Mountain Mutual Water Co.	Mendocino County
Point Arena Water Works	Mendocino County
Point Arena WWTP	Mendocino County
Point Cabrillo Highlands	Mendocino County
Point of View Mutual Water Co.	Mendocino County
Redwood Valley County Water District	Mendocino County
Ridgewood Water System	Mendocino County
River Estates Mutual Water Company	Mendocino County
Round Valley CWD	Mendocino County
Seafair Road and Water Company	Mendocino County
Shorelands Road and Water Company	Mendocino County
Surfwood Mutual Water Corporation	Mendocino County
Ukaih Valley Sanitation District	Mendocino County
Ukiah, City of	Mendocino County
Westport County Water district	Mendocino County
Wildwood Campground	Mendocino County
Willits City WWTP	Mendocino County
Willits, City of	Mendocino County
Willow County Water District	Mendocino County
Woods, (The)	Mendocino County
Woodside RV Park and Campground	Mendocino County
State Line RV Park	Modoc County
Newell County Water District	Modoc County
Cal Ore Trail Mobile Estates	Siskiyou County
Callahan Water District	Siskiyou County
City of Etna	Siskiyou County
Copco Lake MWC	Siskiyou County
Cove Mobile Villa	Siskiyou County
Dorris, City of	Siskiyou County
Fort Jones, City of	Siskiyou County
Grenada Sanitary District	Siskiyou County
Happy Camp CSD	Siskiyou County
Happy Camp SD	Siskiyou County
Hornbrook CSD	Siskiyou County
Juniper Creek Estates	Siskiyou County
Lake Shastina CSD	Siskiyou County

WATER SUPPLY AND/ OR WASTEWATER SERVICE PROVIDER	LOCATION
MacDoel Waterworks	Siskiyou County
McCloud CSD	Siskiyou County
Montague, City of	Siskiyou County
Montair Subdivision Homeowners Association	Siskiyou County
Oak Valley Acres POA	Siskiyou County
Sawyers Bar County Water District	Siskiyou County
Shadow Mountain MHP	Siskiyou County
Shasta View Heights Owners Association	Siskiyou County
Siskiyou Co. Rolling Hills MWC	Siskiyou County
Tennant CSD	Siskiyou County
Tulelake, City of	Siskiyou County
Weed, City of	Siskiyou County
Yreka, City of	Siskiyou County
Armstrong Valley — Cal Water Service (PUC)	Sonoma County
Austin Creek Mutual (Springhill)	Sonoma County
Belmont Terrace MWC	Sonoma County
Blue Spruce Mobile Home Park	Sonoma County
Bodega Water Company	Sonoma County
California American Geyserville Water Works (PUC)	Sonoma County
California American Water Larkfield	Sonoma County
Cazadero Water Company, Inc.	Sonoma County
City of Cotati	Sonoma County
City of Rohnert Park	Sonoma County
City of Santa Rosa	Sonoma County
Cloverdale, City of	Sonoma County
Delores Lane Water System	Sonoma County
El Crystal Mobile Home Park	Sonoma County
El Portal Mobile Estates	Sonoma County
Geyserville Sanitation Zone	Sonoma County
Graton CSD	Sonoma County
Hawkins Water Co — Cal Water Service (PUC)	Sonoma County
Healdsburg, City of	Sonoma County
Heights Mutual Water Company	Sonoma County
Huckleberry Mutual Water Company	Sonoma County
Journey's End Mobile Home Park	Sonoma County
Magic Mountain Mutual Water Company	Sonoma County
Michele Mutual Water Company	Sonoma County
Mobile Home Estates	Sonoma County
Mountain View Mobile Estates, LLC	Sonoma County
Noel Heights — Cal Water Service (PUC)	Sonoma County
North Star Mobile Home Park	Sonoma County
Pine Hill Terrace Mobile Home Park	Sonoma County
Plaza Mobile Home Park	Sonoma County
Rains Creek Water District	Sonoma County
Rancho Del Paradiso — Cal Water Service (PUC)	Sonoma County
Redwood Heights Water Association	Sonoma County
Rincon Valley Mobile Estates	Sonoma County
Roseland Mobile Home Park	Sonoma County
Russian River County Sanitation District	Sonoma County
Russian River Mutual Water Co.	Sonoma County
Santa Rosa Mobile Estates	Sonoma County
Sebastopol, City of	Sonoma County
Shamrock Mobile Home Park	Sonoma County
Six Acres Water Company	Sonoma County
Sonoma County CSA 41 — Salmon Creek	Sonoma County
Sonoma County Mutual Water Company	Sonoma County
Sonoma County Water Agency	Sonoma County

WATER SUPPLY AND/ OR WASTEWATER SERVICE PROVIDER	LOCATION
South Cloverdale Water Company	Sonoma County
South Park County Sanitation District	Sonoma County
Sunset Park Community	Sonoma County
Sweetwater Springs CWD — Guernville	Sonoma County
Sweetwater Springs CWD — Monte Rio	Sonoma County
Valley Ford Water Association	Sonoma County
Wayside Gardens Mobile Home Park	Sonoma County
West Water Company (PUC)	Sonoma County
Western Mobile Home Park	Sonoma County
Willowside Mutual Water Company	Sonoma County
Windsor, Town of	Sonoma County
Yulupa Mutual Water Company	Sonoma County
Bucktail Mutual Water Company	Trinity County
Burnt Ranch Estates Mutual Water Co.	Trinity County
Covington Mill MWC — Division B	Trinity County
Indian Creek Trailer Park	Trinity County
Lewiston Community Services District	Trinity County
Lewiston Park MWC	Trinity County
Pine Cove RV Park	Trinity County
Rush Creek Mutual Water System	Trinity County
Salyer Heights WS, Inc.	Trinity County
Salyer Mutual WC (formerly Riverview AC)	Trinity County
Seymour's Mutual Water System	Trinity County
Treasure Creek Woods MWC	Trinity County
Trinity Center MWC	Trinity County
Trinity Co. WW Dist #1	Trinity County
Trinity Knolls Mutual Water Company	Trinity County
Trinity Village Mutual Water Co.	Trinity County
Weaverville CSD	Trinity County
Weaverville SD	Trinity County
TOTAL NUMBER PROVIDERS	**207**

APPENDIX I. SOCIOECONOMIC

The data included in the following table are organized by North Coast counties to allow for comparison of statistics at varying scales.

Note: Unless otherwise stated, values are provided for the entire county, not for only the portion of the county within the North Coast boundary.

Table 37 Socioeconomic & Demographic Attributes of North Coast Counties

ATTRIBUTE	METRIC	COUNTY	REGION	CALIFORNIA
DEL NORTE COUNTY				
Area/ Size	Land area in square miles, 2010	1,006.37	50,246	155,779.22
Population Size	Population, 2018 estimate	27,828	na	39,557,045
Population Size	Population, 2010	28,610	675,845	37,254,523
Population Size	Population, percent change, April 1, 2010 to July 1, 2018	-2.7%		6.20%
Population Size	Households, 2013-2017	9,683		12,888,128
Population Density	Persons per square mile, 2010	28.4		239.1
Age Distribution	Persons under 5 years, percent, 2018	5.60%		6.20%
Age Distribution	Persons under 18 years, percent, 2018	21.0%		22.70%
Age Distribution	Persons 65 years and over, percent, 2018	18.0%		14.3%
Native	Native, percent, 2018	9.30%		1.60%
Education	High school graduate or higher, percent of persons age 25+, 2007-2011	81.60%		82.5%
Education	Bachelor's degree or higher, percent of persons age 25+, 2007-2011	14.40%		32.6%
Employment	Total employment, percent change, 2015-2016	-0.70%		1.90%
Employment	Percent employed, 2013-2017	43.5%%		63.0%
Economy	Retail sales per capita, 2012	$6,814		$12,665
Per Capita Income	Per capita money income in the past 12 months (2017 dollars), 2013-2017	$20,809		$33,128
Median Household Income	Median household income, 2013-2017	$41,287		$67,169
Poverty Rate	Persons below poverty level, percent, 2013-2017	24.6%		13.3%
HUMBOLDT COUNTY				
Area/ Size	Land area in square miles, 2010	3,567.99		155,779.22
Population Size	Population, 2018 estimate	136,373		39,557,045
Population Size	Population, 2010	134,611		37,254,523
Population Size	Population, percent change, April 1, 2010 to July 1, 2018	1.3%		6.20%
Population Size	Households, 2003-2017	63,315		12,888,128
Population Density	Persons per square mile, 2010	37.7		239.1
Age Distribution	Persons under 5 years, percent, 2012	5.30%		6.20%
Age Distribution	Persons under 18 years, percent, 2012	19.20%		22.70%
Age Distribution	Persons 65 years and over, percent, 2012	17.9%		14.3%
Native	Native, percent, 2012	6.30%		1.60%
Education	High school graduate or higher, percent of persons age 25+, 2007-2011	90.50%		82.5%
Education	Bachelor's degree or higher, percent of persons age 25+, 2007-2011	29.40%		32.6%
Employment	Employment, percent change, 2015-2016	3.5%		1.90%
Employment	Percent employed, May 2013	58.4%		63.0%
Economy	Retail sales per capita, 2012	$13,048		$12,665
Per Capita Income	Per capita money income in the past 12 months (2017 dollars), 2013-2017	$25,208		$33,128
Median Household Income	Median household income, 2007-2011	$43,718		$67,169
Poverty Rate	Persons below poverty level, percent, 2007-2011	19.7%		13.3%
MENDOCINO COUNTY				
Area/ Size	Land area in square miles, 2010	3,506.34		155,779.22
Population Size	Population, 2018 estimate	87,606		39,557,045
Population Size	Population, 2010	87,850		37,254,523
Population Size	Population, percent change, April 1, 2010 to July 1, 2018	-0.30%		6.20%
Population Size	Households, 2013-2017	34,182		12,888,128
Population Density	Persons per square mile, 2010	25.1		239.1
Age Distribution	Persons under 5 years, percent, 2018	5.9%		6.20%
Age Distribution	Persons under 18 years, percent, 2012	21.4%		22.70%
Age Distribution	Persons 65 years and over, percent, 2012	22.1%		14.3%

ATTRIBUTE	METRIC	COUNTY	REGION	CALIFORNIA
Native	Native, percent, 2012	6.30%		1.60%
Education	High school graduate or higher, percent of persons age 25+, 2007-2011	86.9%		82.5%
Education	Bachelor's degree or higher, percent of persons age 25+, 2007-2011	24.8%		32.6%
Employment	Employment, percent change, 2015-2016	2.80%		1.90%
Employment	Percent employed, May 2013	58.4%		63.0%
Economy	Retail sales per capita, 2012	$12,527		$12,665
Per Capita Income	Per capita money income in the past 12 months (2017 dollars), 2013-2017	$27,093		$33,128
Median Household Income	Median household income, 2013-2017	$46,528		$67,169
Poverty Rate	Persons below poverty level, percent, 2013-2017	16.30%		13.3%
MODOC COUNTY				
Area/ Size	Land area in square miles, 2010	3,917.77		155,779.22
Population Size	Population, 2012 estimate	8,777		39,557,045
Population Size	Population, 2010	9,686		37,254,523
Population Size	Population, percent change, April 1, 2010 to July 1, 2018	-9.4%		6.20%
Population Size	Households, 2007-2011	3,638		12,888,128
Population Density	Persons per square mile, 2010	2.5		239.1
Age Distribution	Persons under 5 years, percent, 2018	5.00%		6.20%
Age Distribution	Persons under 18 years, percent, 2018	19.5%		22.70%
Age Distribution	Persons 65 years and over, percent, 2018	26.9%		14.3%
Native	Native, percent, 2018	5.0%		1.60%
Education	High school graduate or higher, percent of persons age 25+, 2013-2017	85.50%		82.5%
Education	Bachelor's degree or higher, percent of persons age 25+, 2013-2017	16.60%		32.6%
Employment	Employment, percent change, 2015-2016	-0.20%		1.90%
Unemployment	Percent Employed, May 2018	46.5%		63.0%
Economy	Retail sales per capita, 2012	$4,904		$12,665
Per Capita Income	Per capita money income in the past 12 months (2017 dollars), 2013-2017	$22,052		$33,128
Median Household Income	Median household income, 2013-2017	$39,296		$67,169
Poverty Rate	Persons below poverty level, percent, 2013-2017	19.2%		13.3%
SISKIYOU COUNTY				
Area/ Size	Land area in square miles, 2010	6,277.89		155,779.22
Population Size	Population, 2018 estimate	43,724		39,557,045
Population Size	Population, 2010	44,900		37,254,523
Population Size	Population, percent change, April 1, 2010 to July 1, 2018	-2.6%		6.20%
Population Size	Households, 2013-2017	19,018		12,888,128
Population Density	Persons per square mile, 2010	7.2		239.1
Age Distribution	Persons under 5 years, percent, 2018	5.2%		6.20%
Age Distribution	Persons under 18 years, percent, 2018	20.1%		22.70%
Age Distribution	Persons 65 years and over, percent, 2018	25.5%		14.3%
Native	Native, percent, 2018	5.1%		1.60%
Education	High school graduate or higher, percent of persons age 25+, 2013-2017	89.3%		82.5%
Education	Bachelor's degree or higher, percent of persons age 25+, 2013-2017	22.7%		32.6%
Employment	Employment, percent change, 2015-16	-3.50%		1.90%
Employment	Percent employed, May 2013	50.9%		63.0%
Economy	Retail sales per capita, 2007	$9,663		$12,665
Per Capita Income	Per capita money income in the past 12 months (2017 dollars), 2013-2017	$24,605		$33,128
Median Household Income	Median household income, 2007-2011	$40,884		$67,169
Poverty Rate	Persons below poverty level, percent, 2007-2011	17.7%		13.3%
SONOMA COUNTY				
Area/ Size	Land area in square miles, 2010	1,575.85		155,779.22
Population Size	Population, 2018 estimate	499,942		39,557,045
Population Size	Population, 2010	483,878		37,254,523
Population Size	Population, percent change, April 1, 2010 to July 1, 2018	3.3%		6.20%
Population Size	Households, 2007-2011	190,058		12,888,128
Population Density	Persons per square mile, 2010	307.1		239.1
Age Distribution	Persons under 5 years, percent, 2012	5%		6.20%
Age Distribution	Persons under 18 years, percent, 2012	19.6%		22.70%
Age Distribution	Persons 65 years and over, percent, 2012	19.7%		14.3%
Native	Native, percent, 2012	2.2%		1.60%
Education	High school graduate or higher, percent of persons age 25+, 2007-2011	87.7%		82.5%
Education	Bachelor's degree or higher, percent of persons age 25+, 2007-2011	33.8%		32.6%

ATTRIBUTE	METRIC	COUNTY	REGION	CALIFORNIA
Employment	Employment, percent change, 2013-2017	1.0%		1.90%
Employment	Percent employed, 2013–2017	64.5%		63.0%
Economy	Retail sales per capita, 2012	$12,233		$12,665
Per Capita Income	Per capita money income in the past 12 months (2017 dollars), 2013-2017	$37,767		$33,128
Median Household Income	Median household income, 2013-2017	$71,769		$67,169
Poverty Rate	Persons below poverty level, percent, 2007-2011	9.3%		13.3%
TRINITY COUNTY				
Area/ Size	Land area in square miles, 2010	3,179.25		155,779.22
Population Size	Population, 2018 estimate	12,535		39,557,045
Population Size	Population, 2010	13,784		37,254,523
Population Size	Population, percent change, April 1, 2010 to July 1, 2018	-9.1%		6.20%
Population Size	Households, 2007-2011	5,462		12,888,128
Population Density	Persons per square mile, 2010	4.3		239.1
Age Distribution	Persons under 5 years, percent, 2018	4.3%		6.20%
Age Distribution	Persons under 18 years, percent, 2018	17.1%		22.70%
Age Distribution	Persons 65 years and over, percent, 2018	27.3%		14.3%
Native	Native, percent, 2018	5.2%		1.60%
Education	High school graduate or higher, percent of persons age 25+, 2013-2017	89.8%		82.5%
Education	Bachelor's degree or higher, percent of persons age 25+, 2013-2017	19.50%		32.6%
Employment	Employment, percent change, 2013-2017	-3.0%		1.90%
Employment	Percent employed, May 2018	47.3%		63.0%
Economy	Retail sales per capita, 2012	$5,372		$12,665
Per Capita Income	Per capita money income in the past 12 months (2011 dollars), 2015-2016	$23,575		$33,128
Median Household Income	Median household income, 2013-2017	$36,563		$67,169
Poverty Rate	Persons below poverty level, percent, 2013-2017	20.3%		13.3%

Source: US Census (www.census.gov)

Table 38 Economically Disadvantaged Populations and Area in the North Coast

TABLE ECONOMICALLY DISADVANTAGED POPULATIONS AND AREA IN THE NORTH COAST										
	Population						**Area**			
	County	**Total Population**	**Population living in EDC**	**%Total Population in EDC**	**Population living in SEDC**	**%Total Population in SEDC**	**Total Area**	**Area considered EDC**	**% Total Area EDC**	**Area considered SEDC**	**% Total Area SEDC**
Participating North Coast Counties	Del Norte	27,787	18,059	65%	12580	45%	648,879	622,568	96%	568,048	88%
	Humboldt	135,030	91,013	67%	38811	29%	2,310,054	1,783,497	77%	850,106	37%
	Mendocino	87,516	55,522	63%	37240	43%	2,245,146	1,411,131	63%	969,604	43%
	Modoc*	1,713	1,713	100%	791	46%	751,022	751,022	100%	224,797	30%
	Siskiyou*	34,798	28,691	82%	15228	44%	3,326,050	3,185,515	96%	1,591,994	48%
	Sonoma*	377,683	92,036	24%	23526	6%	834,109	96,131	12%	18,282	2%
	Trinity	13,363	10,730	80%	8378	63%	2,051,353	1,551,288	76%	1,090,498	53%
Other North Coast Counties	Glenn*	100.46	100	100%	58	58%	54,246	54,246	100%	32,346	60%
	Lake*	1,211.74	1,194	99%	1165	96%	191,944	191,658	100%	191,145	100%
	Marin*	540.00	540	100%	0	0%	22,677	22,677	100%	0	0%
North Coast Totals		679,741	299,598	44%	137,776	20%	12,435,479	9,669,731	78%	5,536,820	45%

Table 39 Historic & Projected Population Growth of North Coast Counties

COUNTY	1980	1990	2000	2010	2020	2030	90-00 % CHANGE	00-10 % CHANGE	10 –20 % CHANGE	20–30 % CHANGE
Del Norte	18,217	23,460	27,507	28,389	26,997	27,570	15%	5%	5%	2%
Humboldt	108,514	119,118	126,518	134,998	137,711	140,779	6%	5%	5%	2%
Mendocino	66,738	80,345	86,265	87,667	90,175	93,452	7%	6%	6%	4%
Modoc	9,449	9,678	9,449	9,689	9,422	9,267	-2%	-3%	-3%	-1.6%
Siskiyou	39,732	43,531	44,301	44,862	44,186	44,406	2%	-2%	-2%	.5%
Sonoma	299,681	388,222	458,614	483,541	515,486	554,694	15%	14%	14%	7.6%
Trinity	11,858	13,063	13,022	13,779	13,389	13,322	0%	0%	0%	-.5%

Source: Department of Commerce, CA Dept. of Finance 2012

Table 40 Economically Disadvantaged Communities of North Coast WMAs

WMA NAME	STATUS	PERCENT AREA	PERCENT DAC OR SDAC
Eel WMA	DAC	19.15	81.89
	SDAC	62.74	
	Not DAC	18.11	
Humboldt WMA	DAC	29.13	49.66
	SDAC	20.53	
	Not DAC	50.34	
Klamath WMA	DAC	18.44	96.57
	SDAC	78.13	
	Not DAC	3.43	
North Coast WMA	DAC	28.92	59.84
	SDAC	30.92	
	Not DAC	40.16	
Russian Bodega WMA	DAC	27.3	29.34
	SDAC	2.04	
	Not DAC	70.66	
Trinity WMA	DAC	25.91	78.00
	SDAC	52.09	
	Not DAC	21.99	

Source: US Census 2010 and California Department of Water Resources

APPENDIX J.
CLIMATE CHANGE VULNERABILITY ASSESSMENT

PROCESS TO DETERMINE POTENTIAL VULNERABILITIES

Approach to Climate Change Vulnerability Assessment

The assessment process and results will provide North Coast water resource managers with a clearer understanding of the combined relative sensitivity and adaptability North Coast sectors to potential future climate impacts. Detail and precision of this assessment is designed to match the information available as well as the likely resources available for these types of assessments in this Region. Because many climate change impacts involve complex system responses to projected climate changes, detailed studies often involving numeric models of other systems (hydrologic, ecologic, vegetation, fire) that use climate projections as inputs are often used to determine and quantify impacts. These modeling studies — combined with regional climate projection data and region-specific information relevant to the sectors defined such as topography, land-use, crop values, water supply source, water quality issues, etc. — formed the core of knowledge for identifying impacts and determining sensitivity and adaptive capacity which combine to specify vulnerability[3].

Overview of Steps to Develop North Coast CCVA

The NCRP framework for determination of North Coast regional vulnerability to climate change includes the following steps (discussed in turn):

1. Identify a suite of sectors comprising regional water-related systems (built/ economic and natural/ ecosystem);
2. Use available data, scenarios, and models to create projections of regional climatic and hydrologic variables (by applying GHG emission scenarios and publically available data);
3. Analyze projected variables to determine likely regional impacts of climate and hydrology on the sectors
4. Determine sensitivity and adaptive capacity of sectors to projected changes in climatic/ hydrologic variables; and
5. Co-analyze sensitivity and adaptive capacity to determine and rank overall vulnerability of each sector.

Per recommendations of the DWR's 2016 IRWM Guidelines, the USEPA/ DWR's "Climate Change Handbook for Regional Water Planning" (2011), and others, the next steps for developing this preliminary CCVA into fuller Climate Analysis (per) include vetting the preliminary list of vulnerability rankings with the NCRP and other stakeholders; identifying priority sectors for further analysis; develop local strategies to reduce sensitivity and/or increase adaptive capacity of these priority sectors; and conducting ongoing refinement of CCVA and climate analyses (e.g. using new downscaled data sufficient to provide high-resolution information) to inform local planning and implementation.

Determinations of sensitivity, adaptive capacity, and vulnerability necessarily contain a degree of subjectivity based on the availability of relevant literature, understanding of cause and effect processes relating future climatic conditions to the current and future state of the systems involved. However, a relative scale from high to low along with a consistently applied process should provide reasonable scoring precision and accuracy. The steps taken to complete the vulnerability assessment are described briefly and in general terms in the sections below.

STEP 1) Identify a suite of "sectors" comprising regional water-related systems

A regional characterization had been created in the form of the previous versions of the NCRP Plan, which provides the physical, and water resource context for defining sectors and assessing impacts to specific components of each sector. The NCRP includes descriptions of the physical and biological characteristics, sensitive habitats, special designations, and current water management issues. The North Coast CCVA considered

3 Other resources relevant to local climate change assessment as part of IRWM planning include: an academic report about how various IRWM regions are addressing climate vulnerability http://www.acwa.com/news/climate-change/new-report-examines-climate-change-and-irwm-regions; a case study from Sonoma County Water Agency www.water.ca.gov/climatechange/docs/Front%20Matter-Final.pdf; a Vulnerability Assessment from East Bay Municipal Utility District http://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=498020; and the "Tribal Communities Climate Change Vulnerability Matrix" currently in development with DWR at erin.chappell@water.ca.gov

all these attributes in the vulnerability assessment, via definition of a list of sectors for analysis, that together subsume these descriptions to represent the Region's preparedness for potential climate change effects.

Sectors have been defined in this assessment to readily align with existing resource management frameworks so that the information can be most efficiently integrated with statewide planning processes, as necessary and appropriate. Assessment of sectors herein includes consideration of the current status of the sector, how it changes over time, and what drives those changes. Sectors sometimes are closely related or may directly or indirectly feedback on one another. The sectors can be grouped into two broad systems: Natural/ Ecological (with sectors representing "green" infrastructure/resources and ecosystem function) and Built/ Human/Economic (with sectors representing "gray" infrastructure/resources and economic viability).

The list of sectors chosen for this preliminary vulnerability assessment is intended to be representative of the suite of North Coast attributes that support its waters, habitats, communities, and economies. A number of sources were referenced during CCVA planning to ensure the NCRP list of sectors is representative, compatible, and meaningful[4].

Table 41 Sectors Assessed for Vulnerability to Climate Change

SYSTEM	SECTOR	DESCRIPTION
Natural/ Ecological	Forests	Forests are areas of the region with high densities of trees, which make up the largest type of land cover of the region by area. This sector includes consideration of the natural ecosystems that compose the forest environment.
	Rangelands	Rangelands are natural landscapes in the form of grasslands, shrublands, woodland, and wetlands, and in this context also include pasture lands (which are grasslands that also function as open spaces and working landscapes). This sector includes consideration of the natural ecosystems that compose the different rangeland types.
	Riparian	The riparian zone or riparian area is the interface between land and a river or stream. They are important natural biofilters, protecting aquatic environments from excessive sedimentation, pollutants, and erosion and provide shelter for aquatic animals and they shade the stream which regulates water temperatures. This sector includes consideration of the ecosystems that compose the riparian zone, with special consideration to cold water fish species. Several of the streams and rivers throughout region are federally designated 'Wild and Scenic' rivers.
	Coastal	The coastal zone can be defined by the area of interaction of land and sea processes. This sector includes systems such as coastal lagoons, the intertidal zone, near shore currents, sea cliffs, and developed areas along the coast. It includes Critical Coastal Areas, Areas of Special Biological Significance, State Water Quality Protection Areas, and Water Management Areas across the North Coast Region.
Built/ Human / Economic	Forestry	Forestry includes the management, use, and conservation of forest for human benefit. This sector includes natural resource management and economic activities related to the forest environment.
	Urban	Urban areas of the region are characterized by higher population and structure density and extensive impervious surface coverage. This sector includes consideration of impacts on property, infrastructure, and development.
	Fisheries	Fish harvesting from the ocean and rivers is an important economic activity on the region. This sector includes consideration how ecological impacts may affect the activities or economics of fish harvesting in the region.
	Water supply/ demand	Water supply is physical and programmatic infrastructure that exists in the region to meet residential, industrial, and agricultural water demands. This sector includes consideration of impacts on water supply sources, storage, and conveyance; and changes in patterns of needs based on seasonal temperatures and land-use.
	Energy capacity/ demand	Energy capacity refers to the amount of energy that power plants are able to generate to meet the needs of customers. This sector includes consideration of climate change impacts on energy sources such as hydropower and changes to overall demands and timing.
	Recreation	Abundant natural landscapes and waterways in the region provide excellent aquatic recreation opportunities. This sector includes consideration of how impacts may limit those opportunities for direct experience in the regions coastal ocean, rivers, and wetlands as well as appreciation of wildlife that depend on these resources.

STEP 2) Use available data, models, and scenarios to create projections of regional climatic/ hydrologic variables

Available data were used to determine the direction and degree of change for regional climatic and hydrologic variables. Projected changes to climatic variables, and related responses in hydrologic variables, are presented in tables below for the Region's counties and WMAs, respectively.

4 Guidance for development of list of sectors provided by: "Climate Change Handbook for Regional Water Planning" (USEPA, DWR 2011)"California Adaptation Planning Guide: Defining Regional and Local Impacts" (CalEMA, CNRA, FEMA 2012); "Adapting to Climate Change: A Planning Guide for State Coastal Managers" (NOAA 2010); and "Preparing for Climate Change: A Guidebook for Local, Regional, and State Governments" (Climate Impacts Group, Univ WA, et al. 2007).

Climate Models

Climate science and associated models have historically been focused on large spatial scales, but have been more recently been applied to estimating future climatic conditions and expected hydrologic responses at regional and local scales (e.g. county, basin/WMA; Thorne et al. 2012a). There are numerous widely applied global climate models, each with variations in representation of the physical and chemical processes and interactions that drive climate patterns. Therefore, climate scientists often use multiple models (rather than a single model) to evaluate potential future climate patterns and trends, since there is a large amount of uncertainty in the ability to model complex and dynamic systems such as climate. In this CCVA, projections of both climate and hydrologic changes have been derived from a number of different sources that have been published in the scientific literature. Analyses incorporate two global climate models: the Parallel Climate Model (PCM) and the Geophysical Fluid Dynamics Laboratory (GDFL) Model. Climate projections have been regionally downscaled by independent studies to better represent future conditions in California and specific regions within the state including the North Coast using bias correction and special downscaling (BCSD) for a suite of several models and emissions scenarios made available by the California Energy Commission were downloaded for this assessment (available at www.caladapt.org) which are reported in Maurer et al., 2002.

Emission Scenarios

All projections of future climate, hydrology, and sea level by global climate models are very sensitive to future carbon and greenhouse gas emissions scenarios, which produce a range of projected change. Emissions scenarios are plausible descriptions, without likelihoods, of the future states of the world and are used to estimate future greenhouse gas emissions. They vary based on assumptions about the nature of population growth and economic development in the future and the resultant estimated rates of fossil fuel and greenhouse gas (GHG) emissions. The two most commonly used emissions scenarios are the A2 and B1 scenarios, which provide a reasonable range of potential future emissions. A2 assumes a continued exponential increase in GHG emissions over the next 100-yrs, with some reduction relative to current rates. B1 assumes a significant global reduction in GHG emissions from industrialized and developing nations with the peak in global carbon emission reached in the middle of 21st century and then declining back to carbon emission rates of the 1970s. For the majority of references cited in this synthesis, the A2 and B1 emissions scenarios are used to bracket the high and low projections. Climatic model outputs are expressed in summary metrics that represent an overall shift in certain climate variables over decadal time scales (e.g., mean annual precipitation), changes in spatial patterns (e.g., temperature gradients), or 'extreme event' changes (e.g., magnitude, frequency, and return intervals).

Table 42 Projected Changes to Climate & Hydrology of North Coast Counties

CLIMATIC & HYDROLOGIC VARIABLES	DEL NORTE	GLENN	HUMBOLDT	LAKE	MARIN	MENDOCINO	MODOC	SISKIYOU	SONOMA	TRINITY	REGION
Actual evapotranspiration	-0.24	+0.52	-0.09	-1.03	-1.69	-1.45	+0.16	+0.54	-2.00	+1.42	+3.42
Climatic Water Deficit	+4.64	+5.50	+4.76	+5.76	+5.61	+5.74	+7.60	+6.95	+6.31	+6.20	-0.11
Excess water	-12.57	-12.64	-10.99	-8.54	-3.68	-8.71	-3.02	-7.88	-5.98	-12.41	-6.43
Fire Risk	+0.05	+0.07	+0.05	+0.07	+0.05	+0.06	-0.02	+0.03	+0.06	+0.07	+0.01
Maximum July Temperature	+11.22	+10.39	+9.86	+9.78	+4.30	+9.39	+11.17	+11.88	+6.62	+10.12	+3.50
Minimum January Temp	+5.25	+5.91	+5.18	+5.62	+6.69	+5.88	+6.76	+5.27	+6.56	+5.43	-1.13
Potential Evapotranspiration	+3.34	+3.82	+3.15	+3.90	+3.33	+3.47	+3.78	+3.49	+3.73	+3.46	-0.27
Recharge	-5.57	-0.21	-6.41	-1.87	-0.98	-4.82	-1.18	-3.09	-2.27	-7.03	-4.76
Runoff	-6.43	-12.16	-4.08	-7.70	-3.90	-4.29	-0.13	-2.35	-4.77	-3.77	+1.00
Snowfall	-3.56	-4.61	-4.62	-0.85	-0.09	-1.82	-3.14	-7.94	-0.20	-11.08	-10.88
Snowmelt	-3.05	-3.67	-4.06	-0.57	-0.03	-1.44	-2.23	-6.81	-0.10	-9.69	-9.59
Snowpack	-3.46	-6.62	-8.87	-0.65	0.00	-1.28	-9.00	-25.23	0.00	-25.31	-25.31
Soil water storage	-5.86	-3.25	-14.56	-4.64	-8.33	-9.70	-2.86	-6.03	-11.00	-5.72	+5.28
Sublimation	-0.51	-0.95	-0.56	-0.29	-0.06	-0.39	-0.84	-1.10	-0.10	-1.33	-1.23
Total precipitation	-13.11	-13.06	-11.37	-11.54	-7.14	-11.29	-2.49	-6.45	-9.61	-11.03	-1.42

Source: United States Geological Survey, California Energy Commission after Thorne et al. 2012a

Table 43 Projected Changes to Climate & Hydrology of North Coast WMAs

CLIMATIC & HYDROLOGIC VARIABLES	EEL	HUMBOLDT	KLAMATH	N. COAST RIVERS	RUSSIAN/ BODEGA	TRINITY	REGION
Actual evapotranspiration	-0.31	+0.39	+0.43	-1.36	-2.07	+1.34	+3.41
Climatic Water Deficit	+5.45	+4.74	+6.78	+5.58	+6.16	+5.95	-0.21
Excess water	-11.19	-11.30	-7.54	-9.18	-5.55	-11.91	-6.36
Fire Risk	+0.07	+0.04	+0.02	+0.06	+0.06	+0.07	+0.01
Maximum July Temp	+9.59	+9.01	+11.68	+10.28	+6.67	+10.28	+3.61
Minimum January Temp	+5.59	+5.07	+5.53	+5.62	+6.38	+5.34	-1.04
Potential Evapotranspiration	+3.49	+3.08	+3.49	+3.51	+3.50	+3.34	-0.16
Recharge	-5.61	-7.91	-3.07	-5.15	-2.38	-6.33	-3.95
Runoff	-5.51	-2.62	-2.22	-4.39	-4.18	-3.93	+0.25
Snowfall	-4.44	-5.72	-6.86	-1.42	-0.26	-10.89	-10.63
Snowmelt	-3.75	-5.05	-5.81	-1.19	-0.13	-9.53	-9.40
Snowpack	-6.96	-12.25	-20.48	-2.34	-0.01	-24.60	-24.59
Soil water storage	-11.21	-19.90	-5.41	-8.60	-11.13	-5.45	+5.68
Sublimation	-0.70	-0.64	-1.01	-0.24	-0.13	-1.29	-1.16
Total precipitation	-12.39	-10.95	-6.31	-11.46	-9.25	-10.58	-1.33

Source: United States Geological Survey, California Energy Commission after Thorne et al. 2012

Incorporating Uncertainty

Because climate model outputs have a range of uncertainty and agreement among individual studies, this CCVA provides a measure of "confidence" associated with each of the climate/hydrology projections considered herein. Confidence in the final "vulnerability" rankings (and priorities identified thereby) is limited by the quality and availability of region-specific data and peer-reviewed literature that were used to score the elements of vulnerability (as described below, vulnerability is a combination of each sector's "sensitivity" and "adaptive capacity." It must be noted that these determinations for both sensitivity and adaptive capacity are somewhat subjective; the credibility of results herein and strength of the CCVA conclusions is supported by the step-wise development process that includes definition of rankings (High, Moderate, Low) and the systematic application of matrices to produce a consistent assessment of the entire (and varied) Region. The table below defines the confidence ratings used for the CCVA.

Table 44 Definitions for Climate Change Projection Confidence Ratings

CONFIDENCE RANKING	DEFINITION
High	General agreement of modeling studies has created consensus in the scientific literature. Available information is directly relevant and applicable to local systems.
Moderate	Scientifically supported but consensus is not present due to lack of information, moderate differences between studies, or limitations for drawing general conclusions from limited scientific information. Accessibility or application of information to local systems may be somewhat limited.
Low	Limited information or conflicting results between studies, model outputs, or research findings. Accessibility or application of information to local systems is very limited.

STEP 3) Analyze projected variables to determine likely regional impacts of climate and hydrology on the sectors

A suite of 48 potential impacts to sectors resulting from changes in climatic and hydrologic variables in North Coast Region were identified using the most credible and recently local and regional scientific literature and publically available datasets. Impacts are evidenced and documented as changes to the state, function, or structure of natural and human systems in the North Coast Region that are thought to be linked to climate (directly) and/or hydrology (indirectly). Such changes have already been detected at global to local scales and are expected to continue (Moser et al. 2009), albeit in largely unpredictable ways. The potential climate-associated impacts listed in Table are not comprehensive, but instead focus on responses related to the health of watershed and aquatic systems in the North Coast Region for which there is a developed body of scientific information. Whenever possible, supporting information has been collated specific to the North Coast Region (or even to the county-level), and in other cases inference is drawn from anticipated impacts throughout the state and for neighboring regions.

STEP 4) Determine sensitivity and adaptive capacity of sectors to projected changes in climatic/hydrologic variables

Sensitivity

For each impact identified, the sensitivity of sectors to projected impacts was determined via examination of the scientific literature, analysis of climate change projection data, and other sources specific to California or within the North Coast IRWM Region boundary. "Sensitivity" is the degree to which system components within each sector (e.g., wildfire regimes, salmonid populations, or stormwater conveyance) respond to climatic/hydrologic conditions (e.g., temperature and precipitation), including to potential system impacts (e.g., stream temperature increases or snowmelt timing changes). If the sector or sector component is likely to be affected by future climatic conditions then it is considered sensitive (on a relative scale). The table below ("Definitions for Sensitivity to Climate Change Impacts") presents the definitions of the relative sensitivity scale. Questions considered when determining the relative degree of sensitivity include:

- What is the degree of exposure to climate change? For example, coastal areas are more exposed to sea level rise related impacts compared to inland areas.
- Would the existing stressors in the system and future climatic conditions exacerbate these stressors? For example, the degree of urban encroachment on forests may be a stressor that promotes greater frequency of wildfire ignitions.
- Is the existing balance of resource demand and supply such that climate may increase demand and/or reduce supply for water-related resources?

Table 45 Definitions for Sensitivity to Climate Change Impacts

SENSITIVITY	DEFINITION
High	System components are expected to respond measurably to an impact based on historical observations or modeling studies.
Moderate	The response of system components to an impact has not necessarily been measured, but based on our understanding system function there are likely to be direct or indirect responses.
Low	System components do not respond measurably to impacts and based on understanding of system function there are not likely to be direct or indirect responses.

Adaptive Capacity

For each impact identified, the adaptive capacity of sectors was determined via literature review and data analysis. Projected climate/ hydrologic data sources are state or Region-specific. "Adaptive capacity" is the inherent natural ability of a sector or sector component to accommodate an impact that results from projected climate or hydrologic changes. For natural systems, the CCVA assesses the intrinsic ability of system components to adapt without any human intervention such as policy or management action changes. For assessment of human/built/economic sectors, adaptive capacity assessment may include consideration of the timeframe and level of effort or cost associated with management actions to increase resiliency to a climate change impact. The following table ("Definitions for Adaptive Capacity to Climate Change Impacts") presents the definitions of the relative adaptive capacity scale. In determining how adaptable a sector is to altered climatic/ hydrologic regime, the following questions are considered:

- What are current level of stressors and flexibility to respond to future stressors? Can or has the system adapted to historic climatic changes or inclement conditions?
- Are there limiting factors that restrict the system's ability to adapt? For example, sub-alpine species' ability to adjust to future climate can be limited by elevation if they currently exist at the top of the existing elevations.
- Are there any barriers to the system's abilities to accommodate adjustments (legal, physical, biological) in response to future climate?
- How do timescales of adaptation rate compare to the rate of climate changes?
- Are there efforts currently underway that would increase adaptability from human/built/economic sectors?

Table 46 Definitions for Adaptive Capacity to Climate Change Impacts

ADAPTIVE CAPACITY	DEFINITION
High	System components are expected to accommodate climate changes and expected impacts in ways that avoid negative consequences.
Moderate	The system has some capacity to adjust, and the degree of negative consequences will depend on the magnitude of individual and cumulative impacts.
Low	The system has little or no capacity to accommodate expected impacts so that negative impacts cannot be avoided

STEP 5) Co-analyze sensitivity with adaptive capacity to determine and rank overall vulnerability of each sector

In the context of this CCVA, "vulnerability" is the susceptibility of a sector to possible detrimental impacts due to changed climate. The vulnerability of systems to specific climate change impacts is determined for this assessment by combining the sensitivity and adaptive capacity ratings in the manner outlined in the matrix below ("Matrix to Determine Climate Change Vulnerability"). Sectors that have high sensitivity to climate changes and a low capacity to adapt are considered to be most highly vulnerable to climate change impacts. As sensitivity decreases the weighting of the adaptive capability is preserved, such that even a system component that is considered not sensitive to climate change but has a low ability to adapt is considered moderately vulnerable. The column labeled 'Comments' in the Table below ("Climate Change Vulnerability Assessment of the North Coast Region") briefly documents specific elements of each sector's sensitivity and adaptive capacity that lead to the final determination of vulnerability. The elements that were considered include physical exposure to the impact, existing stressors, observed or modeled responses, and barriers to adaptation strategies and actions.

Table 47 Matrix to Determine Climate Change Vulnerability

	SENSITIVITY			
ADAPTIVE CAPACITY	**RANK**	High	Moderate	Low
	High	Moderate	Low	Low
	Moderate	High	Moderate	Low
	Low	High	High	Moderate

SECTORS ASSESSED FOR VULNERABILITY TO CLIMATE CHANGE

Checklist for Developing the List of Potentially Vulnerable Sectors

DWR developed the following checklist to guide preliminary development of a climate change vulnerability assessment framework; the checklist represents a "minimum" effort at climate assessment per DWR IRWM Guidelines (DWR 2016). It will continue to serve as a discussion tool and to help identify data gaps, for questions that cannot be answered at this time. In the following list, ***bold italics*** indicate the question was considered of particular relevance (or was answered in the affirmative) during determination of vulnerability of the North Coast Region sectors.

I. DWR Checklist Sector: Water Demand

NCRP CCVA Sector(s): Water Supply/ Demand

- Are there major industries that require cooling/process water in your planning region?
- Does water use vary by more than 50% seasonally in parts of your region?
- ✓ ***Are crops grown in your region climate-sensitive? Would shifts in daily heat patterns, such as how long heat lingers before night-time cooling, be prohibitive for some crops?***
- ✓ ***Do groundwater supplies in your region lack resiliency after drought events?***
- Are water use curtailment measures effective in your region?
- ✓ ***Are some instream flow requirements in your region either currently insufficient to support aquatic life, or occasionally unmet?***

II. DWR Checklist Sector: Water Supply

NCRP CCVA Sector(s): Water Supply/ Demand

- ✓ ***Does a portion of the water supply in your region come from snowmelt?***
- ✓ ***Does part of your region rely on coastal aquifers? Has salt intrusion been a problem in the past?***
- ✓ ***Would your region have difficulty in storing carryover supply surpluses from year to year?***
- Has your region faced a drought in the past during which it failed to meet local water demands?
- Does your region have invasive species management issues at your facilities, along conveyance structures, or in habitat areas?

III. DWR Checklist Sector: Water Quality

NCRP CCVA Sector(s): Riparian, Fisheries, Recreation, Water Supply/Demand

- ✓ ***Are increased wildfires a threat in your region? If so, does your region include reservoirs with fire-susceptible vegetation nearby which could pose a water quality concern from increased erosion?***
- Does part of your region rely on surface water bodies with current or recurrent water quality issues related to eutrophication, such as low dissolved oxygen or algal blooms? Are there other water quality constituents potentially exacerbated by climate change?
- ✓ ***Are seasonal low flows decreasing for some waterbodies in your region? If so, are the reduced low flows limiting the waterbodies' assimilative capacity?***
- ✓ ***Are there beneficial uses designated for some water bodies in your region that cannot always be met due to water quality issues?***
- Does part of your region currently observe water quality shifts during rain events that impact treatment facility operation?

IV. DWR Checklist Sector: Sea Level Rise

NCRP CCVA Sector(s): Coastal, Urban, Agriculture

- ✓ ***Has coastal erosion already been observed in your region?***
- ✓ ***Are there coastal structures, such as levees or breakwaters, in your region?***
- ✓ ***Is there significant coastal infrastructure, such as residences, recreation, water and wastewater treatment, tourism, and transportation) at less than six feet above mean sea level in your region?***
- ✓ ***Are there climate-sensitive low-lying coastal habitats in your region?***
- Are there areas in your region that currently flood during extreme high tides or storm surges?
- ✓ ***Is there land subsidence in the coastal areas of your region?***
- Does part of your region lie within the Sacramento-San Joaquin Drainage District?
- ✓ ***Does aging critical flood protection infrastructure exist in your region?***
- Have flood control facilities (such as impoundment structures) been insufficient in the past?
- Are wildfires a concern in parts of your region?

V. DWR Checklist Sector: Ecosystem and Habitat Vulnerability

NCRP CCVA Sector(s): Forest, Rangeland, Riparian, Coastal, Forestry, Fisheries

- ✓ ***Does your region include inland or coastal aquatic habitats vulnerable to erosion and sedimentation issues?***
- ✓ ***Does your region include estuarine habitats which rely on seasonal freshwater flow patterns?***
- ✓ ***Do climate-sensitive fauna or flora populations live in your region?***
- ✓ ***Do endangered or threatened species exist in your region? Are changes in species distribution already being observed in parts of your region?***
- ✓ ***Does the region rely on aquatic or water-dependent habitats for recreation or other economic***
- ✓ ***Are there rivers in your region with quantified environmental flow requirements or known water quality/quantity stressors to aquatic life?***
- ✓ ***Do estuaries, coastal dunes, wetlands, marshes, or exposed beaches exist in your region? If so, are coastal storms possible/frequent in your region?***
- ✓ ***Are there areas of fragmented estuarine, aquatic, or wetland wildlife habitat within your region?***
- Are there movement corridors for species to naturally migrate? Are there infrastructure projects planned that might preclude species movement?

VII. DWR Checklist Sector: Hydropower

NCRP CCVA Sector(s): Energy Demand/ Capacity

- ✓ ***Is hydropower a source of electricity in your region?***

✓ ***Are energy needs in your region expected to increase in the future?***

- If so, are there future plans for hydropower generation facilities or conditions for hydropower generation in your region?

PROJECTED CHANGES TO CLIMATIC & HYDROLOGIC CONDITIONS

Climatic & Hydrologic Variables for the Region, Basins, and Counties

Projected changes in climate and hydrologic variables are adapted from USGS 2012 at California Climate Commons and Thorne et al. 2012a. The GFDL A2 scenario was used to generate projected values.

PRELIMINARY RESULTS OF CLIMATE CHANGE VULNERABILITY ASSESSMENT

This appendix presents full and summarized results of the Climate Change Vulnerability Assessment (CCVA) that is being conducted for the NCRP. Where appropriate, formal assessment results are supplemented with results from interviews conducted with a diversity of local professional planners throughout the Region. Refinements will be ongoing.

Via analyses of the climatic and hydrologic variables described previously, vulnerability (=sensitivity X adaptive capacity) to 48 inter-related impacts was assessed. The Table below lists these impacts by sector and provides supporting evidence from the recent peer-reviewed scientific literature, a confidence rating, and a recommended (preliminary) vulnerability rating for each sector X impact combination. Vulnerability to projected climatic/ hydrologic conditions ranges throughout Region sectors (as well as spatially) from High to Low. Results suggest that the Region's natural/ecological systems (particularly riparian, coastal, and forest systems) are more vulnerable than its built/human/economic systems; however, of the latter, vulnerabilities exist: in fisheries, forestry, infrastructure (e.g. water provision/treatment, flood management), and recreation. Conversely, agricultural sectors, including rangelands, may respond somewhat favorably to projected climate change "impacts." For example, longer growing season and increased forage can be beneficial; however, complicating co-factors (e.g. reduced surface flows, increased drought frequency) may reduce the expression of these theoretical benefits.

The list below summarizes preliminary findings for "vulnerability" of North Coast sectors. Full results follow (see Table below. Note that in the list below, **bold** indicates a sector is leaning strongly toward an end of the spectrum. Refinement of the preliminary results in will ultimately allow the NCRP to direct North Coast resources toward implementation projects that directly or indirectly address regional climate change goals and objectives (while providing additional local benefits).

Natural/ Ecological Systems

- Riparian: High
- Coastal: Moderate-High
- Forests: Moderate-High
- Rangelands: Moderate

Built/ Human/ Economic Systems

- Agriculture: Moderate-High
- Fisheries: Moderate-High
- Forestry: Moderate-High
- Recreation: Moderate-High
- Urban/ Infrastructure: Moderate-High
- Water Supply & Demand: Low-Moderate
- Energy Capacity & Demand: Low

Table 48 Climate Change Vulnerability Assessment (CCVA), North Coast Region

*"Drivers Of Change" are listed for each impact to which they are most directly connected: Average maximum air temperatures (AMT), Air temperature variability (ATV), Annual precipitation totals (APT), Precipitation variability (PV), Sea Level (SL), Droughts (D), Potential evapotranspiration (PET), Groundwater recharge (GWR), Potential evapotranspiration (PET), Annual runoff (AR), Runoff variability (RV), Snow Pack (SP), Flooding (F).

SECTOR	DRIVER* OF CHANGE	EXPECTED IMPACTS	SUPPORTING EVIDENCE	SENSITIVITY	ADAPTIVE CAPACITY	OVERALL VULNERABILITY	CONFIDENCE RATING	COMMENTS
Forest	AMT ATV PV D PET	Increased wildfire frequency, extent, and intensity	Fried et al. 2004 FRAP, 2010; Flannigan et al., 2000 Westerling et al. 2006 Westerling and Bryant , 2008 Lenihan et al., 2008	High	Moderate	High	High	Forests are extensive throughout the region indicating high exposure to this impact. Current stressors include encroachment at the urban-wildland interface. Forests will adapt to shifting wildfire regimes over the long term but may not do so quickly enough to avoid harm ecosystems.
		Shift from conifer dominance to mixed evergreen hardwood species	FRAP, 2010 Lenihan et al., 2006 PRBO, 2011 Lenihan et al., 2008 Barr et al. 2010	High	Low	High	High	The majority of forests in the North Coast region are conifer dominated, indicating high exposure. Modeling studies generally show that forest composition will shift to mixed evergreen hardwoods rather than adaptation of the conifers indicating low adaptive capacity to this impact.
		Shift in forest species ranges towards higher elevations, loss of subalpine habitat	Lenihan et al., 2006 PRBO, 2011	Moderate	Low	High	High	Primarily mountainous portions of the region will be affected. Habitat fragmentation may limit adaptation in some areas as will the highest elevations that occur in the region. This impact may affect several rare, threatened, or endangered species that live in the region's forests.
		Increased tree mortality due to combined effects to insects, disease and drought	Hansen and Weltzin, 2000 Shugart, 2003 Barr et al., 2010	High	Moderate	High	High	Forests are extensive throughout the region indicating high exposure. Forests will adapt to changes over the long term but may not do so quickly enough to avoid harm to ecosystems.
		Reduction of coastal redwood forest habitat	Flint and Flint, 2012	High	Low	High	Moderate	Large portions of the region provide redwood habitat that exists in a very narrow zone of climate tolerance indicating high exposure. Simulation studies indicate dramatic contractions in the geographic envelope that will support redwood forest in simulation studies indicating low adaptive capacity. Severity of the reduction in suitable habitat is dependent on CO2 emissions scenario, which adds uncertainty to this impact.
		Vegetation production increases and timing changes	FRAP, 2010 Shugart, 2003 Hansen and Weltzin, 2000	Moderate	Moderate	Moderate	Low	Forests are extensive throughout the region indicating high exposure. Complex interactions of enhanced CO2, temperature increases, and hydrologic changes contribute to uncertainty of changes.

SECTOR	DRIVER* OF CHANGE	EXPECTED IMPACTS	SUPPORTING EVIDENCE	SENSITIVITY	ADAPTIVE CAPACITY	OVERALL VULNERABILITY	CONFIDENCE RATING	COMMENTS
Rangeland	AMT ATV PV D PET	Conversion of scrublands and woodland to grasslands	FRAP, 2010 Pierson et al., 2008	Moderate	Moderate	Moderate	Low	Scrublands and woodlands are a smaller portion of the region compared to forests indicating moderate exposure. Modeling studies indicate conversion may occur in some areas rather than adaptation. Limited information and contributes to low confidence for this impact. Complex interactions of enhanced CO_2, temperature increases, and hydrologic changes contribute to uncertainty of changes.
		Increased stress on drought intolerant plant species and inundation by invasive grasses	Cayan et al., 2006 Thorne, et al., 2012a	Moderate	Moderate	Moderate	Moderate	Drought tolerant invasive species will have a competitive advantage during summer months in the future. No specific modeling evidence for the region was identified but this impact is directly tied to future temperatures contributing to moderate confidence. Complex interactions of enhanced CO_2, temperature increases, and hydrologic changes contribute to uncertainty of changes.
		Vegetation production increases and timing changes	FRAP, 2010 Shaw et al., 2009 Chaplin- Kramer, 2012 Cornwall et al., 2012 Ekstrom and Moser, 2012	Moderate	Moderate	Moderate	Low	Rangelands are a smaller portion of the region compared to forests indicating moderate exposure. Complex interactions of enhanced CO_2, temperature increases, and hydrologic changes contribute to uncertainty of changes.
Riparian	AMT ATV D RV SP GWR	Reduced aquatic habitat extent and quality with reduced summer base flows, stream temperature increases, and increased pollutant concentrations.	Moyle et al., 2012a Moyle et al., 2012b Ekstrom and Moser, 2012 PRBO, 2011 NMFS, 2012 Medellín-Azuara et al., 2008 Barr et al., 2010 NCIRWMP, 2007	High	Low	High	High	The North Coast region has the highest amount of high priority riparian zones in the state: locations where high value water supply coincides with other threats which are areas that should be prioritized for restoration. Riparian areas provide habitat for several rare, threatened, or endangered species. Smith River and tributaries, Klamath River and tributaries, Scott River, Salmon River, Trinity River, Eel River, and Van Duzen River are all federally designated Wild and Scenic Rivers. These factors indicate high exposure. Surplus moisture delivered in winter is not expected to provide a sufficient buffer to avoid summer low flow reductions indicating low adaptive capacity. Water bodies that drain approximately fifty-nine percent of the area in the North Coast Region are listed as impaired due to sediment under Section 303(d) of the Clean Water Act.
	AMT ATV	Increased thermal stress on cold water fish, amphibian, and invertebrate species and a shift in thermal spawning conditions to earlier in the year	Porinchu et al., 2010 Melack et al., 1997 Parker et al., 2008 PRBO, 2011 Barr et al., 2010 NCIRWMP, 2007	High	Low	High	High	Salmonids live within a narrow water temperature range directly correlated to air temperatures, outside of which survival is affected. Current stressors include riparian degradation with loss of shade cover and reduced baseflow which will limit adaptive capacity in the future. Several rare, threatened and endangered species may be negatively impacted such as the Northern Red Legged Frog.

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Riparian	RV F	Increased landslides and sediment loading to streams following wildfires and high intensity rainfall events	FRAP, 2010 NCIRWMP, 2007	High	Low	High	Moderate	Large proportions of the region's watersheds are forested and thus exposed to this impact that results from wildfire regime shifts. Some of the most sensitive beneficial uses are currently impacted by sediment. Those uses are associated with the migration, spawning, reproduction, and early development of coldwater fish such as coho salmon and steelhead trout. Uncertainty in rainfall projections contributes to lack reduced confidence in this impact.
	AMT ATV D RV SP GWR	Decreased native fish habitat distribution and population declines	Knapp et al., 2001, Pope et al., 2009 Moyle et al., 2012a Moyle et al., 2012b Ekstrom and Moser, 2012 NCIRWMP, 2007	High	Low	High	Moderate	Populations of these fish currently are low and habitat conditions generally are poor; these circumstances are likely to deteriorate further with projected climate change. Coho salmon have experienced a significant decline in the past 40 to 50 years. Coho salmon abundance, including hatchery stocks, has declined at least 70% since the 1960s, and is currently 6 to 15% of its abundance during the 1940s. Current stressors include riparian degradation, sediment delivery from logging roads, dams and other hydro modifications. These stressors can affect the migration, spawning, reproduction, and early development of coldwater fish such as coho salmon and steelhead trout. Dependence of salmonids populations on ocean dynamics adds to uncertainty to this impact.
Coastal	SL	Increased coastal erosion	Cayan et al., 2008a Cayan, et al., 2009 Bromirski et al., 2005 Laird, 2013	High	Low	High	Moderate	A substantial portion of the region lies adjacent to a coastline, indicating exposure to erosion increases with sea level rise. In the absence of coastal armoring, there is very little natural adaptive capacity that can mitigate beach erosion or seacliff retreat. No specific estimates of increased coastal erosion rates were identified for the region.
	SL	Landward migration of intertidal marine species with sea level rise	Cayan et al., 2008a Laird, 2013	High	Moderate	High	High	If the coastal plains are not developed, landward migration of intertidal species with sea level is possible. The regions beaches are rugged and mountains or steep hills often extend to the shoreline. In several areas there are limited low-lying areas where intertidal marine species can migrate. Additionally many of the coastal low lying areas such as Humboldt Bay and Crescent City have been urbanized thus limiting adaptive capacity near these locations.
	SL	Reduced extent of tidal marshlands and other wetlands	PRBO, 2011 Langley et al., 2009 Stralberg et al., 2011 Ekstrom and Moser, 2012 Laird, 2013	High	Moderate	High	High	Tidal marshlands throughout the region provide essential habitat for fish, amphibians and migratory sea birds in addition to buffering developed areas from flooding indicating exposure to this impact. Where landward migration of tidal marshlands in not possible due to local topography or urbanization, tidal marshlands will disappear.

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Coastal	AMT RV D SL	Shifts in sea bird species migration patterns	PRBO, 2011	High	Moderate	High	Low	The region is home to several species of seabirds that use coastal wetlands of the region for breeding, foraging and resting indicating exposure to this impact. Earlier onset of summer, habitat and food availability changes will affect migration patterns. Complex interactions of seasonal temperature changes with dynamics of the California current (also subject to climate impacts) contribute uncertainty of the severity of changes.
	SL	Increased frequency and spatial extent of flooding of coastal lowlands	PRBO, 2011 Bromirski et al., 2012	High	Low	High	High	Since a large portion of the region is coastline including several developed areas there is substantial to exposure to the increase of sea level driven flooding risks.
	-	Reduction in shell forming ability of mollusks due to higher ocean pH	Michaelidis et al., 2005 Shirayama & Thornton 2005 Kleypas et al., 1999 Riebesell et al., 2000 Feely et al., 2004 Harley et al., 2006	High	Low	High	High	Shellfish are abundant in the region and there is substantial evidence to indicate that they will not be able to adapt to ocean chemistry changes quickly enough to avoid negative effects on species populations.
	AMT ATV	Changes to the timing and intensity of coastal upwelling	Cayan, et al., 2009 Bromirski et al., 2012 Pisias et al., 2001 Snyder et al., 2003	Moderate	Moderate	Moderate	Low	Proximity of the region to coastal currents indicates exposure to this impact. Increasing temperatures will stratify ocean waters, while the current dynamics and winds will promote upwelling. These two forces work counter to one another contributing uncertainty to the timing and severity of changes to the California Current dynamics.
Forestry	AMT ATV PV D PET	Increased tree mortality due to combined effects to insects, disease and drought	Hansen and Weltzin, 2000 Shugart, 2003 Barr et al., 2010	High	Moderate	High	Moderate	A large portion of the region's area is subject to forest management indicating exposure to this impact. Timber harvest is a current stressor that may exacerbate consequences of this impact. Complex interactions of enhanced CO2, temperature increases, and hydrologic shifts contribute to uncertainty of changes.
		Reduced conifer timber harvest	Hannah et al., 2011	High	High	Moderate	Moderate	Timber is in the top 2 grossing agricultural industries in 5 of 7 of the North Coast Counties indicating exposure to this impact. Current stressors include wildfires, human encroachment into forests, insects and disease. Timber harvest practices can be altered to mitigate changes indicating high adaptive capacity.
		Increased costs of fuels management and fire suppression	Joyce et al., 2008	High	Moderate	High	Moderate	Increasing wildfire risks and human encroachment to forests exposes the forest management to increased costs to manage ignitions and damage from fires. Enhanced practices resulting from new research may reduce costs and increase adaptive capacity.

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Agriculture	AMT ATV PV D PET	Crop type changes and geographic pattern shifts	Moser et al., 2009 Jackson et al., 2012a Thorne, et al., 2012a Ekstrom and Moser, 2012 Jackson et al., 2012b Diffenbaugh et al., 2011 Jones et al., 2010 Barr et al., 2010	High	Moderate	High	High	Climate is likely to become unsuitable for high value crops such as grapes, fruits and nuts indicating exposure to this impact. Zones of suitability for fruits and nuts will be reduced with rising temperatures, especially wine grapes. New or modified farming techniques may mitigate the need to change growing locations to some degree.
	AMT ATV PV D PET	Enhanced forage production but reduced forage reliability during drought years	Shaw et al., 2009; Chaplin- Kramer, 2012 Cornwall et al., 2012 Ekstrom and Moser, 2012	Moderate	Low	High	Low	Cattle ranching are one of the top 5 grossing agriculture industries in 6 of the 7 North Coast counties that depend on reliable forage production indicating exposure to this impact. Complex interactions of enhanced CO_2, temperature increases, and hydrologic changes contribute to uncertainty of changes.
	AMT	Longer growing season with shift towards longer summers	Thorne, et al., 2012	High	High	Moderate	High	While many crops in the region are affected by this impact, growers can adjust to changes simply by planting earlier in the season.
	AMT ATV PV D PET	Increased wine grape yields but reduced quality	Chaplin-Kramer, 2012 Ekstrom and Moser, 2012 Jones et al., 2010 Diffenbaugh et al., 2011 Jones et al., 2010	High	Moderate	High	High	Climate changes will alter the economics of wine producing regions. Willamette valley in Oregon may become like Napa is today. Exposure to this impact is based on economic importance of these crops. Growers can adapt with grape breeding, but climate that will be as warm as Napa will be in 2050 would be a table grape region today rather than some of the varieties that the Napa region is currently known for.
	AMT PET	Increased irrigation water demand during summer	Jackson et al., 2012a Thorne et al., 2012a Jackson et al., 2012b	High	High	Moderate	High	Hotter, longer summers will mean that that most crops will require more water indicating exposure to this impact. Current water demands for crops and ecosystem services are the key existing stressors that will be exacerbated with projected climate changes. Conservation practices or crop type changes contribute to adaptive capacity.
	SL RV	Increased risk of field damage from flooding in coastal low lying areas	Laird, 2013 Cayan et al., 2008a	Moderate	Moderate	Moderate	Moderate	The greatest increase in the risk of damage due to floods is in coastal low lying areas. Only 2% of land is dedicated to agriculture and urban land uses. Land use maps indicate that much of the agriculture in the region occurs in coastal lowland areas such as Arcata and Crescent City with some degree of exposure to flood damage, but is a small percent of land use in the region. Flooding damage will also be dependent on rainfall pattern changes which are less certain than sea level rise

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Urban	SL RV	Increased risk of property and infrastructure damage from flooding	Moritz and Stephens, 2008 Jones and Goodrich, 2008 Laird, 2013	Moderate	Moderate	Moderate	Moderate	Low lying communities in the region are anticipated to suffer an increase in acreage flooded by 2100 by approximately 17-18%. Relative to other California coastal areas this is a moderate increase, when compared to more populous coastal areas of the state which have projected inundation increases of ranging from 30-46%
	AMT ATV PV D PET	Increased risk of property and infrastructure damage from wildfires	Thorne et al., 2012b Moritz and Stephens, 2008 Jones and Goodrich, 2008	High	Moderate	High	Moderate	Population increase in the future will mean further pressure for development to encroach into forests and greater damage to property with increasing wildfire occurrence and extent risks. Land-use planning policies are a means of increasing adaptive capacity to climate change and altered fire regimes to mitigate risks of property damage.
	SL RV	Increased erosion risk for coastal development	Cayan et al., 2008a Cayan, et al., 2009 Bromirski et al., 2005 Laird, 2013	High	Low	High	Moderate	The region contains about 400 miles of shoreline all of which are at risk to erosion with projected sea level rise. The major developed areas on the coast in the North Coast region include Santa Rosa, Arcata, and Crescent City which are all exposed to this impact. However, much of the coastline is sparsely populated and undeveloped relative to other coastal regions of the state.
	RV	Increased winter stormwater conveyance requirements	Jones and Goodrich, 2008 Cayan et al., 2009	Moderate	Moderate	Moderate	Low	The possibility of more frequent intense rainfall events may require greater capacity requirements for urban infrastructure. Adaptation actions such as retrofitting culverts, bridges, and storm drains would be a high cost endeavor is required. Uncertainty surrounding rainfall projections contributes to low confidence.
	AMT ATV PV D PET SL RV	Greater constraints on land-use and new development	Moritz and Stephens, 2008 Jones and Goodrich, 2008	Moderate	Moderate	Moderate	Low	Increasing population creates greater development pressure on ecosystems at the urban-wildland interface. Increased flooding and wildfire risks may crate the need to place constraints on development to avoid unnecessary risks to life and property.

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Water supply/ demand	SP	Reduced spring snowpack water supply storage	Cayan et al., 2009 FRAP, 2010 Anderson, 2008 Mote et al., 2005 Hayhoe et al., 2004	Low	Low	Moderate	High	Reduced snowpack is expected but majority of watersheds in the region are rain fed. While a snowpack loss of 73 to 90% (estimated in the PCM model in the Sierras) may stress aquatic ecosystems with lower base flows in summer months, much water supply in the region is met with groundwater sources and groundwater fed springs.
	GWR RV D AMT SP	Increased risk of water conflicts between urban, agriculture, and ecosystems	Barr et al., 2010 PRBO, 2011 Elkind et al., 2012 NC RWQCB, 2011	High	High	Moderate	High	Major water supply projects in the region include the U.S. Bureau of Reclamation Klamath Project, the U.S. Army Corps of Engineers Russian River Project, the Humboldt Bay Municipal Water District Ruth Reservoir, and the U.S. Bureau of Reclamation Trinity Lake Reservoir. The Klamath Project has been extremely controversial because to maintain adequate instream fishery flow to ensure the survival of endangered salmonid populations, coordination between many jurisdictions is necessary. Water to farms has at times been cut off to prevent harm to the fisheries, resulting in extreme controversy, and in some cases, violence. Currently, surplus surface water is exported out of the region for use elsewhere in the state, but reduced snowpack storage may tax existing resources are require changes to satisfy all existing water supply needs in the region.
	GWR RV D AMT SP	Increased dependence on groundwater supply in summer months	NC RWQCB, 2011 Ekstrom and Moser, 2012	High	High	Moderate	Moderate	Most basins within the region depend on groundwater or groundwater fed springs indicating exposure to this impact. Current resources are adequate to meet current and projected needs indicating resilience to changes and a high adaptive capacity.
	GWR SL	Increased seawater intrusion to coastal groundwater aquifers	PRBO, 2011 NC RWQCB, 2011	Low	Moderate	Low	Moderate	Rising sea level will increase the potential for seawater intrusion indicating exposure to this impact for coastal communities. Given the adequate groundwater basin recharge that occurs, saltwater intrusion is not generally a problem in North Coast groundwater basins.

SECTOR	DRIVER* OF CHANGE	EXPECTED IMPACTS	SUPPORTING EVIDENCE	SENSITIVITY	ADAPTIVE CAPACITY	OVERALL VULNERABILITY	CONFIDENCE RATING	COMMENTS
Energy demand/ capacity	AMT ATV	Increased summer energy demand during heat waves	Hanuk and Lund 2008 FRAP, 2010 Barr et al., 2010 NCIRWMP, 2007	Low	High	Low	High	The Iron Gate Reservoir in Siskiyou County provides energy for a hydroelectric facility owned by Pacific Power and Light Company. Future electricity demand will rise due to increased population and needs for home cooling, refrigeration, water (which requires energy to transport), and power supplies for an ever-increasing number of small electronics. At the same time, efficiency and reliability of power transmission and delivery is likely to decline as power lines are stressed with higher ambient temperatures and increased risk from wildfires. As a result, more brownouts and blackouts are expected. Much of the region's climate is moderated by its proximity to the ocean, reducing seasonal temperature variation. Energy conservation and energy efficient development will be responses to mitigate increased demand.
	SP	Reduced hydropower energy generation capacity in spring/summer	Madani and Lund, 2010 Vicuna et al., (2008) FRAP, 2010 Ekstrom and Moser, 2012 Spears et al., 2012 NC RWQCB, 2011 Barr et al., 2010	Low	Moderate	Low	Low	While hydropower is used in the region indicating exposure to this impact, it is not generated at high elevation dams. While lake levels may be reduced in summer months, the projected reductions in snowpack would primarily affect hydropower generation at higher altitudes.
Fisheries	AMT ATV	Shift in marine productivity patterns as a result of nutrient upwelling changes	Snyder et al., 2003	High	Low	High	Low	Fishing is an important industry in the region with economic exposure to climate induced changes of ocean dynamics and chemistry. Complex interactions of seasonal temperature changes with dynamics of the California current, and productivity changes that may occur in other fisheries contribute uncertainty of the severity of the economic impacts.
	AMT ATV D RV SP GWR	Decreased terrestrial cold water fish yields associated with inland habitat degradation	Knapp et al., 2001 Pope et al., 2009 Moyle et al., 2012a Moyle et al., 2012b NMFS, 2012 Barr et al., 2010 Medellín-Azuara et al., 2008	High	Low	High	Low	Increased erosion is likely to impact the spawning of native fish such as lamprey, suckers, salmon, and trout that build their nests in areas of clean rocks and gravels. Greater levels of fine-sediment input will increase nutrient concentrations in aquatic systems and contribute to algae blooms. Current stressors on fish population will limit adaptive capacity in the future.
	SL	Landward migration of salmonid rearing habitats	Cayan et al., 2008a Laird, 2013	High	High	Moderate	High	Rearing habitats will migrate landward with sea level rise. As long as there are not barriers near the coast to migration, rearing habitats should be able to shift upstream from their current locations.
	—	Reduced oyster and clam farm productivity due to ocean chemistry changes	Michaelidis et al., 2005 Shirayama & Thornton 2005 Kleypas et al., 1999 Riebesell et al., 2000 Feely et al., 2004 Harley et al., 2006	High	Moderate	High	Low	Interference with the shell building ability of mollusks will expose oyster and clam farms to greater mortality in the future. Farms will identify new or modify existing practice to adapt their businesses and remain viable.

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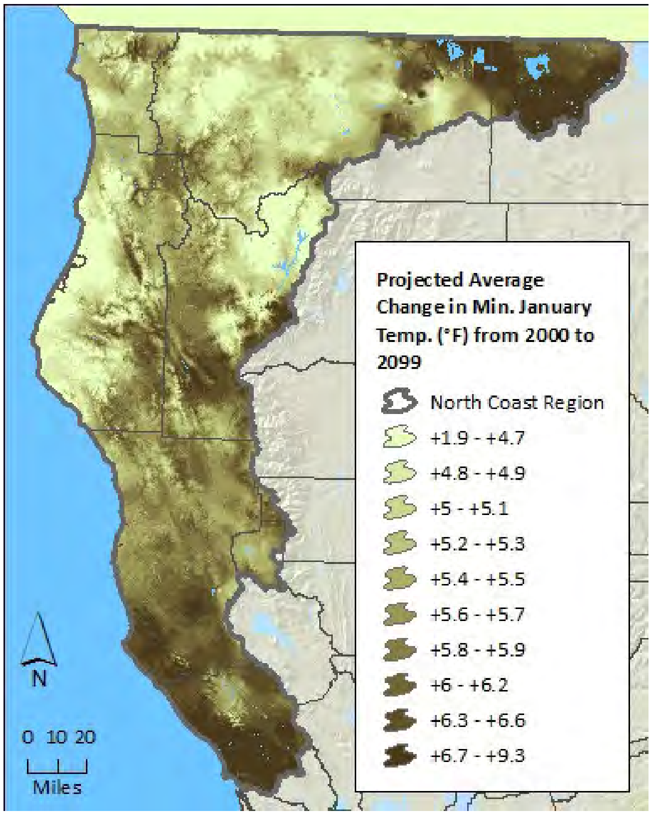
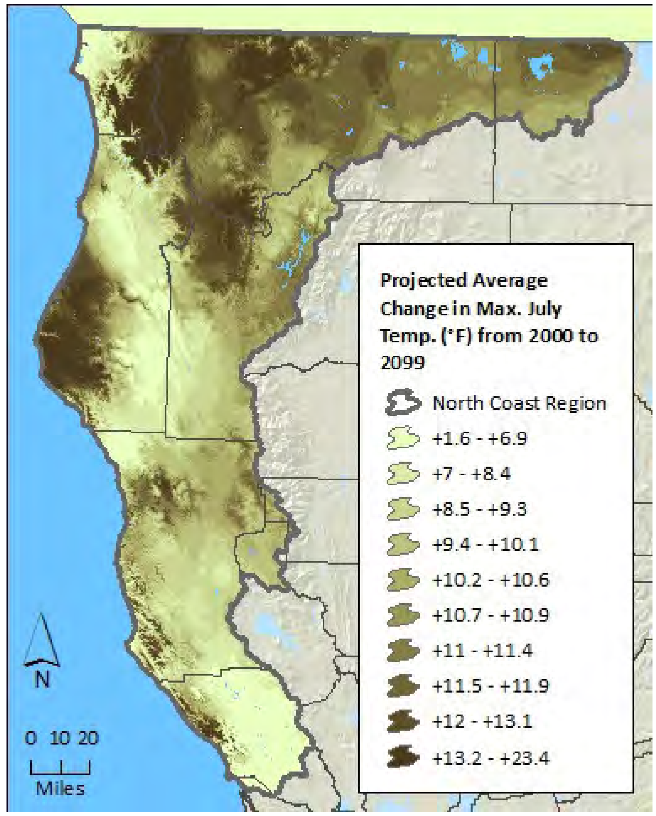
Recreation	RV SP GWR D	Shortened river rafting, boating, and sport fishing season and quality	Morris and Walls, 2009 Cayan et al. 2009	High	Moderate	High	Moderate	Recreation activities that depend on summer river flows and good water quality are exposed to impacts as summer low flows are reduced in rivers due to longer, hotter summers and less snowmelt. There is very little opportunity for adjustment of these activities other than altering dam release patterns upstream.
		Shortened backcountry skiing season	Morris and Walls, 2009 Cayan et al., 2009 Goodstein and Matson, 2004	Moderate	Low	High	High	Opportunities for snow-dependent recreation will be reduced along with the snowpack decline. There is very little opportunity for adjustment of these activities with less snow pack available.
		Reductions in hunting and wildlife viewing opportunities	Morris and Walls, 2009 Cayan et al., 2009	Moderate	Moderate	Moderate	Low	Hunting and wildlife viewing opportunities are dependent on healthy animal populations and associated habitats. Potential habitat degradation in the future exposes this recreation opportunity to impacts from changing climate and hydrologic conditions. New wild areas may become more suitable or made more accessible in response to changing conditions. The extent of limitations is uncertain since they depend on a host of complex system responses to changed climate conditions as well as human behavior patterns.
		Reduced wildland recreation opportunities and viewshed quality	Morris and Walls, 2009 Cayan et al., 2009	Moderate	Moderate	Moderate	Low	Wetland, riparian, and mountain areas that support recreational fisheries and unique bird populations in the region exposed to climate change impacts such as sea level rise and longer, drier summers. New wild areas may become more suitable or made more accessible in response to changing conditions. The extent of limitations is uncertain since they depend on a host of complex system responses to changed climate conditions as well as human behavior patterns.

Maps J.1–J.23 Spatial Distribution of Projected Hydrologic & Climatic Changes

A suite of 23 high-resolution maps were developed in association with the data analysis. The maps below may allow planners to better visualize past, current, and future conditions at the local level. Data for the climate maps are adapted from USGS 2012 and Thorne et al. 2012a. The definitions of each assessed variable are provided by the California Climate Commons[5].

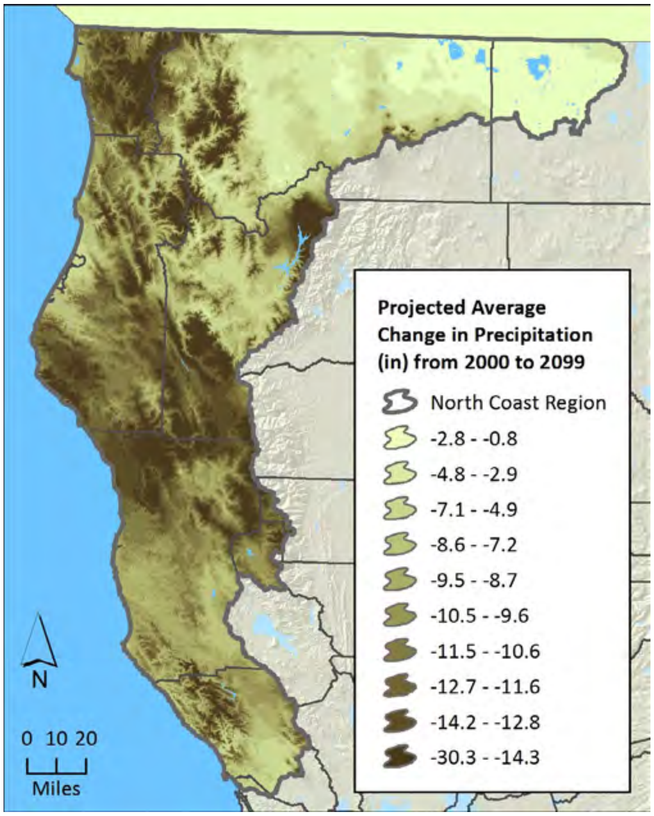


Map J.1

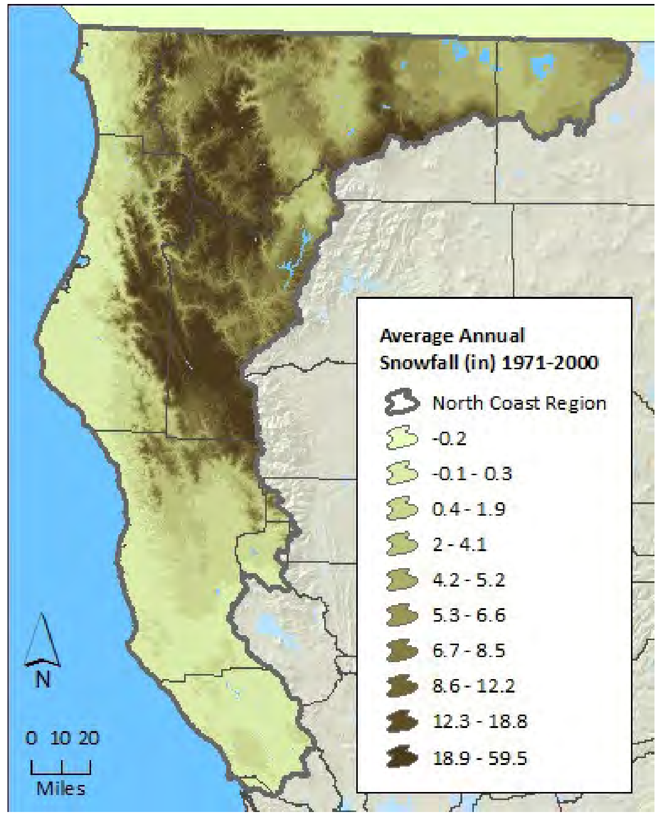


Map J.2

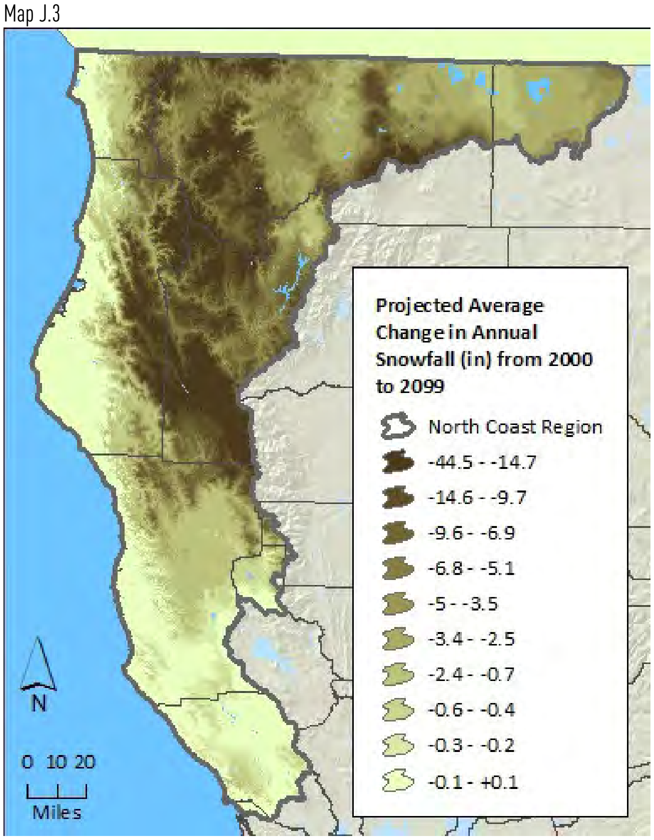
5 California Basin Characterization Model (BCM) downscaled climate and hydrology http://climate.calcommons.org/dataset/10



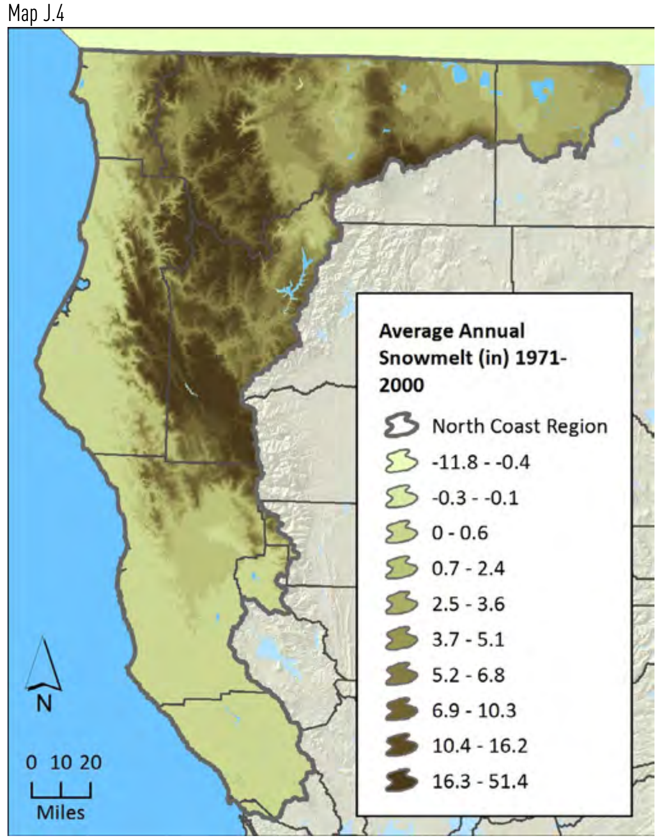
Map J.3



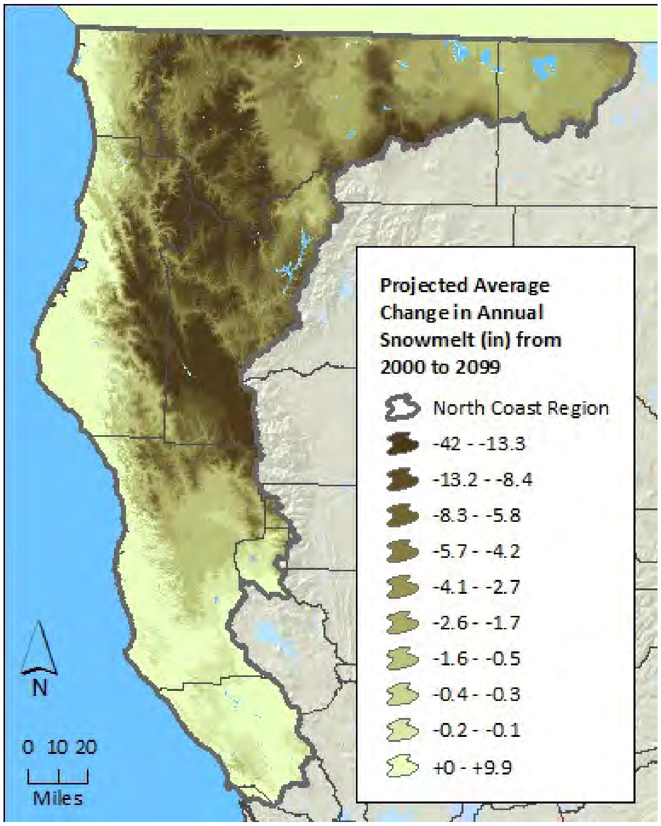
Map J.4



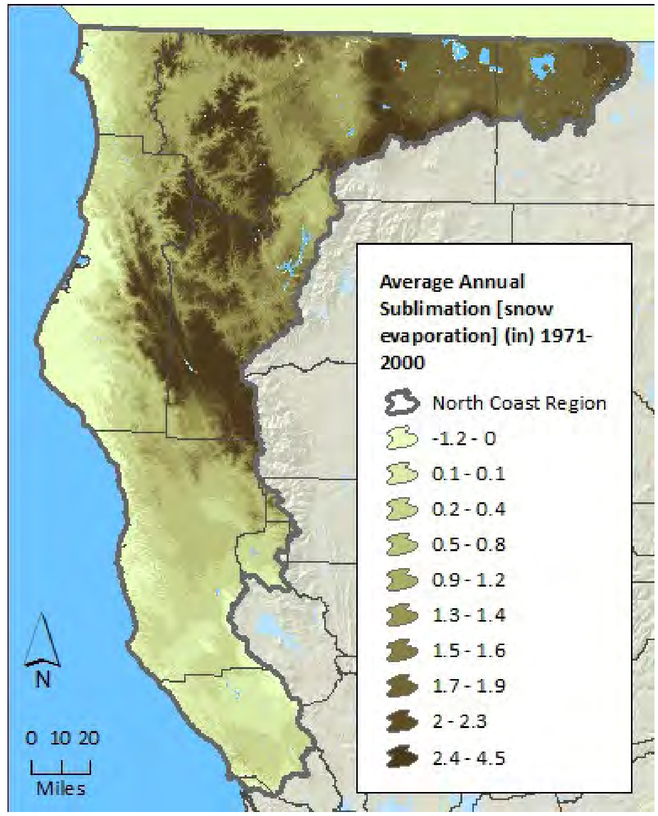
Map J.5



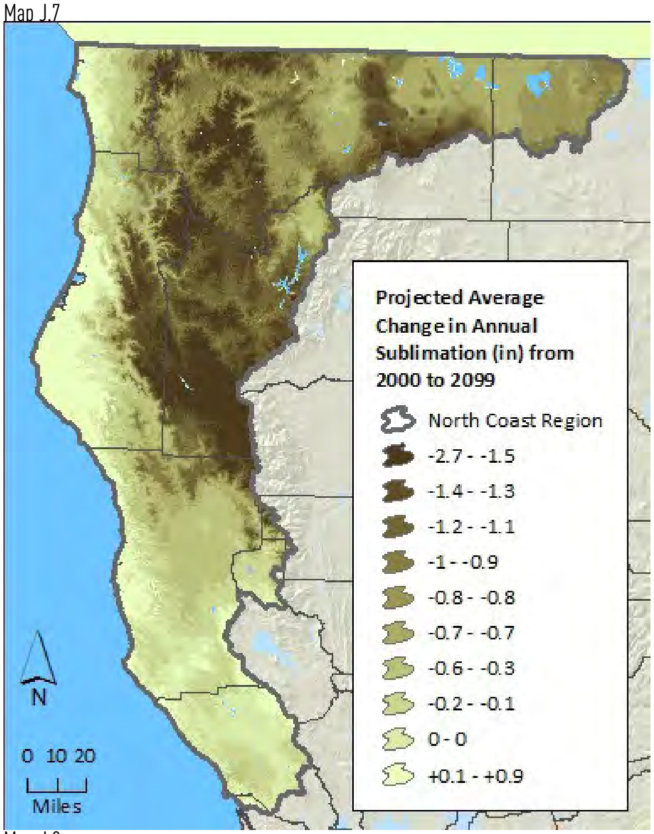
Map J.6



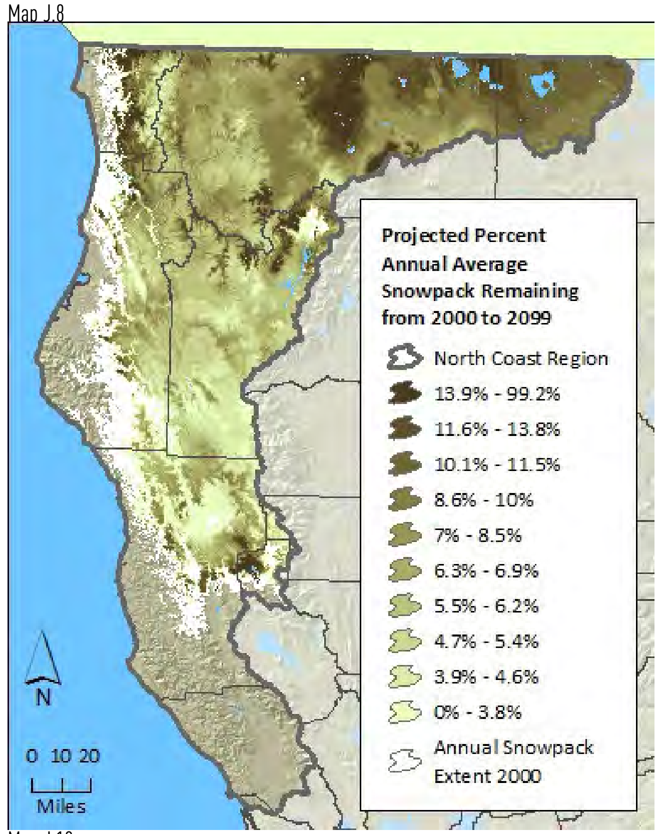
Map J.7



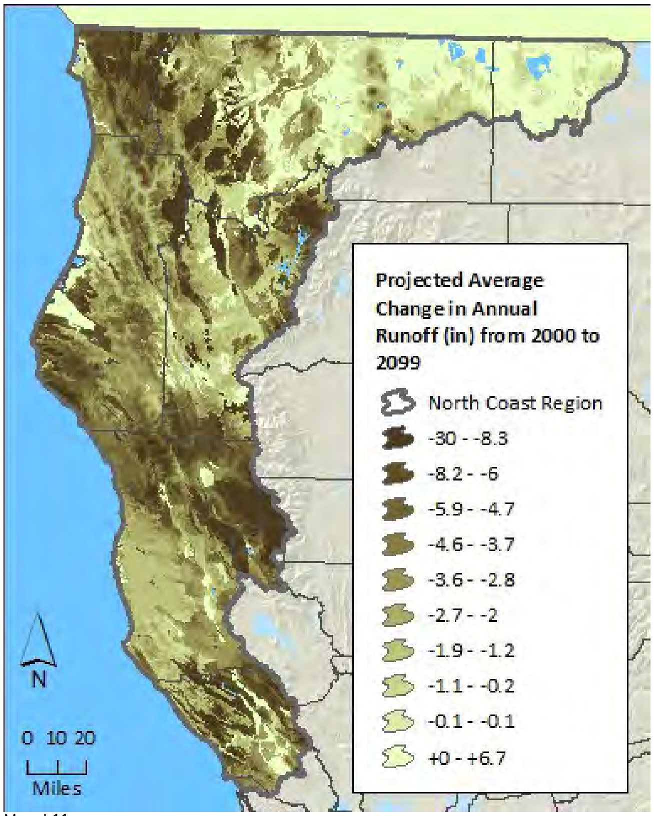
Map J.8



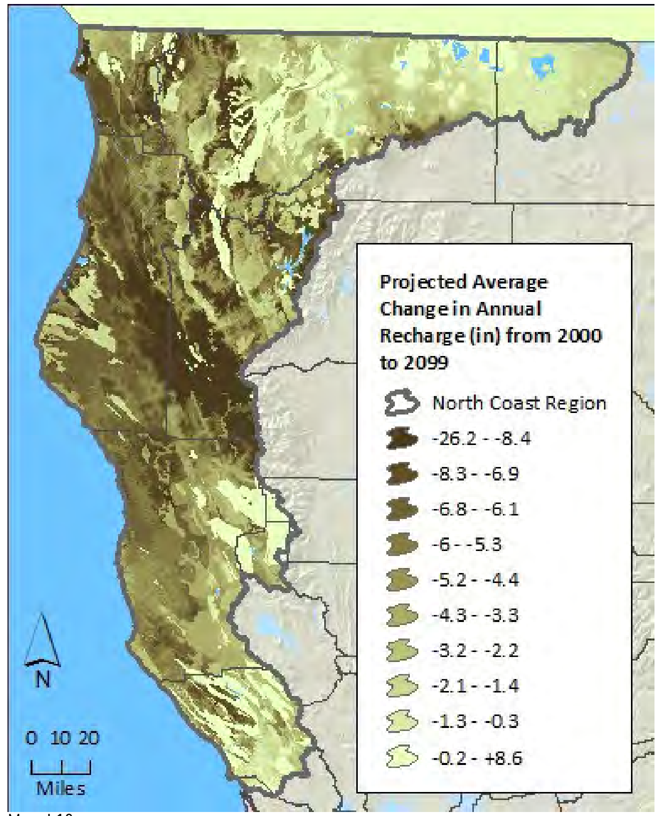
Map J.9



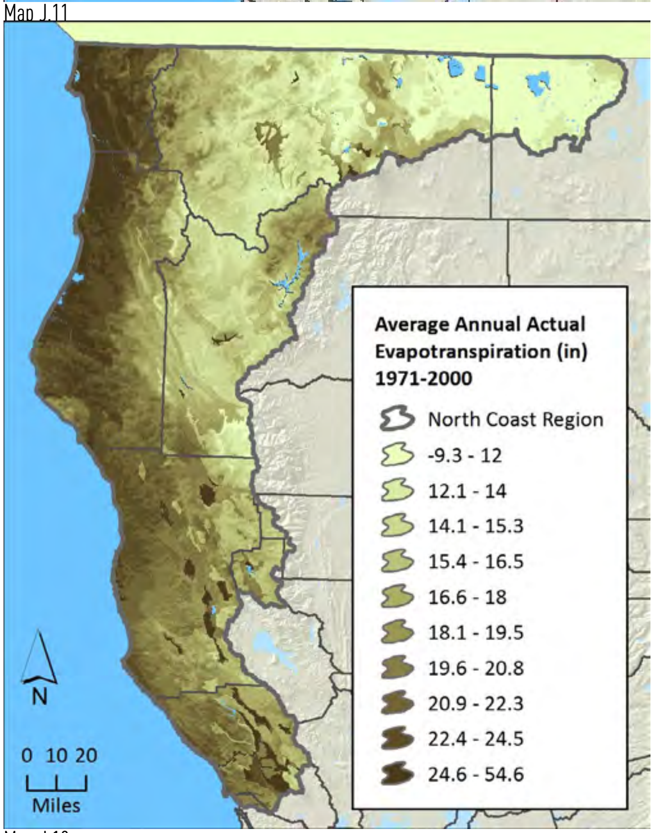
Map J.10



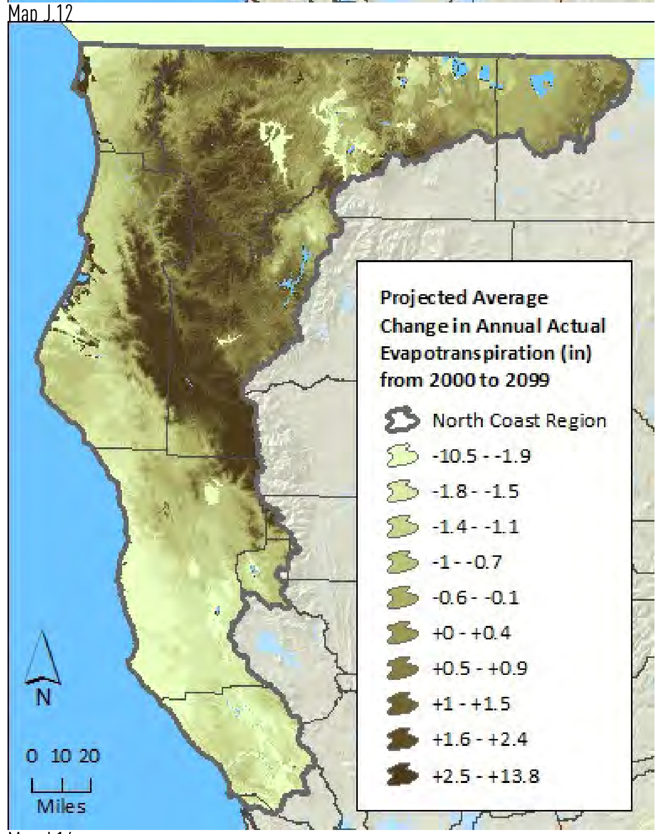
Map J.11



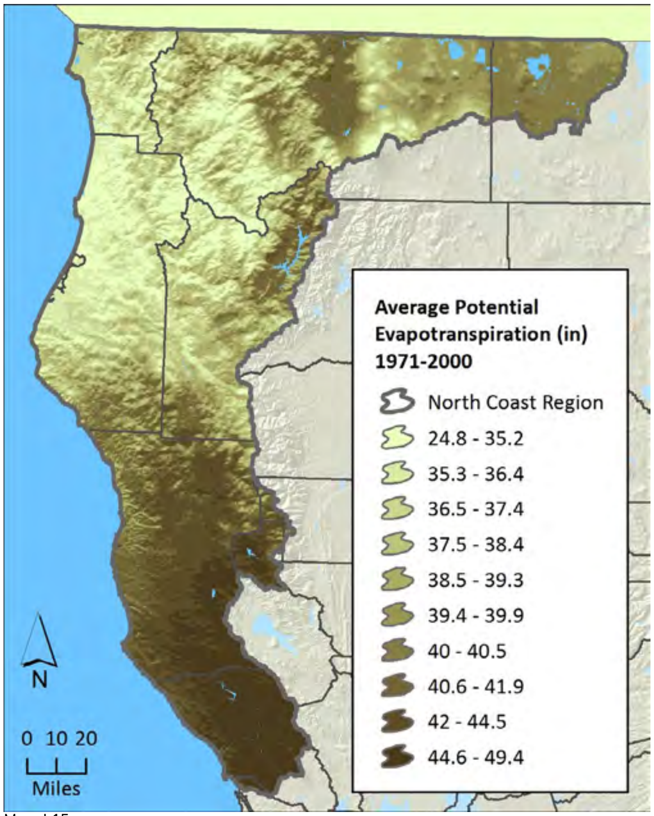
Map J.12



Map J.13



Map J.14



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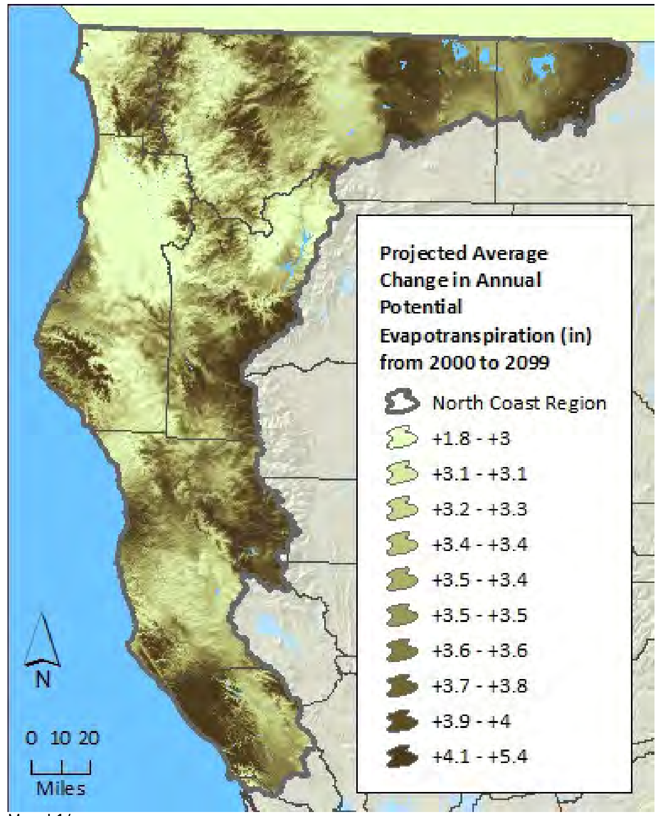
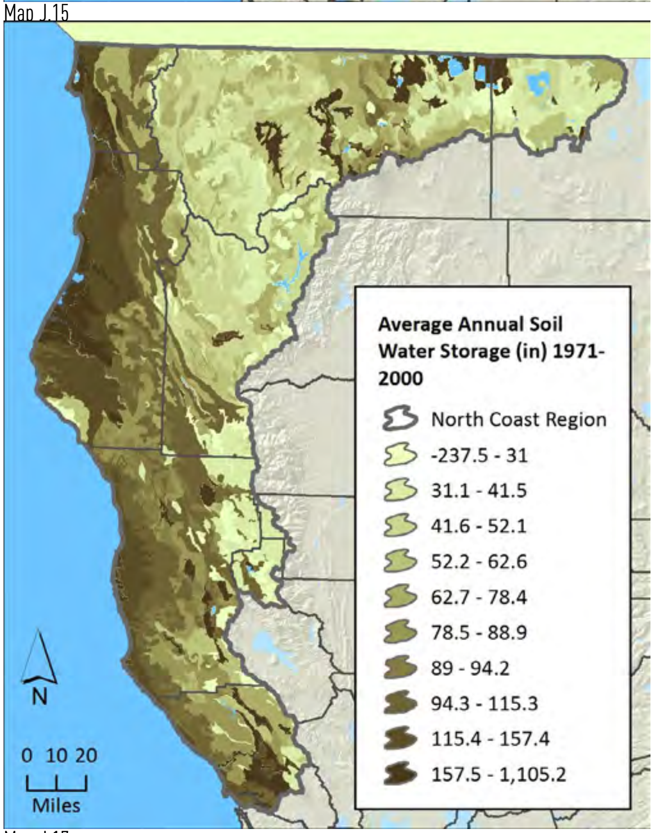
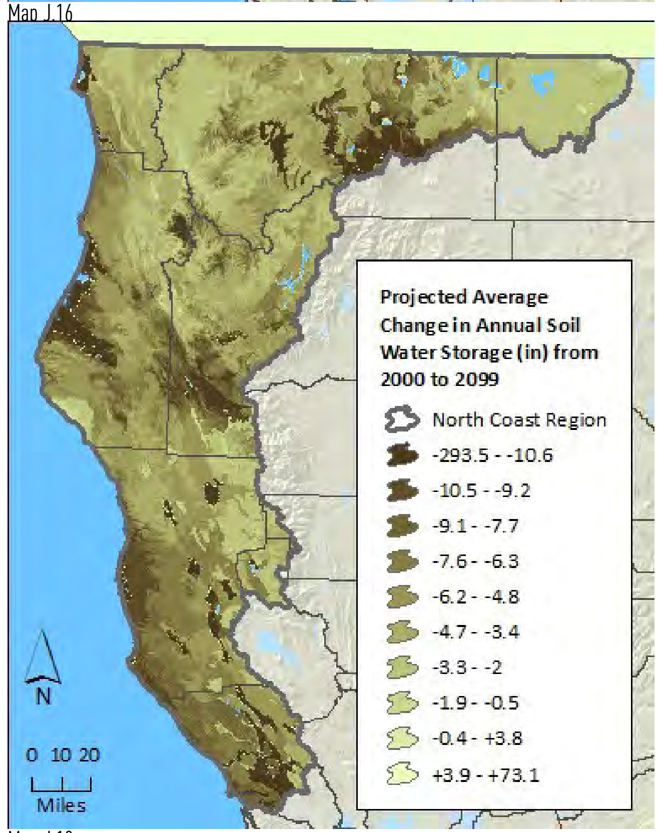


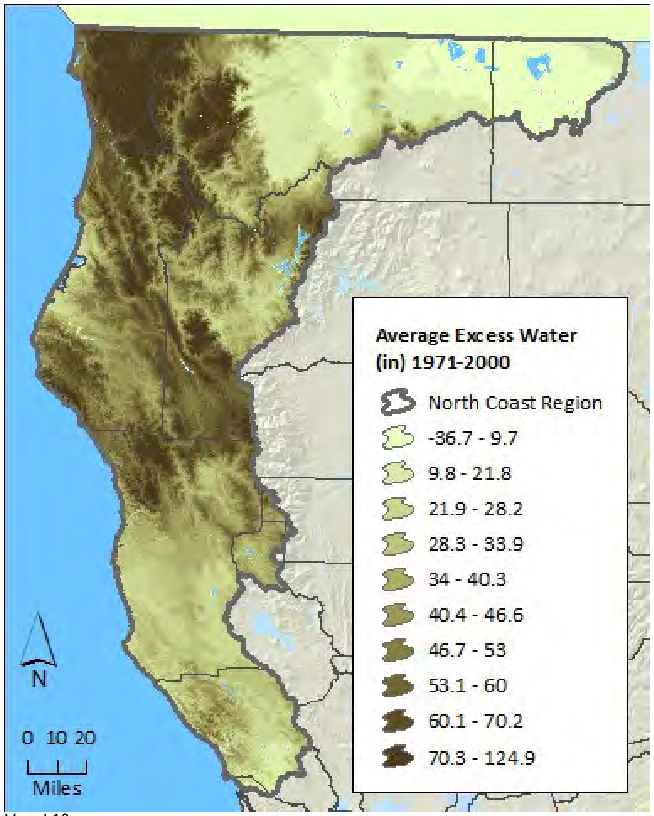
Map J.16



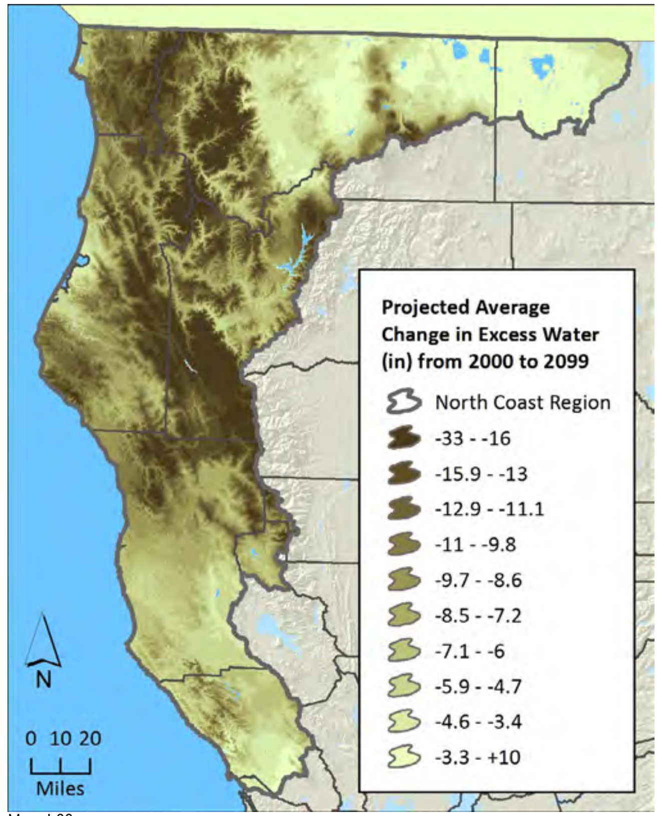
Map J.17



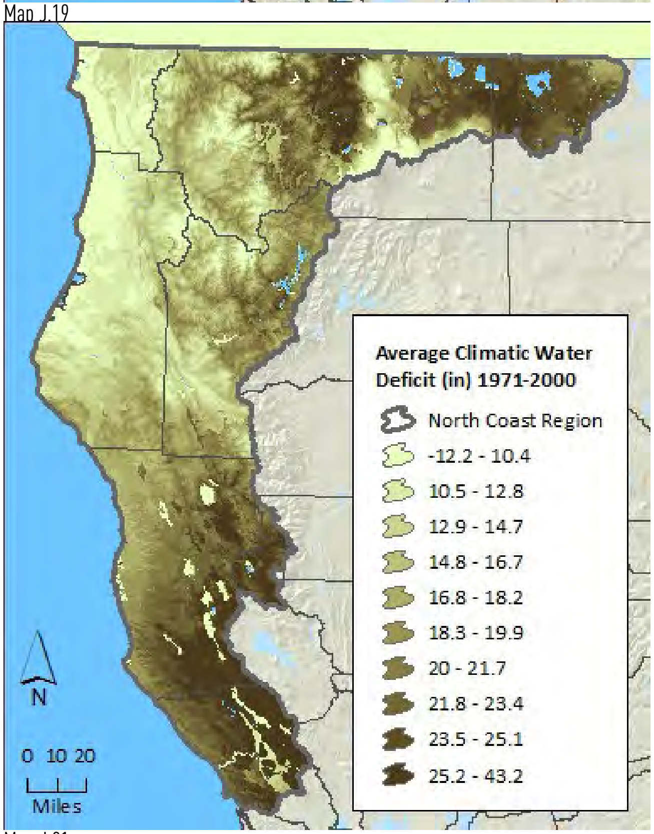
Map J.18



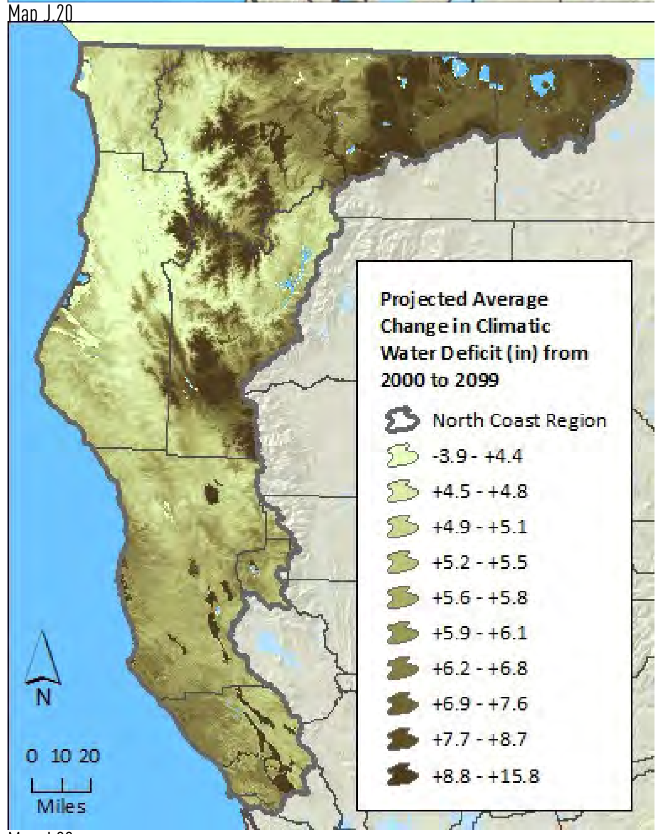
Map J.19



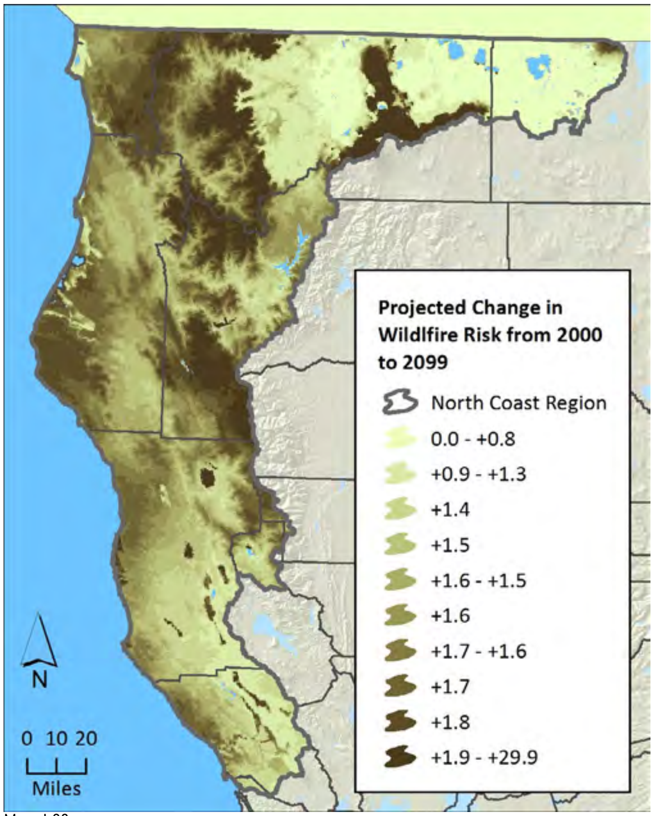
Map J.20



Map J.21



Map J.22


Projected Change in Wildfire Risk from 2000 to 2099
North Coast Region
0.0 - +0.8
+0.9 - +1.3
+1.4
+1.5
+1.6 - +1.5
+1.6
+1.7 - +1.6
+1.7
+1.8
+1.9 - +29.9
N
0 10 20
Miles
Map J.23

APPENDIX K. FINANCING HISTORY & FUTURE FINANCING

Following are the tabular results of the NCRP-commissioned long-term implementation and financing assessment.

Table 49 Summary of NCRP Use of IRWM Funds

IRWMP FUNDING CALL	TOTAL IRWM AWARDS	MATCHING FUNDS	TOTAL INVESTMENT	AWARDS AND LOCAL MATCH
Proposition 50, Round 1	24,825,622	26,297,967	51,123,588	49% IRWMP Award and 51% Local Match
Proposition 50, Round 2 & Supplemental	$4,225,910	$986,220	$5,212,130	81% IRWMP Award and 19% Local Match
Proposition 84, Round 1	$8,226,061	$3,552,194	$11,778,255	70% IRWMP Award and 30% Local Match
Proposition 84, Round 2	$5,386,000	$3,576,447	$8,962,447	60% IRWMP Award and 40% Local Match
Proposition 84, 2014, Dought	$8,700,000	$4,456,634	$13,156,634	66% IRWMP Award and 34% Local Match
Proposition 84, 2015	$14,270,339	$3,222,400	$11,047,939	77% IRWMP Award and 23% Local Match
Total	**$62,411,532**	**$42,091,862**	**$104,503,393**	**60% IRWMP Award and 40% Local Match**

Table 50 Summary of Funding and Financing to Date

APPLICANT	PROJECT	FUNDED CAPITAL COSTS	SOURCE OF CAPITAL FUNDING		SOURCE OF O&M FUNDING	O&M FINANCE CERTAINTY
			STATE AWARD	LOCAL MATCH		
PROPOSITION 50 ROUND 1						
California Land Stewardship Institute	Fish Friendly Farming Environmental Certification Program	$213,510	$210,510	$3,000	Landowners	Grant funded/ landowners
California State Parks — North Coast Redwoods District	Head Hunter/Smoke House Non-point Sediment Reduction Project	$273,146	$273,146	$0	Operating funds	NA
City of Crescent City	Crescent City Wastewater Treatment Plant Renovation	$1,290,000	$910,000	$380,000	Utility Rates	Secure/annually budgeted
City of Etna	City of Etna Water Supply	$663,269	$593,936	$69,333	Utility Rates	Partially secure
City of Eureka	Martin Slough Interceptor Project	$14,525,971	$4,069,684	$10,456,287	Utility Rates	Secure/annually budgeted
City of Santa Rosa	Sonoma County Water Recycling and Habitat Preservation Project	$10,015,085	$4,004,603	$6,010,482	Utility Rates	Secure/annually budgeted
Covelo Community Services District	Covelo Wastewater Facilities Improvement Project	$1,094,068	$1,065,591	$28,477	Utility Rates	Partially secure
Graton Community Service District	Graton Wastewater Treatment Upgrade and Reclamation Project	$3,050,267	$1,116,648	$1,933,619	Utility Rates	Secure/annually budgeted
Gualala River Watershed Council	Sediment Solutions for the Gualala: Phase III	$159,574	$159,052	$522	Landowners	Grant funded/ landowners
Humboldt County Resource Conservation District	Salt River Restoration Project	$5,192,571	$1,573,878	$3,618,693	Operating funds	Secure/annually budgeted
Humboldt County Resource Conservation District	Mid Van Duzen River Ranch Road Sediment Reduction Program	$581,986	$440,948	$141,038	Landowners, operating funds	Landowner maintenance
Mattole Restoration Council	Mattole Integrated Water Management Program	$2,935,674	$1,668,674	$1,267,000	Landowners, operating funds	NA
Mendocino County Resource Conservation District	Navarro Watershed Road Sediment Reduction Project	$1,180,884	$673,633	$507,251	Operating funds	Landowner maintenance
Modoc County	Newell Water System Renovation	$1,493,228	$1,485,228	$8,000	Utility Rates	Partially secure
Pacific Coast Fish, Wildlife & Wetlands Restoration Association	Redwood Creek Erosion Control	$567,971	$567,971	$0	Operating funds	NA
Shasta Valley Resource Conservation District	Shasta Water Association Dam Restoration	$2,632,177	$1,926,351	$705,826	Operating funds	Grant funded/ landowners
Shasta Valley Resource Conservation District	Araujo Dam Restoration	$1,632,490	$769,903	$862,587	Operating funds	Grant funded/ landowners
Trinity County Waterworks District #1	Raw & Recovered Water for Irrigating Public Agencies	$1,027,394	$912,219	$115,175	Utility Rates	Secure/annually budgeted
Weaverville Sanitary District	Weaverville Sanitary District Water Reclamation Project	$306,688	$280,688	$26,000	Utility Rates	Secure/annually budgeted
Westport County Water District	Water Supply Reliability Project	$374,241	$374,241	$0	Utility Rates	Partially secure
PROPOSITION 50 ROUND 2 AND SUPPLEMENTAL						

APPLICANT	PROJECT	FUNDED CAPITAL COSTS	SOURCE OF CAPITAL FUNDING		SOURCE OF O&M FUNDING	O&M FINANCE CERTAINTY
			STATE AWARD	LOCAL MATCH		
Gold Ridge Resource Conservation District	Salmon Creek Sediment Reduction and Water Conservation Program	$1,140,322	$725,322	$415,000	Operating funds, landowners	Grant funded/ landowners
Mattole Restoration Council	Mattole Integrated Coastal Watershed Management Program	$1,321,554	$879,665	$441,889		Grant funded/ long-standing program
Mendocino Land Trust	Big River Lower Mainstem Restoration Project	$662,169	$662,169	$0	State, federal, and private grants, operating funds	Grant funded/ State Parks budget
Mendocino Resource Conservation District	Forsythe Creek Upslope Road Sediment Reduction Project	$1,976,564	$1,791,564	$185,000	Landowners, operating funds	NA
PROPOSITION 84 — ROUND 1						
City of Fort Bragg	Waterfall Gulch Transmission Main	$788,305	$550,000	$238,305	Utility Rates	Secure/annually budgeted
Del Norte Resource Conservation District	Del Norte Agricultural Enhancement Program	$400,000	$255,000	$145,000	Operating funds	Landowner maintenance
Gold Ridge Resource Conservation District	Bodega Bay HU Water Resources Management Project	$955,205	$700,000	$255,205	Operating funds	Grant funded/ landowners
Gualala River Watershed Council	Gualala River Sediment Reduction Program	$908,280	$600,000	$308,280	Landowners	Grant funded/ long-standing program
Happy Camp Community Services District	Happy Camp Water Treatment System Upgrade	$504,000	$253,000	$251,000	Utility Rates	Partially secure/ current budget
Happy Camp Sanitary District	Indian Creek Sewer Pipeline Crossing	$617,065	$542,000	$75,065	Utility Rates	Partially secure/ current budget
Hopland Band of Pomo Indians	Nissa-kah Creek Fish Passage at Hwy 175	$853,237	$803,000	$50,237	Operating funds	NA
Humboldt Bay Municipal Water District	HBMWD-Blue Lake Fieldbrook Pipeline Support Retrofit	$1,603,580	$700,000	$903,580	Utility Rates	Secure/annually budgeted
Karuk Tribe	Camp Creek Habitat Protection-Road Decommissioning Implementation Project	$375,000	$300,000	$75,000	Operating funds	NA
Mattole Restoration Council	Mattole Integrated Watershed Management Initiative	$643,776	$300,000	$343,776	Landowners, operating funds	Grant funded/ long-standing program
Mendocino County Resource Conservation District	Mendocino Headwaters Integrated Water Quality Enhancement Project	$746,577	$462,670	$283,907	Operating funds, landowners	Landowner maintenance
Mendocino County Resource Conservation District	Mendocino Jumpstart Integrated Water Plan	$391,444	$337,330	$54,114	Operating funds	NA
Pinoleville Pomo Nation	Ackerman Creek Habitat Restoration	$226,950	$46,950	$180,000	Operating funds	NA
Redwood Forest Foundation Inc.	Sustainable Forests, Clean Water & Carbon Sequestration Demonstration Project	$328,040	$250,000	$78,040	Operating funds	NA
Sonoma County Water Agency	The Copeland Creek Watershed Detention/ Recharge, Habitat Restoration, and Steelhead Refugia Project	$1,333,333	$1,000,000	$333,333	Operating funds	Secure/annually budgeted
Sonoma Resource Conservation District	Russian River Arundo donax Removal and Riparian Enhancement Program	$295,000	$225,000	$70,000	Operating funds, state, federal, and local grants	grant funded / Landowner maintenance
Sonoma Resource Conservation District	Lower Russian River Water Quality Improvement Project	$416,500	$375,000	$41,500	Operating funds, grants	Grant funded
Willow Creek Community Services District	Hwy 96 Stormceptor	$135,000	$110,000	$25,000	Operating funds	Secure/annually budgeted
PROPOSITION 84 — ROUND 2						
Big Rock Community Services District	Big Rock CSD Stabilize Water Storage Tank	$1,524,421	$875,221	$649,200	Utility Rates	Partially secure/ current budget
California Land Stewardship Institute	Fish Friendly Farming and Fish Friendly Ranching Environmental Certification in the Russian, Navarro, and Gualala River Watersheds	$710,000	$190,000	$520,000	Landowners	grant funded / Landowner maintenance
California Land Stewardship Institute	Russian River Watershed Agricultural Water Conservation and Water Supply Reliability Program	$2,744,500	$523,500	$2,221,000	Landowners	Secure/annually budgeted

APPLICANT	PROJECT	FUNDED CAPITAL COSTS	SOURCE OF CAPITAL FUNDING		SOURCE OF O&M FUNDING	O&M FINANCE CERTAINTY
			STATE AWARD	LOCAL MATCH		
Gold Ridge Resource Conservation District	Gold Ridge Coastal Watersheds Enhancement Project	$837,750	$307,750	$530,000	Landowners, operating funds	grant funded / Landowner maintenance
Gualala River Watershed Council	Gualala River Sediment Reduction Program	$484,288	$259,000	$225,288	Landowners	grant funded / Landowner maintenance
Humboldt Bay Municipal Water District	Ranney Collectors 1 & 1A Lateral Replacement	$1,416,624	$666,624	$750,000	Utility Rates	Secure/annually budgeted
Karuk Tribe	Lower Mid-Klamath Habitat Protection-Road Decommissioning Implementation Project	$375,000	$300,000	$75,000	Operating funds	grant funded / NA
Mendocino County Resource Conservation District	Mendocino County Working Landscapes Riparian Demonstration Project	$266,400	$184,800	$81,600	Operating funds	grant funded / Landowner maintenance
Salyer Mutual Water Company	Larger Capacity Storage Tanks, Dedicated Main Line, Meters/Master Meter Project	$210,000	$210,000	$0	Utility Rates	Partially secure/ current budget
Siskiyou County	Siskiyou County Septage Pond Closure	$519,700	$389,775	$129,925	Operating funds	current budget NA
Trinity County Resource Conservation District	West Weaver Creek — Channel and Floodplain Rehabilitation	$520,000	$441,500	$78,500	Landowners, operating funds	grant funded / Landowner maintenance
Westhaven Community Services District	Westhaven CSD Water Tank	$360,000	$360,000	$0	Utility Rates	Partially secure/ current budget
Yurok Tribe — Yurok Tribal Fisheries Program	Restoration of Lower Klamath River Habitats	$924,729	$421,354	$503,375	Operating funds	grant funded/ ongoing program
PROPOSITION 84 — 2014 Drought						
City of Rio Dell	Rio Dell and Scotia Community Services District Emergency Water Intertie Project	$783,000	$783,000	$0	Utility Rates	Partially secure/ current budget
City of Ukiah	Ukiah Valley-Redwood Valley Water Supply Reliability Intertie and Well Development	$2,226,450	$1,554,450	$672,000	Utility Rates	Secure/annually budgeted
Sonoma County Water Agency	Sonoma-Mendocino Immediate Drought Relief Project	$1,685,000	$1,050,000	$635,000	Operating funds	Secure/annually budgeted
Lewiston Park Mutual Water Company	Lewiston Park Mutual Water Company Meter Installation Project	$224,604	$224,604	$0	Utility Rates	Partially secure/ grant funded
City of Ft Bragg	Summers Lane Reservoir Project	$1,764,840	$700,000	$1,064,840	Operating funds	Partially secure/ current budget
Gualala River Watershed Council	The Flow Bank — Protecting Stream Flow in the Gualala River	$789,024	$594,226	$194,798	Landowners	grant funded / Landowner maintenance
Sanctuary Forest	Mattole Flow Program: Storage and Forbearance	$474,453	$255,200	$219,253	Landowners	grant funded / Landowner maintenance
Yurok Tribe	Weitchpec Water Station Project	$296,076	$201,770	$94,306	Operating funds	grant funded/ ongoing program
Westhaven Community Service District	Water Loss Reduction Project	$608,500	$493,500	$115,000	Utility Rates	Partially secure/ current budget
California Land Stewardship Institute	Agricultural Water Conservation and Water Supply Reliability Program — Russian and Navarro River Watersheds	$3,285,607	$1,970,190	$1,315,417	Landowners	grant funded / Landowner maintenance
Crescent City	Elevated Water Tank Rehabilitation Project	$584,080	$438,060	$146,020	Operating funds	Secure/annually budgeted
PROPOSITION 84 — 2015 Final						
Bear River Band of Rohnerville Rancheria	Reclaimed Water Project	$558,562	$558,562	$0	Operating funds	Secure/ current budget
City of Weed	Boles Fire Water System Rehabilitation and Water System Restoration	$1,299,000	$1,299,000	$0	Operating funds	Secure/ current budget
Del Norte County	County Service Area #1 and Crescent City Lift Station Rehabilitation	$1,021,055	$815,195	$205,860	Operating funds	Secure/ current budget
Gold Ridge Resource Conservation District	Working Landscape Drought Resiliency Project	$444,960	$332,460	$112,500	Operating funds, landowners	Grant funded/ landowners

APPLICANT	PROJECT	FUNDED CAPITAL COSTS	SOURCE OF CAPITAL FUNDING		SOURCE OF O&M FUNDING	O&M FINANCE CERTAINTY
			STATE AWARD	LOCAL MATCH		
Gualala River Watershed Council	The Flow Bank Program — Phase II	$763,803	$493,254	$270,549	Operating funds, landowners	Grant funded/ landowners
Happy Camp Community Service District	Happy Camp Water Systems Upgrades — Phase I	$290,000	$217,000	$73,000	Utility Rates	Partially secure/ current budget
Hoopa Valley Tribe	Hoopa Valley Public Utility District Conservation Project	$131,253	$131,253	$0	Operating funds	grant funded/ ongoing program
Hoopa Valley Tribe	Lower Supply Flood Risk Reduction and Fisheries Habitat Improvement Project	$955,475	$655,475	$300,000	Operating funds	grant funded/ ongoing program
Hopland Band of Pomo	Community Test Wells and Water Security Study	$149,170	$149,170	$0	Operating funds	Partially secure /grant funded
Humboldt County Resource Conservation District	Restoring Stream Flow and Fish Pasage on the Eel River Delta	$187,869	$187,869	$0	Operating funds, landowners	Grant funded/ landowners
Lewiston Park Mutual Water Company	Lewiston Valley Drinking Water Interie Pipeline	$558,000	$558,000	$0	Utility Rates	Partially secure/ grant funded
Mattole Restoration Council	Lower Mattole River and Estuary Enhancement and Drought Resiliency Project	$693,529	$491,100	$202,429	Operating funds, landowners	grant funded/ ongoing program
Mendocino Resource Conservation District	Implementing on Farm Water Conservation Projects in the Navarro to Address Critical Low Flows	$251,525	$187,480	$64,045	Landowners	grant funded/ ongoing program
Mendocino Resource Conservation District	Water Conservation Technical Assistance to Mendocino County Tribes	$137,670	$114,860	$22,810	Operating funds	grant funded/ ongoing program
Montague Water Conservation District	Instream Flow enhancement through Water Conservation	$1,655,585	$887,960	$767,625	Landowners	grant funded/ ongoing program
Northwest Resource Conservation and Development Council	Trinity River Water Reliability and Drought Resiliency Project	$334,822	$334,822	$0	Landowners	grant funded/ ongoing program
Sanctuary Forest	Mattole Flow Program: Mainstem and Tributary Storage and Forebearance	$383,250	$270,750	$112,500	Landowners	grant funded/ ongoing program
Shasta Valley Resource Conservation District	Shasta River Drought Response and Irrigation Efficiency Project	$347,092	$347,092	$0	Landowners	Partially secure/ grant funded
Resort Improvement District #1	Shelter Cove Water Recycling Project	$103,500	$95,000	$8,500	Planning project	No O&M
Sonoma County Water Agency	Northern Sonoma County Water Conservation Program	$1,052,059	$475,031	$577,028	Operating funds, landowners	Secure grant funds/ ongoing program
Sonoma County Resource Conservation District	Russian River Coho Drought Resiliency Planning and Implementation Program	$461,143	$343,800	$117,343	Operating funds, landowners	grant funded/ ongoing program
Watershed Research and Training Center	South Fork Trinity River- Spring Run Chinook Salmon Restoration Project	$749,446	$621,446	$128,000	Landowners	grant funded/ no O&M
Weott Community Service District	Additional Water Storage	$75,000	$75,000	$0	Planning project	No O&M
Westhaven Community Service District	Water Storage Tank and Roof Replacement Project	$151,500	$151,500	$0	Utility Rates	Partially secure/ grant funded
Yurok Tribe	Yurok Watershed Restoration and Drinking Water Security	$962,674	$702,463	$260,211	Operating funds	grant funded/ ongoing program

Table 51 Small Community Toolkit Elements

TOOLS	BENEFIT TO SERVICE PROVIDERS
Cost Estimating Tools	The cost estimating tools will assist service providers in developing budget level estimates for various types and sizes of infrastructure. While not a substitute for design, this information helps service providers understand budget level costs and begin initial dialogues on funding strategies.
Funding Program Summaries FAQs Capital Recovery Factor Tables	Compiled and synthesized from funding agency information and containing active links to funding program websites, this is a one-stop information shop for service providers. The capital recovery factor tables will allow service providers to translate total project costs to annual debt service needs providing a preliminary understanding of budget and rate impacts
Institutional Summaries Financing District Summaries LAFCO Requirements	Building on the work contained in the Partnership's System Needs Survey, the Institutional Summary and LAFCO summary provides an overview of public and private institutional options and the various legal and administrative steps required to form a public district. The financing district summary provides an overview of commonly used borrowing structures (COPs, assessment districts, Joint Powers Authorities etc) and the steps required to use each borrowing structure, because grants cannot fund 100% of project costs.

Consolidated Preliminary Engineering Report Template List of CEQA/NEPA Exemptions CEQA/NEPA Checklists CEQA GIS Information	Almost every funding program requires some form of a preliminary engineering report and CEQA/NEPA document to process a funding request. But the requirements aren't always aligned. The toolkit includes a proven consolidated report outline with maximum value and flexibility in developing preliminary engineering reports. The summary of CEQA/NEPA exemptions and checklists will assist service providers in tailoring projects to minimize environmental impacts saving both costs and time. The CEQA GIS layers will help purveyors understand possible constraints that could impact their projects.
Technology Overviews	The technology overview is a summary of common system issues, the types of technology used to resolves those issues and the pros and cons of each (first cost, operating costs, operator sophistication etc).

Table 52 Disadvantaged Community Demonstration Projects

COUNTY	APPLICANT AND ORGANIZATION TYPE	DESCRIPTION
Del Norte	Smith River CSD — Public Agency	Developed a template to explore the feasibility of adding solar energy production to small water districts.
Humboldt	Orleans CSD — Public Agency	Study of water supply capacity and storage options to support Tribal housing.
Humboldt	Orick CSD Public Agency	Evaluate cluster wastewater systems. The feasibility study built on past investigation into a larger wastewater project.
Mendocino	Pine Mountain Mutual Water Company — Mutual	Assistance to secure funds to purchase a new tank and repair a well. Consultant services put them in a better position to secure grant funds.
Siskiyou	Callahan Water District — Public Agency	Evaluate water system filtration options
Siskiyou	City of Weed	Feasibility study for wind and solar options to offset power consumption and cost.
Sonoma	Graton CSD — Public Agency	Feasibility study/cost estimation to repair aging collection system.
Sonoma	Huckleberry Mutual Water Company — Mutual	Assistance with securing financing for a filtration system and meters.
Sonoma	Kashaya Utility District — Tribal Utility	Evaluated extending water supply to adjacent land.
Trinity	Lewiston Park Mutual Water Company Mutual	Plan for an upgrade or a new water treatment plant to lift boil notice. Received guidance about how to consolidate with neighboring system.

Table 53 Energy Efficiency Block Grant Program

COMMUNITY	TOTAL FUNDS ALLOCATED	PROJECT DESCRIPTION	ANNUAL PROJECT SAVINGS	SIMPLE PAYBACK PERIOD
Humboldt County	$397,762	Energy Efficiency upgrades including motors, VFDs, HVAC, boilers and controls, chillers, lighting & occupancy sensors and ozone laundry	$162,089	5.2
Trinity County	$81,911	HVAC replacement project on Library and Jail.	-$1,234	0
Arcata	$94,637	LED Streetlights, Energy Management Systems, HVAC Improvements, lighting retrofit, refrigeration projects	$21,588	5.3
Blue Lake	$25,000	Premium efficiency booster pumps	$2,860	8.5
Eureka	$141,208	Adorni lighting retrofit, heat pump water heaters, Eureka P.D. VAV boxes, Public works controls	$17,030	10.5
Fortuna	$62,756	Street lighting	$4,039	19.4
Ferndale	$25,000	Premium efficiency booster pumps	$3,255	6.6
Rio Dell	$25,000	Replacement of air conditioning/heating and ducting	$935	44.3
Trinidad	$25,000	City Hall Insulation & furnace replacement	$0	45.9
Point Arena	$25,000	Purchase and install (1) 30 HP Premium Efficiency Motor	$872	21.3
Crescent City	$44,555	Replace the 3 existing 125HP direct drive motors with 3 Variable Frequency Drive (VFD) controlled motors.	$29,394	4.1
Etna	$25,000	Insulation of town hall and replace (1) furnace	$40,612	16.1
Totals	$972,829		$281,440	5.3

Table 54 Common Local Agency Funding Mechanisms

	WATER OR SEWER RATES	BENEFIT ASSESSMENTS (AKA PROPERTY BASED FEES AND STORM WATER RATES)	PARCEL TAX	AD VALOREM PROPERTY TAX	SALES TAX
Loan Security	Certificates of Participation	Assessment Bonds	Certificates of Participation	General Obligation Bonds	Certificates of Participation
Election Requirements	None	Mailed ballot with 45-day ballot period	With any general or special election	With any general or special election	Any election
Who Votes	Not required	Property Owners	Registered Voters	Registered Voters	Registered Voters
Approval Requirements	Written protests do not exceed 50%	Majority of Assessment amount	2/3 of those voting	2/3 of those voting	2/3 of those voting
Reserve Requirement	Typically less than 10%	Typically less than 10%	Typically less than 10%	Not required	Typically less than 10%

Term for Debt	Less than 40 years	Less than 40 years	Per Ballot — can be indefinite	Less than 40 years	Per Ballot — can be indefinite
Term for Operation and Maintenance	Indefinite	Per ballot — indefinite	Per ballot — indefinite	Cannot be used for maintenance	Per ballot
Additional Documentation	Rate Study	Engineers Report			

Table 55 Summary of Funding Agencies, Mandates and Eligibility

AGENCY	MANDATE	ELIGIBLE ENTITIES					
		Public Systems	Private Non Profits	Private for Profit	Federally Recognized Tribes	Non Recognized Tribes	Successful Partnering Track Record with NCRP Participants
FEDERAL							
Army Corps of Engineers (Corps)	Grants for Flood Control & Water Supply*	Yes	No	No	No	No	Yes
Bureau of Indian Affairs	Funding for climate change, fish and wildlife, natural resources	No	No	No	Yes	No	Yes
Bureau of Reclamation (BuRec)	Grants for Water Supply	Yes	No	No	No	No	
Environmental Protection Agency	Funding for water quality protection, habitat enhancement,	Yes	Yes	No	Yes	No	Yes
Federal Emergency Management Agency	Funding for flood and other natural hazard mitigation	Yes	Yes	No	Yes	Not specified	
Fish and Wildlife Service	Funding for restoration and habitat protection, special status species, wildlife and sport fish,	Yes	Yes	No	Yes	No	Yes
Indian Health Service (IHS)	Grants for Tribal Support	No	No	Yes	No	No	Yes
National Oceanic and Atmospheric Administration CSC, NMFS	Funding for climate change amelioration, coastal resiliency, coastal and natural resource management, NPS pollution control, and sensitive species protection.	Yes	Yes	No	Yes	No	Yes
US Dept of Agriculture (USDA)	Grants and Loans for Rural Community Infrastructure, farm improvement programs	Yes	Yes	No	Yes	No	Yes
STATE							
Air Resources Board	Grants, incentives, and credit programs to improve air quality	Yes	Yes	Yes	Yes	Yes	Yes
California Pollution Control Financing Authority	Low cost financing to qualified waste and recycling projects and other projects to control pollution.	Yes	Yes	Yes	Yes	Yes	
California Coastal Commission	Funding for Local Coastal Program assistance, beach maintenance, coastal habitat restoration, and education	Yes	Yes	No	No	No	Yes
California Energy Commission	Funding for energy efficiency, planning and renewable energy	Yes	No	No	No	No	Yes
Coastal Conservancy	Funding for public access along the coast, natural resource protection and restoration in the coastal zone, protection of coastal agricultural land, restoration of coastal urban waterfronts, and resolution of land use conflicts.	Yes	Yes	No	No	No	Yes
Department of Food and Agriculture	Specialty Crops	Yes	Yes	Yes	Yes	Not specified	
Department of Public Health (CDPH)**	Grants and Loans for Public Health	Yes	Yes	No	No	No	Yes
Department of Pesticide Regulation	Grants for IPM	Yes	Yes	Yes	Yes	Yes	
Department of Fish and Wildlife	Funding for fish and wildlife management, habitat management, and oil spill prevention and response	Yes	Yes	No	Yes	No	Yes
Department of Water Resources	Grants for Water Supply and Flood Control	Yes	No	No	Not Directly	No	Yes
Housing & Community Development	Grants for Housing and Community Development	Yes	Yes	No	No	No	Yes
Infrastructure Bank (I-Bank)	Loans for Economic Development	Yes	No	No	No	No	
State WaterBoard	Grants and Loans for Water Quality	Yes	No	No	Yes	No	Yes
Wildlife Conservation Board Programs	Funding for habitat restoration projects and improvements to public access	Yes	Yes	Under specific cond-itions	No	No	Yes
REGIONAL AGENCIES							
North Coast Resource Partnership	Grants for Integrated Water Planning	Yes	No	No	Yes	Within an integrated project	Yes
PRIVATE ENTITIES							
California Special District Association (CSDA)	Loans to Supporting Special District Members	Yes	No	No	No	No	

AGENCY	MANDATE	ELIGIBLE ENTITIES					
		Public Systems	Private Non Profits	Private for Profit	Federally Recognized Tribes	Non Recognized Tribes	Successful Partnering Track Record with NCRP Participants
Christensen Fund	Grants in support of biocultural diversity for climate change, indigenouse knowledge, and resilient landscapes in the Bay Area	No	No	No	Yes	Not specified	
David & Lucille Packard Foundation	Grants for Conservation and Science	Yes	Yes	No	Not specified	Not specified	Yes
National Fish & Wildlife Foundation	Grants to protect and restore wildlife and habitats	Yes	Yes	No	No	No	Yes
Gordon and Betty Moore Foundation	Grants for Bay Area land conservation, innovative approaches to conservation challenges	Yes	Yes	No	Not specified	Not specified	Yes
Pacific Gas & Electric Company (PG&E)	Rebates for Energy Efficiency and Renewables	Yes	Yes	Yes	Yes	Yes	Yes
Rural Community Assistance Corporation (RCAC)***	Loans for Rural Community Assistance	Yes	Yes	Yes	Yes	No	Yes
William and Flora Hewlett Foundation	Grants for conservation, climate change amelioration, energy, and SF Bay Area DACs	No	Yes	No	Not specified	Not specified	Yes
*Water Supply mandate comes through the recently approved Water Resources Development Act (WRDA)							
** On July 1, 2014, CDPH's Office of Drinking Water will merge with Water Board. Plans are in place to transition funding programs at that time							
***RCAC also has technical assistance contracts with USDA, CDPH and Water Boards and has an EPA grant to provide technical assistance							

Table 56 NCRP Funding Opportunity Descriptions by Type

FEDERAL FUNDING OPPORTUNITIES
The Army Corps of Engineers can provide flood control assistance and will soon be able to provide water supply assistance under the auspices of the developing Water Resources Development Act (WRDA). The flood control programs are well established but require congressional budget authorizations in order to fund projects. Because of this, Corps programs can be less than certain and are most applicable to larger agencies and projects, where there are resources available to manage the federal process. The WRDA program is new but provides a promising venue for large water supply and water recycling programs. Like the flood control programs, WRDA is subject to congressional budget approval, reducing certainty and making it more appropriate for large agencies and projects.
The Bureau of Reclamation provides a number of grant opportunities including the WaterSMART Water and Energy Efficiency Grants, the WaterSMART Pilot and Demonstration Project Grants, WaterSMART Grants for Climate Analysis Tools, WaterSMART System Optimization Grants, the WaterSMART Cooperative Water Management Program and Water Recycling Grants. Like the Corps programs, the Bureau's programs have a stable history, generally through the authorization provided by Tile XVI, but certainty varies with congressional budgeting cycles.
The Department of Agriculture (USDA) has several funding programs for rural and agricultural areas. The Rural Utility Service provides water and wastewater grants and loans that fund the planning, design and construction of water and waste disposal systems in rural areas and towns with a population not in excess of 10,000. The funds are available to public bodies, non-profit corporations and Tribes. The program funds renewable energy installations for water and wastewater utilities. The program is well developed and receives regular budget allocations, making funding available on an annual basis. Funding is indexed to median household income, with grants of up to 45% of project costs reserved for the communities most in need. Loans are typically secured by rates or assessments. RUS also has a national "Search Grant" Program that can provide up to $25,000 in grant assistance for the development of application materials. This program is highly competitive. USDA Natural Resource Conservation Service (NRCS) also offers individual landowners assistance with its Environmental Quality Incentives Program (EQIP) and Conservation Stewardship Program (CSP), which are funded annually through the Farm Bill and implemented locally by Resource Conservation Districts. Other programs include easement programs to conserve working agricultural lands, wetlands, grasslands and forestlands and Conservation Innovation Grants, which are meant to stimulate the development and adoption of innovative conservation approaches and technologies.
The Environmental Protection Agency (EPA) has multiple grant programs to improve environmental quality, remove contaminants, empower communities, disseminate information, and provide funding for state administered drinking water, wastewater, pollution prevention, and wetlands protection grants. Many of these grant programs are well established and funded on an annual cycle.
The Federal Emergency Management Agency (FEMA) provides state and local governments with preparedness program funding in the form of Non-Disaster Grants to enhance capacity to respond to emergencies. It also provides hazard mitigation assistance to implement long-term hazard mitigation measures following a major disaster, and flood mitigation assistance to reduce or eliminate flood damage. These FEMA programs are well developed with regular budget allocations, with funding available on an annual basis.
The US Fish and Wildlife Service (FWS) provides funding for habitat conservation and restoration through the North American Wetlands Conservation Act. It supports projects throughout North America that involve long-term protection, restoration and/or enhancement of wetlands and their associated uplands habitats. The Act was passed to support activities under the North American Waterfowl Management Plan and included funding mechanisms. The most recent reauthorization expired in 2012 and grant program appropriation has decreased, but additional program funding from fines, penalties, and other fees provided over $31 million in grant funds.
Indian Health Service (IHS) can provide grants for water resources and watershed improvements to Tribal communities. IHS can also assist when Tribal households have on-site costs, such as assessments or the cost of water and sewer laterals, as part of a larger community project. IHS funding is stable and proven and can provide a source of matching funds for projects that benefit Tribal communities. This funding source can fund renewable energy projects.
National Oceanic and Atmospheric Administration (NOAA) provides grants for coastal communities to become more resilient to threats posed by coastal hazards such as storms, sea level rise, and climate change. It also provides funding for coastal and marine habitat restoration projects in support of listed species recovery. Funding has been steady for the past decade as NOAA has made an effort to use a habitat-based approach to promote species recovery and increase sustainable fisheries.

STATE FUNDING OPPORTUNITIES
The Air Resources Board (ARB) has hundreds of millions of dollars in grants available over the next several years to reduce emissions from on- and off-road vehicles and equipment. Typically, vehicle and equipment owners apply for funds. Other programs provide incentives for emissions reduction, demonstration projects, and clean air initiatives. The ARB also provides emission credit programs. Future programs relevant to the NCRP may derive from the sale of AB 32 cap and trade auction revenues.
California Pollution Control Financing Authority provides low-cost innovative financing to California businesses for qualified waste and recycling projects. Some pollution control projects qualify for tax-exempt financing. CPCFA assists small businesses with loans up to $2.5 million. Recent assistance has included the purchase of clean air vehicles and conversion of animal waste to clean burning fuel.
California Coastal Commission provides grant funds for public access and coastal maintenance and restoration projects with a public education component. It also supports local government planning for sea-level rise, climate change and development of current Local Coast Programs consistent with the California Coastal Act.
California Energy Commission is administering four energy conservation, clean energy, and planning programs funded through American Recovery and Reinvestment Act stimulus funding. It also provides efficiency services and an energy efficiency financing program. Low interest loans for energy in agriculture and energy efficiency are offered on a "no time-limit" basis. The CEC also offers rebates for solar installation and energy upgrades.
California Coastal Conservancy awards grants to public agencies and nonprofit organizations for projects that enhance public access, habitat protection and restoration in the coastal zone or affecting coastal areas, restoration of coastal urban waterfronts, protection of coastal agricultural land, and resolution of land use conflicts. Project stages generally funded by the Conservancy include pre-project feasibility studies, acquisition, planning, design, environmental review, construction and monitoring. Most projects are developed over time in coordination with Conservancy staff. A current opportunity is climate ready grants, which help to advance planning and implementation of climate change amelioration efforts for local governments.
The Department of Food and Agriculture disperses federal USDA funds for the Specialty Crop Block Grant. Specialty crops are fruits, vegetables, tree nuts, dried fruits, horticulture, and nursery crops. A program objective is the expansion of stewardship practices, natural resource conservation, and the development of ecosystem services to improve environmental and financial performance of specialty crop growers. Funding is contingent upon passage of a Farm Bill yearly and available funding from the USDA Agricultural Marketing Service and ranges from $50,000 to $400,000 per project.
The Department of Parks and Recreation offers grants for habitat conservation and land and water conservation. The Habitat Conservation Fund Program provides funding for acquisition, habitat enhancement, and increasing urban visitor use. The Land and Water Conservation Fund is administered by DPR for the National Park Service. The NPS has been required to manage the fund by law since 1964 when it was signed by President Johnson. Land acquired in this way must be placed under federal protection to preserve outdoor recreational use of the site in perpetuity.
The Department of Public Health Safe Drinking Fund provides funding and financing for water system improvements necessary to comply with the Safe Drinking Water Act. The funding source is stable and proven and accepts continuous applications for funding. The program can provide funding up to $30 million per applicant with provisions for grants for disadvantaged communities. Loans are typically secured by rates. The Safe Drinking Water Fund prioritizes projects by public health need and is most successfully used by communities with difficulties complying with primary and secondary drinking water standards.
The California Department of Fish and Wildlife awards grant funds for projects that sustain, restore, and enhance California's fish, wildlife, plants, and habitats. The Fisheries Restoration Grant Program has been ongoing since 1981 and has invested millions of dollars to support projects from sediment reduction to watershed education. Natural Community Conservation Planning (NCCP) includes grants for developing NCCPs and Habitat Conservation Plans (HCPs) and provides funds for tasks associated with implementation of approved NCCPs. DFW is also the state sponsor of federal ESA grants that support conservation planning and habitat purchases.
The Department of Water Resources provides a range of matching grant programs, generally capitalized by bond sales. While DWR's history as a funding agent is well proven, the availability of any particular source of funding is dependent on bond sales. The IRWM funding administered through the NCRP comes through DWR as a result of bond laws passed with Propositions 50, 84 and 1E. Because of this dependence on bond sales, DWR's programs are less certain than the firmly capitalized revolving funds administered by CDPH and SWRCB. In its work with the DAC Targeted Grant Program, the NCRP has identified the following current DWR programs that could be utilized to provide financial assistance for projects throughout the Region:
Safe Drinking Water Contaminant Removal Proposition 50: provides grants of up to $5 million for pilot and demonstration projects and disinfection improvements for drinking water;
Local Groundwater Assistance: currently expended but the program can provide grants of up to $250,000 for local groundwater development;
California Safe Drinking Water Bond Law Proposition 81: Provides very limited grants and loans to disadvantaged communities in partnership with CDPH and been effectively used for leak detection, metering and to "make up the difference" around a Drinking Water SRF project.
Housing and Community Development block grants from the federal government, through the state to the counties, vary widely in their use for water and wastewater infrastructure. While the funding source is stable and has a long history, its primary focus is the development of affordable housing and counties will often limit the amount of block grant funds that are expended on infrastructure. Community Development Block Grants can be a good source of grant funding for on-site costs (assessments, construction of laterals) for low-income households as part of a larger community project.
I-Bank provides loans of up to $20 million for local public projects that meet tax-exempt financing criteria, promote economic development and attract long-term employment opportunities. Loans are typically secured by rates or assessments. I-Bank's funding approval process is relatively rapid and it can be an effective source of funding for communities with strict, short compliance deadlines.
State Water Resources Control Board provides loan and grant funding for construction of sewage and water recycling facilities, underground storage tank remediation, watershed protection, and NPS pollution control projects.
The State Revolving Fund (SRF) Program provides loans of up to $50 million for water quality improvement projects, including wastewater, stormwater and recycled water. The Water Recycling Program provides $75,000 grants for recycled water feasibility studies. The SRF's "Expanded Use Program" can provide for more flexible "principal forgiveness" options for disadvantaged communities. This program is proven and certain with a 20-year history of assisting communities. SRF loans are typically secured by rates or assessments. The Agricultural Drainage Loan Program addresses treatment, storage, conveyance or disposal of agricultural drainage that threatens water quality. SWRCB also offers several ongoing grant programs, including the Clean Beaches Initiative, Clean Water Act NPS projects, Small Community Wastewater, and the Stormwater Program; these programs are proven and stable.
The Wildlife Conservation Board administers a capital outlay program for wildlife conservation and outdoor recreation. The WCB selects, authorizes, and allocates funds for acquisition of land suitable for recreation and the preservation, protection, and restoration of wildlife habitat. Programs are grouped by type: riparian, forest, inland wetlands, agricultural lands, rangeland, oaks, habitat enhancement, acquisition, tax credit, public access, and monitoring.

PRIVATE FUNDING OPPORTUNTIES
The California Special District Association provides a "pool" program that allows smaller agencies, which are members of CSDA, to access capital markets more effectively through a joint bond sale. Bond proceeds can fund the construction of projects and bonds payments are typically made from rates or assessments. This program is stable and can provide a relatively certain source of loan funding.
The National Fish & Wildlife Foundation supports more than 70 grant programs to protect and restore wildlife and habitat, including Acres for America, a well-known partnership with Walmart Corporation. Priorities for this program include providing access, conserving critical plant and wildlife habitat, connecting existing protected lands, and ensuring the future of rural economies. The Bring Back the Natives/More Fish program funds activities that protect and enhance sensitive and listed fish species. In 2012, NFWF partnered with Wells Fargo to launch the Environmental Solutions for Communities initiative, which is designed to support projects that link economic development, community wellbeing, stewardship, and health of the environment. This five-year initiative is expected to provide a total impact of over $37.5 million. NFWF funding is stable and secure with a proven track record; several NCRP project proponents have successfully obtained NFWF grants.
Pacific Gas & Electric provides rebates for projects that generate renewable energy. While rebate funds typically cannot be used as security for loans or other types of debt, the rebates can reduce the overall cash demand for a renewable energy project and reduce payback time. Rebate programs are variable and rebate amounts have generally been reducing over time, however rebates can enhance the economics of an otherwise cost-effective renewable energy program.
Rural Community Assistance Corporation (RCAC) provides loans much like the CSDA program, which can be used for infrastructure improvements and paid back with rates or assessments. This program is proven and certain. In addition, RCAC writes annual grants to community foundations, which may support specific activities, particularly those targeted at disadvantaged communities. Examples include the Humboldt Area Foundation, which focuses on Humboldt County and the California Endowment, which supports drinking water for public schools. RCAC also writes grants to large banks, which must invest in infrastructure to support low-income housing through the various community reinvestment acts. While this targeted grant-writing activity is not as certain as the capitalized revolving funds, it can provide valuable assistance in certain situations.
Various Community and private family foundations may have an interest in funding research, planning or particular project implementation in the North Coast.

APPENDIX L. NCRP PROJECT INFORMATION

PROJECT REVIEW & SELECTION GUIDELINES

The NCRP Plan describes the process steps and guidelines developed by the NCRP Policy Review Panel (PRP) and ad hoc committee, and utilized by the PRP and Technical Peer Review Committee (TPRC) to identify, rank, and select priority projects to implement the NCRP Plan. The current (Spring 2019) NCRP Project Review and Selection Process Guidelines (NCRP Guidelines[6]) refine and update the process and are subject to continual review and refinement per recommendations of the PRP, TPRC, NCRP staff, and the DWR's IRWM Grant Program Guidelines.

PROJECT LISTS

The NCRP process has identified through multiple rounds of proposal solicitation numerous projects from throughout the North Coast Region that address state, regional, and local objectives and priorities for water management. Proposed projects that are aligned with NCRP Goals & Objectives may qualify for formal NCRP endorsement and subsequent inclusion in the NCRP Plan. The project proponents then can work with NCRP members and staff to develop project-funding applications to appropriate sources.

The NCRP priority projects comprise a project portfolio consisting predominantly of the highest scoring projects recommended to the PRP by the TPRC for inclusion in the Plan and related funding applications. The PRP has the discretion to select additional projects to supplement high-scoring proposed projects so as to achieve regional equity, address integrated coastal watershed management, and respond to urgent public health problems. The NCRP website provides project summaries of the following funded projects at https://northcoastresourcepartnership.org/projects/.

IRWM Proposition 50 Funded Projects

These projects represent the specific actions, projects, and studies by which the first phase of the NCRP Plan was implemented. Monitoring measures are identified and will be used to provide feedback to the NCRP, which will continue to modify the NCRP Plan and project implementation and prioritization as new information and technology becomes available.

Table 57 IRWM Proposition 50 Funded Projects

PROJECT SPONSOR	PROJECT	COUNTY
Proposition 50 — Round 1		
California Land Stewardship Institute	Fish Friendly Farming Environmental Certification Program	Mendocino
California State Parks — North Coast Redwoods District	Head Hunter/Smoke House Non-point Sediment Reduction Project	Humboldt
City of Crescent City	Crescent City Wastewater Treatment Plant Renovation	Del Norte
City of Etna	City of Etna Water Supply	Siskiyou
City of Eureka	Martin Slough Interceptor Project	Humboldt
City of Santa Rosa	Sonoma County Water Recycling and Habitat Preservation Project	Sonoma
Covelo Community Services District	Covelo Wastewater Facilities Improvement Project	Mendocino
Graton Community Service District	Graton Wastewater Treatment Upgrade and Reclamation Project	Sonoma
Gualala River Watershed Council	Sediment Solutions for the Gualala: Phase III	Mendocino
Humboldt County Resource Conservation District	Salt River Restoration Project	Humboldt
Humboldt County Resource Conservation District	Mid Van Duzen River Ranch Road Sediment Reduction Program	Humboldt
Mattole Restoration Council	Mattole Integrated Water Management Program	Humboldt
Mendocino County Resource Conservation District	Navarro Watershed Road Sediment Reduction Project	Mendocino
Modoc County	Newell Water System Renovation	Modoc
Pacific Coast Fish, Wildlife & Wetlands Restoration Association	Redwood Creek Erosion Control	Humboldt
Shasta Valley Resource Conservation District	Shasta Water Association Dam Restoration	Siskiyou
Shasta Valley Resource Conservation District	Araujo Dam Restoration	Siskiyou
Trinity County Waterworks District #1	Raw & Recovered Water for Irrigating Public Agencies	Trinity
Weaverville Sanitary District	Weaverville Sanitary District Water Reclamation Project	Trinity
Westport County Water District	Water Supply Reliability Project	Mendocino

6 The 2019 NCRP Project Review & Selection Process Guidelines https://northcoastresourcepartnership.org/proposition-1-irwm-round-1-implementation-funding-solicitation/

PROJECT SPONSOR	PROJECT	COUNTY
Proposition 50 — Round 2 and Supplemental		
Gold Ridge Resource Conservation District	Salmon Creek Sediment Reduction and Water Conservation Program	Sonoma
Mattole Restoration Council	Mattole Integrated Coastal Watershed Management Program	Humboldt
Mendocino Land Trust	Big River Lower Mainstem Restoration Project	Mendocino
Mendocino Resource Conservation District	Forsythe Creek Upslope Road Sediment Reduction Project	Mendocino

IRWM Proposition 84 Funded Projects

Projects and their benefits are summarized in Appendix I.3. These projects represent the specific actions, projects, and studies by which Phase III of the NCRP Plan will be implemented. Monitoring measures are identified and will be used to provide feedback to the NCRP, which will continue to modify the Plan and project implementation and prioritization as new information and technology becomes available.

Table 58 IRWM Proposition 84 — Funded Projects

PROJECT SPONSOR	PROJECT	COUNTY / TRIBE
Proposition 84 — Round 1		
City of Fort Bragg	Waterfall Gulch Transmission Main	Mendocino
Del Norte Resource Conservation District	Del Norte Agricultural Enhancement Program	Humboldt
Gold Ridge Resource Conservation District	Bodega Bay HU Water Resources Management Project	Sonoma
Gualala River Watershed Council	Gualala River Sediment Reduction Program	Mendocino
Happy Camp Community Services District	Happy Camp Water Treatment System Upgrade	Siskiyou
Happy Camp Sanitary District	Indian Creek Sewer Pipeline Crossing	Siskiyou
Hopland Band of Pomo Indians	Nissa-kah Creek Fish Passage at Hwy 175	Hopland Band of Pomo Indians
Humboldt Bay Municipal Water District	HBMWD-Blue Lake Fieldbrook Pipeline Support Retrofit	Humboldt
Karuk Tribe	Camp Creek Habitat Protection-Road Decommissioning Implementation Project	Karuk Tribe
Mattole Restoration Council	Mattole Integrated Watershed Management Initiative	Humboldt
Mendocino County Resource Conservation District	Mendocino Headwaters Integrated Water Quality Enhancement Project	Mendocino
Mendocino County Resource Conservation District	Mendocino Jumpstart Integrated Water Plan	Mendocino
Pinoleville Pomo Nation	Ackerman Creek Habitat Restoration	Mendocino
Redwood Forest Foundation Inc.	Sustainable Forests, Clean Water & Carbon Sequestration Demonstration Project	Mendocino
Sonoma County Water Agency	The Copeland Creek Watershed Detention/Recharge, Habitat Restoration, and Steelhead Refugia Project	Sonoma
Sonoma Resource Conservation District	Russian River Arundo donax Removal and Riparian Enhancement Program	Sonoma
Sonoma Resource Conservation District	Lower Russian River Water Quality Improvement Project	Sonoma
Willow Creek Community Services District	Hwy 96 Stormceptor	Trinity
Proposition 84 — Round 2		
Big Rock Community Services District	Big Rock CSD Stabilize Water Storage Tank	Del Norte
California Land Stewardship Institute	Fish Friendly Farming and Fish Friendly Ranching Environmental Certification in the Russian, Navarro, and Gualala River Watersheds	Mendocino
California Land Stewardship Institute	Russian River Watershed Agricultural Water Conservation and Water Supply Reliability Program	Mendocino
Gold Ridge Resource Conservation District	Gold Ridge Coastal Watersheds Enhancement Project	Sonoma
Gualala River Watershed Council	Gualala River Sediment Reduction Program	Mendocino
Humboldt Bay Municipal Water District	Ranney Collectors 1 & 1A Lateral Replacement	Humboldt
Karuk Tribe	Lower Mid-Klamath Habitat Protection-Road Decommissioning Implementation Project	Karuk Tribe
Mendocino County Resource Conservation District	Mendocino County Working Landscapes Riparian Demonstration Project	Mendocino
Salyer Mutual Water Company	Larger Capacity Storage Tanks, Dedicated Main Line, Meters/Master Meter Project	Trinity
Siskiyou County	Siskiyou County Septage Pond Closure	Siskiyou
Trinity County Resource Conservation District	West Weaver Creek — Channel and Floodplain Rehabilitation	Trinity
Westhaven Community Services District	Westhaven CSD Water Tank	Humboldt
Yurok Tribe — Yurok Tribal Fisheries Program	Restoration of Lower Klamath River Habitats	Yurok Tribe
Proposition 84 — 2014 Drought Round		
City of Rio Dell	Rio Dell and Scotia CSD Emergency Water Intertie	Humboldt

PROJECT SPONSOR	PROJECT	COUNTY / TRIBE
City of Ukiah	Ukiah Valley-Redwood Valley Water Supply Reliability Intertie and Well Development Project	Mendocino
Sonoma County Water Agency	Sonoma-Mendocino Immediate Drought Relief Project	Mendocino, Sonoma
Lewiston Park Mututal Water Company	Meter Installation	Trinity
City of Fort Bragg	Summers Lane Reservoir Project	Mendocino
Gualala River Watershed Council	The Flow Bank — Protecting Stream Flow in the Gualala River	Mendocino, Sonoma
Sanctuary Forest Inc.	Mattole Flow Program: Storage and Forbearance	Humboldt
Yurok Tribe	Weitchpec Water Station	Yurok Tribe
Westhaven Community Services District	Westhaven Community Services District Water Loss Reduction Project	Humboldt
California Land Stewardship Institute	Agricultural Water Conservation and Water Supply Reliability Program — Russian and Navarro River Watersheds	Mendocino
City of Crescent City	Elevated Water Tank (EWT) Rehabilitation (Wonder Stump Road)	Del Norte
Proposition 84 — 2015		
Bear River Band	Reclaimed Water Project	Bear River Band of the Rohnerville Rancheria
City of Weed	Boles Fire Water System Rehabilitation/ Water System Restoration	Siskiyou
Del Norte County CSA #1 and Crescent City	Lift Station Rehabilitation	Del Norte
Gold Ridge RCD	Working Landscapes Drought Resiliency Project	Sonoma
Gualala River Watershed Council	Flow Bank Program — Phase II	Mendocino
Happy Camp CSD	Happy Camp Water System Upgrades — Phase I	Siskiyou
Hoopa Valley Tribe PUD	Conservation Project	Hoopa Valley Tribe
Hoopa Valley Tribe	Lower Supply Flood Risk Reduction and Fisheries Habitat Improvement	Hoopa Valley Tribe
Hopland Band of Pomo Indians	Test Well and Community Water Security	Hopland Band of Pomo Indians
Humboldt County RCD	Restoring Stream Flow and Fish Passage on the Eel River Delta	Humboldt
Lewiston Park CSD	Lewiston Valley Drinking Water Intertie Pipeline	Trinity
Mattole Restoration Council	Lower Mattole River and Estuary Enhancement and Drought Resiliency Project	Humboldt
Mendocino County RCD	Implementing On-Farm Water Conservation Projects in the Navarro to Address Critical Low Flows	Mendocino
Mendocino County RCD	Water Conservation Technical Assistance to Mendocino County Tribes	Mendocino
Montague Irrigation District	Instream Flow Enhancement through Water Conservation	Siskiyou
Northwest CA Resource Conservation & Development Council	Trinity River Water Reliabity and Drought Resiliency Project	Trinity
Sanctuary Forest	Mattole Flow Program: Mainstem & Tributary Storage and Forbearance	Mendocino
Shasta Valley RCD	Shasta River Drought Response and Irrigation Efficiency Project	Siskiyou
Resort Improvement District #1	Shelter Cove Water Recycling Project	Humboldt
Sonoma County Water Agency	Northern Sonoma county Water Conservation Program	Sonoma
Sonoma RCD	Russian River Coho Drought Resiliency Planning and Implementation Program	Sonoma
Watershed Research & Training Center	South Fork Trinity River Spring Run Chinook Salmon Restoration Project	Trinity
Weott CSD	Additional Water Storage	Humboldt
Westhaven CSD	Water Storage Tank and Roof Replacement Project	Humboldt
Yurok Tribe	Yurok Watershed Restoration and Drinking Water Security	Yurok Tribe

Table 59 Proposed NCRP IRWM Proposition 1 Round 1 Projects

NCRP 2019 PROPOSITION 1 IRWM ROUND 1 PRIORITY PROJECTS	FUNDING AMOUNT	COUNTY / TRIBE
Blue Lake Rancheria, Water Storage Project	$382,085	Blue Lake Rancheria
Briceland Community Services District, Water Supply Enhancement Project	$1,076,625	Humboldt
City of Ferndale, California Street Sewer Replacement	$326,750	Humboldt
City of Willits, Improving Willits Water Supply Reliability and Drought Resiliency with Groundwater and Conjunctive Use	$551,156	Mendocino
County Service Area No. 1, Onsite Emergency Power Supply for Sanitary Sewer Lift Stations	$807,641	Del Norte
Covelo Community Services District, Collection System and Wastewater Treatment Plant Improvements	$750,000	Mendocino

NCRP 2019 PROPOSITION 1 IRWM ROUND 1 PRIORITY PROJECTS	FUNDING AMOUNT	COUNTY / TRIBE
Eel River Watershed Improvement Group, Kenny Creek Instream Habitat Enhancement Project	$176,077	Mendocino
Fieldbrook Glendale Community Services District, Water Tank Seismic Retrofit Project	$314,744	Humboldt
Gold Ridge Resource Conservation District, Rainwater Catchment Rebate and Streamflow Enhancement Pilot Project	$420,324	Sonoma
Humboldt Bay Municipal Water District, Ranney Collector 2 Rehabilitation Project	$600,000	Humboldt
Lewiston Community Services District, Water Distribution System Replacement Project	$1,073,273	Trinity
Mattole Restoration Council, Carbon Sequest Lower Mattole River and Estuary Enhancement Project Phase II	$656,165	Humboldt
Newell County Water District, Water System Improvements Project	$461,607	Modoc
Pacific Reefs Water District, Water Tank Replacement Project	$386,274	Mendocino
Sanctuary Forest Inc., Drought and Emergency Water Project	$558,501	Humboldt
Scott River Watershed Council, Scott River Headwaters Forest Health, Fire Safety, and Water Quality Improvement Project	$632,370	Klamath
Smith River Community Services District, Water System Emergency Generator Project	$322,445	Del Norte
Watershed Research and Training Center, South Fork Trinity River — Spring Run Chinook Salmon Restoration Project — Phase II	$832,495	Trinity
Weaverville Sanitary District, Sewer Improvements Project	$691,000	Trinity
Yurok Tribe , Upgrading Critical Infrastructure to Support Resource Recovery in the Blue Creek Sanctuary	$937,268	Humboldt
Total Amount	$11,956,800	
Contingency project: City of Trinidad, Trinidad-Westhaven Community Water Reliability, Security and Enhancement Project	$831,389	Humboldt

NCRP Projects

As of June 2019, the NCRP process has identified 335 projects from throughout the North Coast Region with a total project cost of $890,489,899 and a combined funding request of $517,741,023. The current (Fall 2018) NCRP Project Review and Selection Process Guidelines (NCRP Guidelines) standardize the process for on-going project inclusion into the NCRP Plan.

Table 60 NCRP Projects — All projects

PROJECT SPONSOR	PROJECT NAME	COUNTY /TRIBE
NCRP PROPOSITION 50		
City of Crescent City	Crescent City Wastewater Treatment Plant Renovation	Del Norte
California State Parks — North Coast Redwoods District	Head Hunter/Smoke House Non-point Sediment Reduction Project	Humboldt
City of Arcata Environmental Services Department	Arcata Storm Water Master Plan Elements	Humboldt
City of Arcata Environmental Services Department	Arcata Watershed Enhancement through I & I Reduction	Humboldt
City of Arcata Environmental Services Department	Jolly Giant Dam Retrofit	Humboldt
City of Blue Lake	Blue Lake Wastewater Treatment Plant	Humboldt
City of Eureka	Eureka Inflow and Infiltration Reduction Project	Humboldt
City of Eureka	Mad River Pipeline Improvements	Humboldt
City of Eureka	Martin Slough Interceptor Project	Humboldt
City of Ferndale	Ferndale Drainage Improvements	Humboldt
City of Ferndale	Ferndale Infiltration & Inflow Reduction	Humboldt
City of Ferndale	Ferndale Wastewater Treatment Plant Improvements	Humboldt
City of Rio Dell	Sludge Disposal and Handling Improvement Project	Humboldt
City of Rio Dell	Stormwater Master Plan	Humboldt
City of Rio Dell	Valve and Fire Hydrant Replacement Project	Humboldt
City of Rio Dell	Wastewater Disposal Project	Humboldt
City of Rio Dell	Wastewater Master Plan and Inflow and Infiltration Study	Humboldt
City of Rio Dell	Water Treatment System Improvements	Humboldt
City of Trinidad	Water Storage improvement Project	Humboldt
Fieldbrook Community Services District	Water Storage improvement Project	Humboldt
Garberville Sanitary District (Garberville Water Company)	Garbervillle Water Supply Reliability Project	Humboldt
Garberville Sanitary District (Garberville Water Company)	Wastewater Treatment Plant Improvements	Humboldt
Gasquet Community Services District	Gasquet Community Services District Water System Upgrade	Humboldt
Hoopa Valley Tribal Protection Agency	Klamath-Trinity Water Quality and Water Supply Database and	Hoopa Valley Tribe
Humboldt Bay Municipal Water District	Ranney Collectors Rehabilitation/Upgrade	Humboldt
Humboldt Bay Municipal Water District	Samoa Peninsula Pipeline Replacements	Humboldt
Humboldt Bay Municipal Water District	Water Supply Interties	Humboldt
Humboldt Community Services District	CR Transmission Main	Humboldt
Humboldt Community Services District	Steel Water Main Replacement	Humboldt
Humboldt County Department of Agriculture	BMP for Control of Invasive Plants in Northcoast Watersheds	Humboldt
Humboldt County Resource Conservation District	Eel River Cooperative Sediment Reduction Program	Humboldt

PROJECT SPONSOR	PROJECT NAME	COUNTY /TRIBE
NCRP PROPOSITION 50		
Humboldt County Resource Conservation District	Mid Van Duzen River Ranch Road Sediment Reduction Program	Humboldt
Humboldt County Resource Conservation District	Salt River Restoration Project	Humboldt
Hydesville County Water District	Infrastructure Upgrade	Humboldt
Loleta Community Services District	Loleta I&I	Humboldt
Loleta Community Services District	Water Supply	Humboldt
McKinleyville Community Services District	Sewer Main Construction	Humboldt
Orick Community Services District	Orick Community Services District Wastewater Treatment Sys.	Humboldt
Pacific Coast Fish, Wildlife and Wetlands Restoration Association	Redwood Creek Erosion Control	Humboldt
Redwood Community Action Agency	Humboldt Bay Water Quality Improvement Program	Humboldt
Redwood Community Action Agency	Humboldt Bay Watershed Plan Implementation	Humboldt
Redwood Community Action Agency	KRIS Humboldt Bay	Humboldt
Redwood Community Action Agency	KRIS Mad River	Humboldt
Redwood Community Action Agency	Luffenholtz Creek Barrier Modification Designs and Sediment	Humboldt
Westhaven Community Services District	Water Storage Improvement Project	Humboldt
Willow Creek Community Services District	Hwy 96 Stormceptor	Humboldt
Willow Creek Community Services District	Water Filtration Plant	Humboldt
North Coast Regional Land Trust	Six Rivers to the Sea	Humboldt County
Mattole Restoration Council	Mattole Integrated Water Management Program	Humboldt, Mendocino
Mendocino National Forest	Soda Creek Riparian Improvement	Lake
The Conservation Fund	Big River/Salmon Creek Watershed Restoration Project	Marin
Bioengineering Institute	Ten Mile Creek Watershed Outreach and Organizing Project	Mendocino
Bioengineering Institute	Walker Creek Restoration Project	Mendocino
California State Parks Mendocino District	Big River Focused Landform and Habitat Restorations	Mendocino
City of Ukiah	Inflow and Infiltration Reduction Project	Mendocino
City of Ukiah	Reclaimed Water System	Mendocino
City of Ukiah	Wastewater Secondary Treatment Upgrade	Mendocino
City of Ukiah	Water Treatment Plant Improvement Project	Mendocino
City of Willits	Willits Wastewater Treatment/ Water Reclamation Project	Mendocino
Covelo CSD (Community Services District)	Covelo Wastewater Facilities Improvement Project	Mendocino
E Center, Mendocino Fisheries Program	Hollow Tree Road Improvement Project	Mendocino
Mendocino County RCD	Navarro Watershed Road Sediment Reduction Project	Mendocino
Mendocino County Resource Conservation District	Navarro Watershed Upslope Road Inventory Project	Mendocino
Mendocino County Resource Conservation District	Upper Rancheria Creek Riparian Enhancement Project	Mendocino
Mendocino County Water Agency	Eel River Basin KRIS database	Mendocino
Mendocino County Water Agency	Mendocino County Water Quality/Supply Database (KRIS)	Mendocino
Mendocino County Water Agency	Russian River Basin KRIS Database	Mendocino
Mendocino County Water Agency	U. S. Army Corps Coyote Valley Dam Feasibility Study	Mendocino
Mendocino County	Development of Mendocino County Grading Ordinance	Mendocino
Russian River Unlimited	2005 River Clean-up and River Education in Schools	Mendocino
Westport County Water District	Wages Creek Source Water Protection	Mendocino
Westport County Water District	Water Supply Reliability Project	Mendocino
Mendocino County RCD	Garcia Effectiveness Monitoring	Mendocino
Mendocino County RCD	Sinkyone Road Restoration Project	Mendocino
Mendocino County Resource Conservation District	BMPs for Invasive Plant Control in Coastal Watersheds	Mendocino County
Mendocino County Resource Conservation District	Robinson Creek Restoration Demonstration Project	Mendocino County
Modoc County	Newell Water System Renovation	Modoc
Siskiyou County	Siskiyou Co. Integrated Water Mgt/Coho Recovery Project	Siskiyou
California Department of Forestry	California Forest Improvement Program	Sonoma
California Department of Forestry	Sensitive Watershed Monitoring and Mapping Resource	Sonoma
California Land Stewardship Institue	Fish Friendly Farming Environmental Certification Program	Sonoma
California Land Stewardship Institue	Sediment Reduction and Habitat Improvements — 4 RRiver tribs	Sonoma
City of Cotati	Low Water Use Demonstration Program	Sonoma
City of Rohnert Park	Rohnert Park/Cotati Urban Recycled Water System Expansion	Sonoma
City of Santa Rosa	Citywide Creek Master Plan	Sonoma
City of Santa Rosa	Colgan Creek Restoration	Sonoma
City of Santa Rosa	Development of Standby Water Supply Wells	Sonoma

PROJECT SPONSOR	PROJECT NAME	COUNTY /TRIBE
NCRP PROPOSITION 50		
City of Santa Rosa	Prince Memorial Greenway Pierson Reach Restoration	Sonoma
City of Santa Rosa	Santa Rosa Creek B Street Outfall Retrofit Project	Sonoma
City of Santa Rosa	Sonoma County Water Recycling and Habitat Preservation Proj	Sonoma
City of Sebastopol	Sebastopol MWS Groundwater Management Program	Sonoma
Community Clean Water Institute	Humboldt Bay Regional Water Quality Monitoring Project	Sonoma
Community Clean Water Institute	Middle Reach Russian River Citizen Monitoring Project	Sonoma
Gold Ridge Resource Conservation District	Dutch Bill Creek Coho Habitat Enhancement	Sonoma
Gold Ridge Resource Conservation District	Laguna de Santa Rosa Restoration Program	Sonoma
Gold Ridge Resource Conservation District	Salmon Creek Watershed Assessment and Implementation	Sonoma
Graton Community Service District	Graton Wastewater Treatment Upgrade and Reclamation Project	Sonoma
Gualala River Watershed Council	Lower Fuller Creek Sediment Source Implementation Plan	Sonoma
Institute for Fisheries Resources	Networked Watershed Library for the North Coast Region	Sonoma
Laguna de Santa Rosa Foundation	Laguna de Santa Rosa Cotati Reach Restoration	Sonoma
Laguna de Santa Rosa Foundation	Laguna de Santa Rosa Riparian and Wetland Restoration	Sonoma
LandPaths	Dam Failure Prevention & Sediment Reduction Santa Rosa Creek	Sonoma
Occidental Arts and Ecology Center's WATER Institute	Dutch Bill Watershed Literacy Project: No Coho Left Behind	Sonoma
Occidental County Sanitation District	Camp Meeker-Occidental Joint Wastewater Reclamation Project	Sonoma
Sebastopol Water Information Group (SWiG)	Groundwater Studies in the Sebastopol Area	Sonoma
Sonoma County Regional Parks	Cloverdale River Park, Russian River Bank Restoration	Sonoma
Sonoma County Regional Parks	Shiloh Ranch & Foothill Regional Parks Erosion Prevention	Sonoma
Sonoma County Regional Parks	Storm Water System and Natural Resource Inventory	Sonoma
Sonoma County Water Agency	Cook Creek Restoration Project	Sonoma
Sonoma County	Monte Rio Community Wastewater Project	Sonoma
Sotoyome Resource Conservation District	Russian River Arundo Removal and Habitat Restoration Project	Sonoma
Town of Windsor	Sonoma County Airport Area Recycled Water Irrigation-Phase 1	Sonoma
Sonoma County	Implementing an Effective Storm Water Management Program	Sonoma
Gualala River Watershed Council	Sediment Solutions for the Gualala: Phase III	Sonoma and Mendocino
North Coast Resource Conservation & Development Council	Rural Municipal Service Provider Techincal Assistance Progrm	Sonoma /Marin / Mendocino /Lake
The Watershed Research and Training Center	Hayfork Forest Health Phase II	Trinity
Trinity County Resource Conservation District	East Branch Irrigation Ditch Piping Project	Trinity
Trinity County Waterworks District #1	Raw & Recovered Water for Irrigating Public Agencies	Trinity
Trinity County	Trinity Drinking Water Source Sediment Reduction Project	Trinity
Weaverville Community Services District	East Weaver Creek Booster Pump Station	Trinity
Weaverville Sanitary District	Weaverville Sanitary District Water Reclamation Project	Trinity
Trinity County Resource Conservation District	Reading Creek Water Conservation Project	Trinity

PROJECT SPONSOR	PROJECT NAME	COUNTY /TRIBE
NCRP PROPOSITION 84 ROUND 1		
California Land Stewardship Institute	Russian River Watershed Agricultural Water Conservation and Water Supply Reliability Program	Mendocino and Sonoma
California Land Stewardship Institute	Fish Friendly Farming Environmental Certification Program, Mendocino and Sonoma Counties	Mendocino and Sonoma
City of Blue Lake	Powers Creek Fish Passage Enhancement Project	Humboldt
City of Fort Bragg	Waterfall Gulch Transmission Main	Mendocino
City of Fortuna	Rohner Creek Flood Control and Salmonid Habitat Improvement Project	Humboldt
City of Montague	Lift Station Upgrade	Siskiyou
City of Rio Dell	Rio Dell Stormwater Control Flood Reduction Project	Humboldt
City of Rohnert Park	Rohnert Park Creek Master Plan	Sonoma
City of Rohnert Park	Rohnert Park Urban Reuse Expansion Project	Sonoma
City of Santa Rosa	Trash Exclusion	Sonoma
City of Santa Rosa	North Coast Regional Indoor Water Efficiency Program	Potentially all in region
City of Santa Rosa	Russian River Regional Cash for Grass Program	Mendocino and Sonoma
City of Santa Rosa — Utilities Department	Santa Rosa Plain Subbasin Salt and Nutrient Management Plan	Sonoma
City of Santa Rosa — Utilities Department	Sonoma County Water Recycling and Habitat Preservation Project	Sonoma

PROJECT SPONSOR	PROJECT NAME	COUNTY /TRIBE
NCRP PROPOSITION 84 ROUND 1		
City of Trinidad	Trinidad Westhaven Coastal Water Quality Restoration Program / OWTS Emphasis	Humboldt
City of Tulelake	Tulelake Wastewater Project	Siskiyou
City of Ukiah	City of Ukiah Recycled Water Plan	Mendocino
Colgan Creek Restoration Project	City of Santa Rosa	Sonoma
Del Norte Resource Conservation District	Real-Time Weather Data for Irrigation Water Management	Del Norte
Del Norte Resource Conservation District	Del Norte Agricultural Enhancement Program	Del Norte
Freshwater Conservation Trust	Instream Water Dedications	Potentially all in region
Gold Ridge RCD	Bodega Bay HU Water Resources Management Project	Sonoma
Gualala River Watershed Council	Gualala River Sediment Reduction Program	Mendocino and Sonoma
Gualala River Watershed Council	Gualala River Wood In the Stream Program	Mendocino and Sonoma
Happy Camp Community Services District (CSD)	Water Treatment System Upgrade	Siskiyou
Happy Camp Sanitary District	Indian Creek Sewer Pipeline Crossing	Siskiyou
Hopland Band of Pomo Indians	Nissa-kah Creek Fish Passage at Nokomis Road	Mendocino Tribal
Hopland Band of Pomo Indians	Nissa-kah Creek Fish Passage at Hwy 175	Mendocino Tribal
Hopland Band of Pomo Indians	Russian River Tribal Watershed Group — Non-profit organization	Mendocino, Sonoma and Lake
Humboldt Bay Municipal Water District	Ranney Collector 3 Lateral Replacement	Humboldt
Humboldt Bay Municipal Water District	Ranney Collectors 1, 2, & 4 Lateral Replacement	Humboldt
Humboldt Bay Municipal Water District	15-inch Somoa Peninsula Pipeline Replacement	Humboldt
Humboldt Bay Municipal Water District	HBMWD-Blue Lake Fieldbrook Pipeline Support Retrofit	Humboldt
Humboldt Bay Municipal Water District	Ruth Hydro Plant Generator & Turbine Replacement	Trinity
Karuk Tribe	Camp Creek Habitat Protection-Road Decommissioning Implementation Project	Humboldt, Siskiyou Tribal
Mattole Restoration Council	Mattole Integrated Watershed Management Initiative	Humboldt, Mendocino
McKinleyville Community Services District	Murray Road Water Supply Tank and Piping	Humboldt
McKinleyville Community Services District	Water Meter Replacement and Upgrade	Humboldt
McKinleyville Community Services District	Critical Emergency Drinking Water Supply Wells and Piping	Humboldt
McKinleyville Community Services District	Waste Water Management Facility Treatment System Improvements	Humboldt
McKinleyville Community Services District	Solar Pilot Project	Humboldt
McKinleyville Community Services District	Regional Intertie for Emergency Drinking Water Supply and Water Reliability	Humboldt
Mendocino County RCD	Mendocino Headwaters Integrated Water Quality Enhancement Project	Mendocino
Mendocino County Water Agency	Mendocino County Stormwater Retrofit, Water Conservation and Rainwater Capture Project	Mendocino
Mendocino County Water Agency	Mendocino Jumpstart Integrated Water Plan	Mendocino
Occidental County Sanitation District	Wastewater Reclamation and Storage Project	Sonoma
Pinoleville Pomo Nation	Ackerman Creek Habitat Restoration	Mendocino Tribal
Redwood Community Action Agency, Natural Resources Services Division	The North Coast Stormwater Coalition's Non-Point Source Pollution Prevention Program	Humboldt, Mendocino
Redwood Forest Foundation Inc. (RFFI)	Sustainable Forests, Clean Water & Carbon Sequestration Demonstration Project, Redwood Forest Foundation Inc.	Mendocino
Russian River Watershed Association (RRWA)	Russian River Friendly Landscapes (RRFL) and Low Impact Development (LID) Demonstration Project	Mendocino and Sonoma
School of Performing Arts and Cultural Education (SPACE)	SPACE Theater Water Efficiency Project	Mendocino
Siskiyou County	Septage Receiving Pond Closure	Siskiyou
Siskiyou County	Siskiyou County Septage Receiving Facility	Siskiyou
Smith River Community Services District	Smith River Community Services District Infrastructure Improvement Plan — Phase 1 Back-up Power System	Del Norte
Sonoma County Water Agency	The Copeland Creek Watershed Detention/Recharge, Habitat Restoration, and Steelhead Refugia Project	Sonoma
Sotoyome Resource Conservation District	Russian River Arundo donax Removal and Riparian Enhancement Program	Sonoma
Sotoyome Resource Conservation District	Lower Russian River Water Quality Improvement Project	Sonoma
Town of Windsor	Windsor Groundwater Exploration Project	Sonoma
Town of Windsor	Esposti Park Well Connection Project	Sonoma
Willow Creek Community Services District	Hwy 96 Stormceptor	Humboldt

PROJECT SPONSOR	PROJECT NAME	COUNTY /TRIBE
NCRP PROPOSITION 84 ROUND 2		
Big Rock Community Services District	Big Rock CSD Stabilize Water Storage Tank	Del Norte
County of Del Norte	Waste Water Lift Station Replacement	Del Norte
Smith River Community Services District	Smith River Community Services District Infrastructure Improvement Project	Del Norte
California State Parks	Benbow Dam Removal	Humboldt
California Trout	Elk River Recovery Assessment and Pilot Implementation Projects	Humboldt
Humboldt Bay Municipal Water District	Ranney Collectors 1 & 1A Lateral Replacement	Humboldt
Humboldt County Resource Conservation District	Humboldt Bay Nutrient Management Program	Humboldt
Mattole Restoration Council	Mattole Watershed Integrated Climate Adaptation Initiative	Humboldt
McKinleyville Community Services District	Mad River Estuary Enhancement	Humboldt
McKinleyville Community Services District	McKinleyville CSD Radio-Read Water Meter Upgrade	Humboldt
McKinleyville Community Services District	McKinleyville CSD Water Reliability Development	Humboldt
Redwood Community Action Agency	Martin Slough Enhancement Project	Humboldt
Resort Improvement District #1	Teleraph Creek Barrier Removal and Channel Restoration	Humboldt
City of Trinidad	Trinidad-Westhaven Coastal Water Quality Restoration Program	Humboldt
Westhaven Community Services District	Westhaven CSD Water Tank	Humboldt
California Land Stewardship Institute	Fish Friendly Farming and Fish Friendly Ranching Environmental Certification in the Russian, Navarro, and Gualala River Watersheds	Mendocino/ Sonoma
California Land Stewardship Institute	Russian River Watershed Agricultural Water Conservation and Water Supply Reliability Program	Mendocino/ Sonoma
Gualala River Watershed Council	Gualala River Watershed Management and Enhancement	Mendocino/ Sonoma
Jug Handle Creek Farm and Nature Center	Jug Handle Creek Farm and Nature Center Ecological Enhancement Project	Mendocino
Mendocino County Resource Conservation District	Mendocino County Working Landscapes Riparian Demonstration Project	Mendocino
Siskiyou County	Siskiyou County Septage Pond Closure	Siskiyou
Gualala River Watershed Council	Gualala River Sediment Reduction Program	Mendocino/ Sonoma
Gold Ridge Resource Conservation District	Gold Ridge Coastal Watersheds Enhancement Project	Sonoma
Laguna de Santa Rosa Foundation	Restoring Sebastopol Railroad Forest	Sonoma
Occidental County Sanitation District/ SCWA	Occidental Recycled Water and Restoration Project	Sonoma
Russian River Watershed Association	Russian River Watershed Urban Creek Care Program	Sonoma
City of Santa Rosa	Santa Rosa Plain Groundwater Monitoring Well Installation and Data Analysis	Sonoma
City of Santa Rosa	Santa Rosa's Russian River Friendly Landscapes and Low Impact Development Project	Sonoma
City of Sebastopol Public Works	Arsenic Removal Pilot Project for Well 6	Sonoma
City of Sebastopol Public Works	Arsenic Treatment Implementation for Well 6	Sonoma
Sonoma County Water Agency	Regional Water Use Efficiency Program	Sonoma
Sotoyome Resource Conservation District	Austin Creek Watershed Restoration Program	Sonoma
Sotoyome Resource Conservation District	LandSmart Laguna: Achieving TMDL Compliance and Ag Water Quality Improvements in the Laguna de Santa Rosa Watershed	Sonoma
Town of Windsor	Windsor Groundwater Banking Pilot Demonstration Project	Sonoma
Salyer Mutual Water Company	Larger capacity storage tanks, dedicated main line, meters/master meter	Trinity
Trinity County Resource Conservation District	West Weaver Creek — Channel and Floodplain Rehabilitation	Trinity
Weaverville Community Services District	East Weaver Treatment Plant Improvement Project	Trinity
Weaverville Sanitary District	Weaverville Sanitary District Water Reclamation Project	Trinity
Karuk Tribe	Lower Mid-Klamath Habitat Protection-Road Decommissioning Implementation Project	Karuk Tribe
Yurok Tribe — Yurok Tribal Fisheries Program (YTFP)	Restoration of Lower Klamath River Habitats	Yurok Tribe
Rural Community Assistance Corporation	DAC/ Tribal DAC Implementation Circuit Rider	North Coast region

PROJECT SPONSOR	PROJECT NAME	COUNTY / TRIBE
NCRP PROPOSITION 2014 DROUGHT ROUND		
California Land Stewardship Institute	Agricultural Water Conservation and Water Supply Reliability Program	Sonoma Mendocino
Sonoma Resource Conservation District	Agricultural Water Conservation Rebate Program	Sonoma
Gold Ridge Resource Conservation District	Rural Water Conservation and Drought Preparedness Project	Sonoma
Kelly Mutual Water Company	New Well	Sonoma
Town of Windsor	Off-River Water Supply Program — Esposti Well Project	Sonoma
Yulupa Mutual Water Company	Water Meter Project 2014	Sonoma
Clear Creek Water Company	Repair and Increased Efficiency of Water System	Sonoma
Sonoma County Water Agency	Sonoma-Mendocino Immediate Drought Relief Project	Sonoma Mendocino
Gualala River Watershed Council	The Flow Bank — Protecting Stream Flow in the Gualala River	Sonoma Mendocino
12th District Agricultural Association	Redwood Empire Water Supply Improvement and Conservation Project	Mendocino
City of Ukiah	Ukiah Valley — Redwood Valley Water Supply Reliability Project	Mendocino

PROJECT SPONSOR	PROJECT NAME	COUNTY / TRIBE
Mendocino County Resource Conservation District	Implementing On-Farm Water Conservation Strategies	Mendocino
City of Fort Bragg	Summers Lane Reservoir Project	Mendocino
Resort Improvement District No. 1	Telegraph Creek Drinking Water Diversion Habitat Protection Project	Humboldt
Westhaven Community Services District	Water Loss Reduction Project	Humboldt
Sanctuary Forest Inc.	Mattole Flow Program: Storage and Forbearance	Humboldt
City of Rio Dell	Rio Dell Metropolitan Well Project	Humboldt
City of Crescent City	Elevated Water Tank Rehabilitation	Del Norte
Yurok Tribe	Weitchpec Water Station	Yurok Tribe
Newell County Water District	Newell Well Deepening Project	Modoc
Weaverville Community Services District	Meter Reading Upgrade	Trinity
Lewiston Park Mutual Water Company	Meter Installation	Trinity
Rush Creek Mutual Water Company	Drought Relief Assistance	Trinity

PROJECT SPONSOR	PROJECT NAME	COUNTY / TRIBE
NCRP PROPOSITION 84 2015		
Alderpoint County Water District	Alderpoint Capacity Study	Humboldt
Bear River Band of the Rohnerville Rancheria	Bear River Band of The Rohnerville Rancheria Reclaimed Water Project	Tribal
Brooktrails Township Community Services District	Tank #3 Replacement	Mendocino
California Trout, Inc	Elk River Sediment Remediation Pilot Implementation Projects	Humboldt
Caspar Community	Caspar Water Project	Mendocino
City of Arcata, Environmental Division	City of Arcata Discharge Permit Compliance and Energy Conservation Project	Humboldt
City of Blue Lake	Blue Lake Water Supply Protection and Creek Restoration Project	Humboldt
City of Dorris	Dorris Water Storage Tank	Siskiyou
City of Ferndale	City of Ferndale Flood Management Plan	Humboldt
City of Santa Rosa	Lower Colgan Creek Restoration — Phase 2	Sonoma
City of Ukiah	Ukiah Valley and Russian River Water Supply Reliability Project	Mendocino
City of Weed	Boles Fire Water System Rehabilitation/Water System Restoration	Siskiyou
City of Willits	Emergency Groundwater Supply Project	Mendocino
City of Willits	Permanent Groundwater Supply Project	Mendocino
Del Norte County	County Service Area # 1 and Crescent City Lift Station Rehabilitation	Del Norte
Fieldbrook Glendale Community Services District (FGCSD)	FGCSD Water Storage Improvement Project	Humboldt
Gold Ridge Resource Conservation District	Working Landscapes Drought Resiliency Project	Sonoma
Gualala River Watershed Council	Flow Bank Program — Phase II	Sonoma / Mendocino
Happy Camp Community Services District	Happy Camp Water System Upgrades — Phase 1	Siskiyou
Hoopa Valley Tribe	Hoopa Valley Public Utility District Conservation Project	Tribal — Central District
Hoopa Valley Tribe	Lower Supply Flood Risk Reduction and Fisheries Habitat Improvement Project	Tribal — Central District
Hopland Band of Pomo Indians	Hopland Band of Pomo Indians Community Test Wells and Water Security Study	Tribal — Southern District
Huckleberry Mutual Water Company	Huckleberry Mutual Water Company Disinfection, Storage, Distribution and Intertie Planning and Execution	Sonoma
Humboldt Bay Harbor, Recreation and Conservation District	Humboldt Bay Spartina Control	Humboldt
Humboldt Bay Municipal Water District (HBMWD)	Ranney Collector 2 Rehabilitation Project	Humboldt
Humboldt Community Services District	Ridgewood Water Reliability Improvement Project	Humboldt
Humboldt County Resource Conservation District (HCRCD)	Restoring Stream Flow and Fish Passage on the Eel River Delta	Humboldt
Lewiston Community Services District (LCSD)	Lewiston Community Services District Wastewater Collection, Treatment, and Disposal Project	Trinity
Lewiston Park Mutual Water Company (LPMWC)	Lewiston Valley Drinking Water Intertie Pipeline	Trinity
Mattole Restoration Council	Lower Mattole River and Estuary Enhancement and Drought Resiliency Project	Humboldt
Mendocino Coast Botanical Gardens	Mendocino Coast Botanical Gardens Water Infrastructure Project	Mendocino
Mendocino County Resource Conservation District	Implementing On-Farm Water Conservation Projects in the Navarro to Address Critical Low Flows	Mendocino
Mendocino County Resource Conservation District	Water Conservation Technical Assistance to Mendocino County Tribes	Mendocino
Mid Klamath Watershed Council	Horse Creek Wood Loading, Floodplain Relief and Groundwater Recharge Project: Phase III	Siskiyou
Mid Klamath Watershed Council (MKWC)	Mid Klamath Tributary Thermal Refugia Improvement and Groundwater Recharge Project	Siskiyou
Montague Water Conservation District	Montague Water Conservation District- Instream Flow Enhancement through Water Conservation	Siskiyou

PROJECT SPONSOR	PROJECT NAME	COUNTY / TRIBE
NCRP PROPOSITION 84 2015		
Northern California Resource Center	Scott River Water Yield Enhancement	Siskiyou
Northwest CA Resource Conservation & Development Council	Trinity River Water Reliability and Drought Resiliency Project	Trinity
Palmer Creek Community Service District	Palmer Creek Water System Reliability Project	Humboldt
Redwood Community Action Agency	Martin Slough Enhancement Project	Humboldt
Rural Communities Housing Development Corporation (RCHDC)	Landscape & Irrigation Water Conservation for Low Income Senior and Multi-Family Housing Complexes	Mendocino
Russian Riverkeeper	Scarlet Wisteria (Sesbania punicea) Invasive Plant Removal Project	Sonoma / Mendocino
Salmon River Restoration Council	Taylor Creek In-Stream Barrier Removal	Siskiyou
Sanctuary Forest Inc.	Mattole Flow Program: Mainstem & Tributary Storage and Forbearance	Humboldt
Shasta Valley Resource Conservation District	Shasta River Drought Response and Irrigation Efficiency Project	Siskiyou
Resort Improvement District No.1 (RID)	Shelter Cove Water Recycling Project	Humboldt
Sonoma County Water Agency	Northern Sonoma County Water Conservation Program	Sonoma
Sonoma Resource Conservation District	Russian River Coho Drought Resiliency Planning and Implementation Program	Sonoma
Trinidad Rancheria	Trinidad Harbor ASBS Discharge Elimination Project	Tribal — Northern District
Trinity County Waterworks Dist #1	TCWW Filter Plant Compliance Project	Trinity
Watershed Research and Training Center (WRTC)	South Fork Trinity River (SFTR) — Spring Run Chinook Salmon Restoration Project	Trinity
Weaverville Sanitary District	Weaverville Sanitary District Wastewater Reclamation Project	Trinity
Weott Community Services District	Additional Water Storage	Humboldt
Westhaven Community Services District	Water Storage Tank and Roof Replacement Project	Humboldt
Westside Community Improvement Association	Jefferson Community Park and Urban Farm Sustainable Irrigation Project	Humboldt
Willow County Water District	Willow County Water Security Project	Mendocino
Yurok Tribe	Yurok Watershed Restoration and Drinking Water Security	Tribal — Northern District

PROJECT SPONSOR	PROJECT NAME	COUNTY / TRIBE
NCRP PROPOSITION 1 2019 IRWM IMPLEMENTATION PROJECTS		
12th District Agricultural Association	Drought Response and Water Efficiency Project	Mendocino
Blue Lake Rancheria	Water Storage Project	Tribal
Briceland Community Services District	Water Supply Enhancement Project	Humboldt
California Trout	Scott River Valley Managed Aquifer Recharge	Siskiyou
Conservation Biology Institute	Fire Risk Reduction Decision Support for the Russian River Watershed	Sonoma /Mendocino
Covelo Community Services District	Collection System and Wastewater Treatment Plant Improvements	Mendocino
County Service Area No. 1	Onsite Emergency Power Supply for Sanitary Sewer Lift Stations	Del Norte
City of Dorris	Water System Infrastructure Project	Siskiyou
Eel River Watershed Improvement Group	Cuneo Creek Riparian Restoration Project	Humboldt
Eel River Watershed Improvement Group	Kenny Creek Instream Habitat Enhancement Project	Mendocino
City of Eureka	Storm Water Management and Sea Level Rise Resiliency Project	Humboldt
City of Ferndale	California Street Sewer Replacement	Humboldt
Fieldbrook Glendale Community Services District	Water Tank Seismic Retrofit Project	Humboldt
City of Fort Bragg	Pudding Creek Water Main Relocation	Mendocino
City of Fort Bragg	Storm Water Trash Capture Devices	Mendocino
Gold Ridge Resource Conservation District	Rainwater Catchment Rebate and Streamflow Enhancement Pilot Project	Sonoma
Humboldt Bay Municipal Water District	Ranney Collector 2 Rehabilitation Project	Humboldt
Lewiston Community Services District	Water Distribution System Replacement Project	Trinity
Mattole Restoration Council	Carbon Sequest Lower Mattole River and Estuary Enhancement Project Phase II	Humboldt
Mendocino Woodlands Camp Association	Mendocino Woodlands State Park Sediment Reduction Project	Mendocino
County of Mendocino	Mendocino County Coastal MS4 Area Trash Capture Devices	Mendocino
Mendocino County Resource Conservation District	Forsythe Creek Floodplain and Riparian Restoration Project	Mendocino
Newell County Water District	Water System Improvements Project	Modoc
Pacific Reefs Water District	Water Tank Replacement Project	Mendocino
Round Valley County Water District	Upper Grist Creek Watershed Restoration Plan	Mendocino
Sanctuary Forest Inc.	Drought and Emergency Water Project	Humboldt
Scotia Community Service District	Emergency Power Generator Project	Humboldt
Scott River Watershed Council	Scott River Headwaters Forest Health, Fire Safety, and Water Quality Improvement Project	Siskiyou
Smith River Community Services District	Water System Emergency Generator Project	Del Norte
Treasure Creek Woods Mutual Water Company	Water Storage and Distribution System Improvement Project	Trinity

PROJECT SPONSOR	PROJECT NAME	COUNTY / TRIBE
NCRP PROPOSITION 1 2019 IRWM IMPLEMENTATION PROJECTS		
City of Trinidad	Trinidad-Westhaven Community Water Reliability, Security and Enhancement Project	Humboldt
Weaverville Sanitary District	Sewer Improvements Project	Trinity
City of Willits	Improving Willits Water Supply Reliability and Drought Resiliency with Groundwater and Conjunctive Use	Mendocino
Watershed Research and Training Center	South Fork Trinity River — Spring Run Chinook Salmon Restoration Project — Phase II	Trinity
Yurok Tribe	Upgrading Critical Infrastructure to Support Resource Recovery in the Blue Creek Sanctuary	Humboldt / Yurok
City of Weed	Automated Meter Reading Project	Siskiyou

PROJECT SPONSOR	PROJECT NAME	COUNTY / TRIBE
PROPOSITION 1E IRWM STORMWATER FLOOD MANAGEMENT		
City of Fortuna	Rohner Creek Flood Control and Riparian Habitat Restoration Project	Humboldt
The Rohner Creek Flood Control and Riparian Habitat Improvement Project is a watershed-based, channel corridor-scale project with multiple objectives and benefits including habitat restoration and enhancement, water quality improvement and flood alleviation. The project is intended to provide immediate and substantial improvements to channel corridor function, reduce the frequency of flood related property damage and improve riparian habitat along a 1-mile stretch of creek which runs through the center of the City of Fortuna.		
Sonoma County Water Agency	Copeland Creek Enhancement and Restoration Project: Detention and Recharge Basins Project	Sonoma
The Project will provide habitat enhancement and restoration and sediment removal from Copeland Creek which will improve storm water management, surface water quality, the quantity and quality of habitat available for native wildlife, and enhance stream conditions to support fisheries. It also includes construction of storm water detention/groundwater recharge basins sited to capture runoff from the Copeland Creek headwaters which would reduce the impacts of future 100 year floods upon the downstream properties and structures. The regional and local impacts of a 100 year flood have been determined to affect at least one — quarter of the downstream City of Rohnert Park including Sonoma State University, Rancho Cotati High School, businesses, residences, and adjoining City arterial roadways, such as Rohnert Park Expressway, Snyder Lane, and Commerce Boulevard.		
OTHER PROJECTS		
Shasta Valley Resource Conservation District	Groundwater Monitoring Implementation Program for the Shasta Valley GSA	Siskiyou
The purpose of this project is to provide technical assistance to the Groundwater Sustainability Agency (GSA) for the Shasta Valley Medium Priority Basin 1-004 (the Basin) and the Basin's public and private stakeholders, gather and submit pertinant data to the GSA to utilize in preparation of a Groundwater Sustainability Plan (GSP) to satisfy the requirements set forth by the 2014 Sustainable Groundwater Management Act (SGMA). This objective will be accomplished by establishing a groundwater and surface water monitoring network in the Basin that will establish baseline conditions in the Basin, and to assess the complex interactions between groundwater, surface water, and irrigation practices in the Shasta Valley. Data will be collected and analyzed in accordance with the Best Management Practices (BMPs) outlined by the Department of Water Resources (DWR). The data and analysis will be summarized and submitted to the Shasta Valley GSA for the purpose of informing an effective GSP.		

Table 61 California Energy Commission Funded Projects — 2010

In 2010 the NCRP was funded a California Energy Commission Energy Efficiency & Conservation Block Grant to address other challenges facing the region, including energy independence, greenhouse gas emissions reduction, and job creation.

PROJECT NAME	COST	PROJECT SUMMARY
COUNTY OF HUMBOLDT		
Agricultural Farm Bureau — Lighting Fixtures	$4,746	The proposed project will replace the 2 existing furnaces with two 240 kBTU/hour furnaces each with AFUE of 90%. After the proposed changes the furnaces will use 4,080 therms/year. Energy savings will be 1,785 therms/year. Savings will be $1,731/year with a simple payback of 8.3 years.
Agricultural Farm Bureau — Forced Air Furnace	$14,340	Energy and power savings will be 5,794 kWh/year and 2.3 kW. Savings will be $916/year with a simple payback of 5.2 years.
Airport Lighting	$4,434	The proposed project will replace 48 T12 fixtures with 48 T8's, 1 incandescent exit sign with 1 LED exit sign, and 5 incandescent flood lights with 5 CFL flood lights. After the proposed changes the lighting will use 17,995 kWh/year with peak usage of 14.5 kW. Energy and power savings will be 20,218 kWh/year and 2.8 kW. Savings will be $3,321/year with a simple payback of 1.3 years.
Animal Shelter Lighting	$10,233	The proposed project will replace existing T8's with higher efficiency T8's. After the proposed changes the lighting will use 17,034 kWh/year and with peak usage of 9.1 kW. Energy and power savings will be 3,835 kWh/year and 2.1 kW. Savings will be $527/year with a simple payback of 19.4 years.
Arcata Veterans Building — Forced Air Furnace	$6,943	The proposed project will replace the two existing furnaces with two 120 kBTU/hour furnaces each with AFUE of 95%. After the proposed changes the furnaces will use 707 therms/year. Energy savings will be 414 therms/year. Savings will be $401/year with a simple payback of 17.3 years.
Clark Complex Lighting Project	$2,056	The proposed project will replace 21 T12 fixtures with 21 T8's. After the proposed changes the lighting will use 808 kWh/year with peak usage of 1.5 kW. Energy and power savings will be 745 kWh/year and 1.2 kW. Savings will be $132/year with a simple payback of 15.6 years.
Courthouse Lighting	$16,193	The lighting system will be upgraded through a combination of occupancy sensors and fluorescent lighting retrofits. Most of the existing fluorescent fixtures will be retrofitted, not replaced. The existing lamps and ballasts will be removed and disposed of. The new T8 lamps and electronic ballasts will be installed in the existing fixture with minimal physical modification of the fixture. Occupancy sensors can replace existing switches. Based on the reduction in hours of operation and higher efficiency lamps and ballasts the energy and power savings, resulting from lighting retrofits, will be 45,649 kWh and 11.5 kW, respectively.

PROJECT NAME	COST	PROJECT SUMMARY
Courthouse Parking Exhaust Fan	$5,760	EEM-1: Install Demand-Controlled Ventilation System in Courthouse Garage. The proposed project will add Carbon Monoxide (CO) sensors to control the operation of two ventilation fans in the courthouse parking facility. These two fans currently run continuously, 8,760 hours per year. After the retrofit the fans will each run approximately 3432 hours per year. After the proposed changes the two fans will use 15,191 kWh per year. Energy savings will be 23,583 kWh/year. Savings will be $2,731/year with a simple payback of 2.1 years.
Courthouse – Replace CV with VAV	$482,752	EEM-4: Replace Constant Volume Systems with Variable-Air-Volume Systems at the Courthouse
Courthouse – Efficient Motor Replacement	$67,901	EEM-5: Replace Old Low Efficiency Motors with Premium Efficiency Motors in the Jail and Courthouse
Environmental Health Lighting	$1,066	The proposed project will replace 18 T12 fixtures with 18 T8's. This retrofit will effectively increase the efficacy (lumens/watt) of the lighting system, while maintaining current lighting levels. Typically, upgrading to third generation T8 lamps with electronic ballasts will also increase the quality of the light primarily through higher color rendering and significant reduction of flicker normally associated with older fluorescent lighting systems. After the proposed changes the lighting will use 976 kWh/year with peak usage of 0.9 kW. Energy and power savings will be 813 kWh/year and 0.7 kW. Savings will be $144/year with a simple payback of 7.4 years.
Eureka Veterans Hall Lighting	$4,913	The proposed project will also replace 42 T12 fixtures with 42 T8's, 17 incandescent exit sign with 17 LED exit signs, and 31 incandescent flood lights with 31 CFL flood lights. After the proposed changes the lighting will use 3,227 kWh/year with peak usage of 3.1 kW. Energy and power savings will be 7,647 kWh/year and 5.4 kW. Savings will be $1,347/year with a simple payback of 3.6 years.
Fortuna Veterans Hall – Furnace	3,784	The proposed project will replace the existing furnace with a 150 kBTU/hour furnace with AFUE of 95%. After the proposed changes the furnace will use 1,436 therms/year. The proposed project will replace an existing blower with a 95% efficient blower. After the proposed change the blower will use 419 kWh/year with peak usage of 0.46 kW.
Repair Garage Lighting	$18,229	The proposed project will add an occupancy sensor to one CFL fixture, replace 26 metal halide fixtures with 26 T8 fixtures, replace 77 T12 fixtures with 77 T8's, add occupancy sensors to 42 T8 fixtures and delamp four T8 fixtures from four lamps to two lamps. After the proposed changes the lighting will use 38,681 kWh/year with peak usage of 17.2 kW. Energy and power savings will be 31,486 kWh/year and 11.7 kW. Savings will be $5,555/year with a simple payback of 3.3 years.
Garberville Veterans Building – Forced Air Furnace	$33,401	The proposed project will replace the 3 existing furnaces with two 90 kBTU/hour furnaces each with AFUE of 95%. After the proposed changes the furnaces will use 479 gallons/year. Propane savings will be 262 gallons/year. Savings will be $609/year. The proposed project will replace the 3 existing air conditioners with two air conditioners with capacities of 60 kBTU/hour and 48 kBTU/hours respectively each with SEER of 15. After the proposed changes the air conditioners will use 2,160 kWh/year. Electricity savings will be 720 kWh/year. Savings will be $130/year. Simple payback for the overall project will be 45.2 years.
IT Building Lighting	$4,287	The proposed project will replace 61 T8 fixtures with 61 higher-efficiency T8's, add an occupancy sensor to one fixture, replace 5 incandescent flood lights with 5 CFL flood lights, replace 10 T12 fixtures with 10 T8 fixtures. After the proposed changes the lighting will use 6,769 kWh/year with peak usage of 3.6 kW. Energy and power savings will be 3,014 kWh/year and 1.4 kW. Savings will be $414/year with a simple payback of 10.4 years.
Jail Lighting	$20,681	The lighting system will be upgraded through a combination of exit sign replacements and fluorescent lighting retrofits. The existing fluorescent fixtures will be retrofitted, not replaced. The existing lamps and ballasts will be removed and disposed of. The new T8 lamps and electronic ballasts will be installed in the existing fixture with minimal physical modification of the fixture. Exit signs can be replaced with energy efficient signs.
Jail Ozone Laundry	$35,000	Ozone laundry systems are quickly being recognized as being an energy efficient alternative to traditional systems because of their lowered hot water consumption. Two ozone laundry systems are proposed for this site. The ozone systems will be incorporated into four of the five existing machines that have a capacity between 50 and 55 lbs. Ozone will be produced on site and used as a cleaning agent. The chemical properties of ozone make it a powerful oxidizing, cleaning and bleaching agent. No hot water is used during an ozone based laundering process, so significant hot water savings are possible. Based on current estimates, this project is expected to result in an annual savings of 4,190 therms. Other benefits of ozone laundry systems are decreased rinsing requirements and longer fabric life.
Jail – Replace Inlet Guide Vanes with Variable Frequency Drives	$63,783	EEM-3: Replace Inlet Guide Vanes with Variable Frequency Drives for the Air Handling Units at Jail
Jail – Efficient Motor Replacement	see Courthouse Project	EEM-5: Replace Old Low Efficiency Motors with Premium Efficiency Motors in the Jail and Courthouse
Library Lighting	$6,217	The proposed project will add occupancy sensors to some fixtures, add daylight sensors to some fixtures, replace metal halide fixtures with T8 fixtures, and slightly delamp some overlit areas. After the proposed changes the lighting will use 33,482 kWh/year with peak usage of 9.2 kW. Energy and power savings will be 22,060 kWh/year and 1.2 kW. Savings will be $3,489/year with a simple payback of 1.8 years.
Motor Pool Lighting	$5,572	The proposed project will replace 21 T8 fixtures with 21 higher-efficiency T8's, eight metal halide high bays with eight fluorescent high bays, replace two incandescent lamps with two CFL lamps, replace one mercury vapor fixture with a CFL fixture, and utilize twelve wall and fixture mount occupancy. After the proposed changes the lighting will use 7,273 kWh/year with peak usage of 4.7 kW. Energy and power savings will be 5,944 kWh/year and 3.4 kW. Savings will be $1,065/year with a simple payback of 5.2 years.
Public Health Lighting	$14,090	The proposed project will convert T12's to T8's, convert incandescents and incandescent floods to CFL, add occupancy sensors to some fixtures, and delamp some overlit areas. After the proposed changes the lighting will use 22,994 kWh/year with peak usage of 12.3 kW. Energy and power savings will be 21,527 kWh/year and 9.7 kW. Savings will be $3,798/year with a simple payback of 3.7 years.
Public Health Outside Air Damper Repair	$776	EEM-2: Repair Outside Air Damper for Air Handling Unit on Public Health Building Roof

PROJECT NAME	COST	PROJECT SUMMARY
Public Works Building — Forced Air Furnaces	$10,500	The proposed project will replace the three existing furnaces with three 62 kBTU/hour furnace with AFUE of 95%. After the proposed change the furnaces will use a total of 1,905 therms/year. Energy savings will be 666 therms/year. Savings will be $646/year with a simple payback of 16.3 years.
Public Works Building — Lighting	$11,834	The proposed project will convert T12's to T8's, convert incandescents and incandescent floods to CFL, add occupancy sensors to some fixtures, and delamp some overlit areas. After the proposed changes the lighting will use 22,004 kWh/year with peak usage of 12.3 kW. Energy and power savings will be 21,527 kWh/year and 9.7 kW. Savings will be $3,798/year with a simple payback of 3.7 years.
Soils Lab Lighting	$3,894	The proposed project will convert T12's to T8's, convert incandescents and mercury vapor lamps to CFL's, add occupancy sensors to some fixtures, add daylight sensors to outside lights, and install lower wattage lamps in some overlit areas. After the proposed changes the lighting will use 5,948 kWh/year with peak usage of 12.3 kW. Energy and power savings will be 8,541 kWh/year and 1.9 kW. Savings will be $1,049/year with a simple payback of 3.7 years.
COUNTY OF TRINITY		
Jail Furnace	$10,636	The existing heating and cooling equipment will be replaced with a split heating and cooling heat pump system servicing one of the two inmate dorms at the Trinity County Jail in Weaverville. These dorms are described as F-dorm and G-dorm, these two dorms are same in size and construction built in 1982. The new system has an HSPF rating of 8 and a SEER rating of 13. Energy will be saved by increased efficiency on the heating and cooling equipment. Despite the increase in electricity use, the total energy savings of the project is estimated at 199 mmBtu (source Btu).
Library HVAC	$45,573	The county is proposing to replace two HVAC roof pack units atop Weaverville Library and one split system serving conference room section of building. All three existing units are full propane heat/AC and are 19 yrs old. All three existing units will be converted to a air-to-air heat pump HVAC systems. The energy savings projected is 20,879 kWh per year and $22,367 per year at current rates with a simple payback (before rebates) of 6.8 years and a EECBG cost-effectiveness ratio of 9.56. Additional savings are projected with intangible savings from maintenance reduction and lowered personnel costs from repairing and maintaining the old pumps.
Murray Building — Furnace Replacement	$24,808	Trinity Co. is proposing to replace three gas split systems that are 23 yrs old of which two serve a county rental portion of the Murray building and one serves the Sheriff Sub station portion of building. The project would consist of determining new heating and cooling loads for the rental portion of building and replacing ducting as needed due to deterioration. The rental area is currently served buy two systems that previously handled a much larger area before remodeled to existing square footage. This portion of project would be sizing a single new heat pump system that would service this area independently.
CITY OF ARCATA PROJECTS		
Alliance Pump Station Lighting	$3,472	The proposed project will convert T12's to T8's and incandescents to CFL's and, add occupancy sensors to some fixtures. After the proposed changes the lighting will use 1,721 kWh/year with peak usage of 1.5 kW. Energy and power savings will be 1,932 kWh/year and 4.0 kW. Savings will be $266/year with a simple payback of 13.0 years.
City Hall Air Conditioning	$29,138	The proposed project will replace the 2 existing air conditioners with two air conditioners of capacities 24.2 kBTU/hour and 33.1 kBTU/hour respectively both with SEER's of 15. After the proposed changes the air conditioners will use 9,432 kWh/year. Energy savings and power savings will be 5,727 kWh/year and 3.5 kW. Savings will be $788/year with simple payback time of 13.7 years.
Corp Yard Lighting Retrofits	$20,690	The proposed project will do the following: Convert halogen to CFL; Convert high-pressure sodium to CFL; Convert incandescent to T8; Convert incandescent floods to CFL floods; Add motion sensors to CFL floods; Convert mercury vapor to T8; Convert T12's to T8's; Delamp overlit areas; Add occupancy sensors. After the proposed changes the lighting will use 21,418 kWh/year with peak usage of 12.2 kW. Energy and power savings will be 28,714kWh/year and 12.5 kW. Savings will be $3,954/year with a simple payback of 5.2 years.
D Street HVAC	$6,740	The proposed project will replace the existing furnace with two 80 kBTU/hour furnaces with AFUE of 95%. After the proposed change the furnaces will use a total of 440 therms/year. Energy savings will be 260 therms/year. Savings will be $252/year with a simple payback of 26.7 years.
Foodworks Lighting	$16,097	The proposed project will do the following: Convert T12's to T8's; Convert HPS to CFL flood; Convert Incandescent exit signs to LED exit signs; Convert metal halides to T8's; Convert T12's to T8's; Add occupancy sensors to T8's. After the proposed changes the lighting will use 24,338 kWh/year with peak usage of 12.0 kW. Energy and power savings will be 21,064 kWh/year and 8.6 kW. Savings will be $3,798/year with a simple payback of 4.3 years.
Foodworks Refrigeration	$12,199	On each refrigeration unit, some (and perhaps all) of the efficiency measures (evaporator fan controls, new motors, and door heater controls) will be installed. In all but one unit, the existing shaded pole evaporator fan motor is replaced with a EC motor. The EC motors are roughly 65% more efficient and realize savings through lowered kW demand. In total, the retrofits are expected to save 30,098 kWh/ year and 2.7 peak kW.
LED Streetlights	$17,860	This project physically replaces the cobra-head component of a pole-mounted street light, in order to retrofit the fixture from HPS to LED technology. This is a one-to-one retrofit, with no other modifications required. The street lights in question use either 200-watt, 250-watt or 310-watt HPS lamps, with additional wattage necessary for ballast power. All energy savings are projected to result from the combined efficiency of the LED fixture head and electronic controller, in comparison to the HPS lamp and ballast combination. Each HPS-to-LED retrofit is expected to save 131 watts for a 200W fixture, 54 watts for a 250W fixture, and 185 watts for a 310W fixture.
Wastewater Treatment Plant Automatic Aeration	$5,659	As part of the treatment process aeration pumps in the treatment marshes pump in air to provide oxygen used by microorganisms to digest waste. Running the aeration pumps based on oxygen demand rather than on a fixed schedule will save 55,841 kWh and $7,668 per year.
CITY OF BLUE LAKE		
Booster Pumps Replacement	$24,246	The water pumping facility currently operates 6,000 hours per year (based on historical documentation). Two pumps operate daily pumping water from the Humboldt Bay Municipal Water District line to two holding tanks owned by the city. The existing pumps are over 25 years old with one running at 54% efficiency and the other at 60%. The city plans to replace both pumps with premium efficiency motors and appropriately sized pumps. The energy savings projected is 21,155 kWh per year and $3,596 per year at current rates with a simple payback (before rebates) of 6.7 years.

PROJECT NAME	COST	PROJECT SUMMARY
CITY OF CRESCENT CITY		
Variable Frequency Drive Pumps	$120,000	The City is proposing to replace three existing inefficient water pumps (used for pumping potable water) with premium efficiency motors coupled with variable frequency drives. The energy savings projected is 214,553 kWh per year and $9,069 per year at current rates with a simple payback (before rebates) of 13.2 years.
CITY OF ETNA		
Replace Furnace w/Heat Pump	$40,612	The city is proposing to replace two old, inefficient fuel-oil boilers and hydronic heating system and one old A/C units with a state-of-the-art ground-coupled heat exchanger system which will provide heating and cooling for the building. The energy savings projected is 159 gals. of fuel oil per year at approx. $2,306 per year and 2,483 kWh savings worth approx. $224 at current rates with a simple payback of 17.6 years.
CITY OF EUREKA		
Adorni Building — Replace Electric Water Heaters with Heat Pumps	$5,200	The proposed project will replace the two existing electric resistance tank water heaters with two air-source heat pump tank water heaters each with and Energy Factor (EF) of 2.35. By replacing the water heaters, energy savings will be 3,709 kWh/year and 6.4 kW.
Adorni Building — Lighting Retrofits	$31,930	The lighting system will be upgraded either through retrofits or fixture replacement. Linear fixture retrofits will replace T12 lamps with third-generation T8 lamps. Magnetic ballasts will be replaced with NEMA premium efficiency ballasts. A combination of lamp count and ballast factor will be used to maintain existing light levels for the lowest energy consumption. Incandescent lamps will be replaced on a one-for-one basis with equivalent compact fluorescent lamps. Fluorescent exit signs will be replaced with LED versions. Occupancy and photocell sensors will be used to control fixtures where appropriate. Replaced equipment will be disposed based on existing regulations, including recycling, e-waste, and universal waste. The energy and power savings will be 67,966 kWh and 14.7 kW, respectively.
City Hall Solar PV	$119,903	The proposed Project is a 14.7 kW AC Photovoltaic Generation facility located at the Eureka City Hall. The project will be a roof mounted grid tied solar electric system, which will work concurrently with electrical energy supplied by the utility service provider during daytime hours. The total available building rooftop and/or land area footage meets the required installation area for the Project. The proposed 14.7 kW (AC) PV system will produce approximately 20,455 kWh per year.
Service Garage Lighting	$23,092	The proposed project will convert T12's to T8's, convert metal halides to T8, convert high-pressure sodium exterior lights to CFL floods, add photocells to the exterior lights, add occupancy sensors to some fixtures, and delamp some overlit areas. After the proposed changes the lighting will use 32,684 kWh/year with peak usage of 22.6 kW. Energy and power savings will be 18,186 kWh/year and 7.4 kW. Savings will be $2,876/year with a simple payback of 8.0 years.
CITY OF FERNDALE PROJECTS		
Ferndale Elementary School Lighting	$12,539	The proposed project will convert T12's to T8's, replace incandescent lamps with CFL's, control selected fixtures with occupancy sensors, and add daylight sensors to outside fixtures. After the proposed changes the lighting will use 22,307 kWh/year with peak usage of 17.9 kW.
Ferndale High School Lighting	$29,766	The proposed project will convert T12's to T8's, replace incandescent lamps with CFL's, control selected fixtures with occupancy sensors, add daylight sensors to outside fixtures. After the proposed changes the lighting will use 43,378 kWh/year with peak usage of 32.9 kW.
CITY OF FORTUNA PROJECTS		
LED Street Lighting	$78,412	This project physically replaces the cobra-head component of a pole-mounted street light, in order to retrofit the fixture from HPS to LED technology. This is a one-to-one retrofit, with no other modifications required. The street lights in question use either 70-watt or 100-watt HPS lamps, with additional wattage necessary for ballast power. All energy savings are projected to result from the combined efficiency of the LED fixture head and electronic controller, in comparison to the HPS lamp and ballast combination. Each HPS-to-LED retrofit is expected to save 47 watts for a 70W fixture, and 66 watts for a 100W fixture.
CITY OF POINT ARENA PROJECTS		
Replace Wastewater Treatment Pumps	$18,775	Point Arena operates its wastewater treatment facility with an inefficient water pump which operates daily, pumping water from sewage and storm drain systems. The existing pump is 30 years old and runs at 55% efficiency. The city plans to replace the motor with a premium efficiency motor and rebuild the existing pump with stainless steel impeller (projected to yield 69% overall-pump-efficiency when calculated net efficiency at optimal load set-point). The proposed replacement pump is a 25 HP, 3600 RPM, premium efficiency TEFC motor with the existing rebuilt pump.
CITY OF RIO DELL PROJECTS		
Air Conditioner & Furnace Replacement	$22,513	The proposed project will replace the three, existing old, slightly oversized 80 kBTU 80% AFUE furnaces with three efficient 60 kBTU/hour 95.5% AFUE furnaces. Four existing 24 kBTU 8 SEER AC units will be replaced with four 24 kBTU/hour 13 SEER units. Energy will be saved by increased efficiency on both units, by optimizing the furnace for the load, and sealing ducts.
CITY OF TRINIDAD PROJECTS		
City Hall Insulation & Furnace Replacement	$24,600	The city is proposing to insulate the ceiling with R-21 blown-in insulation and R-24 spray-on foam insulation in the floor and replace (2) 25+ year old inefficient furnaces with (2) 95% energy efficient propane furnaces yielding 167 Therms combined savings. An additional independent ventilation system will be required to with provide sufficient fresh air for high-occupancy events when the building tends to overheat. The energy savings projected are 3,310 kWh and 161 Therms per year and $920 annual savings at current rates with a simple payback of 26.8 years.

APPENDIX M.
NCRP PROJECT IMPACT & BENEFIT ANALYSIS

Following are the tabular results of NCRP implementation project impact/benefit assessment. Section 4.3 ("Impacts & Benefits") provides the methodology and discussion for these results.

Table 62 Minimum Estimated Annual Benefits, 2016 Dollars, by WMA

WMA	WATER SUPPLY	WATER QUALITY	ECOSYSTEM SERVICES
Eel	$14,226,182	$12,417,182	$1,682,674
Humboldt Bay	$4,363,246	$38,222,417	$6,314,929
Klamath	$8,530,995	$2,663,998	$24,892,450
North Coast	$48,576,011	$44,430,923	$54,991,689
Russian/ Bodega	$26,856,940	$22,673,317	$58,324,757
Trinity	$4,229,047	$107,439	$7,875,927

Table 63 Indicators of Project Impacts and Benefits

TYPE OF CAPITAL	INDICATOR OF BENEFIT OR IMPACT	PHYSICAL UNIT OF MEASURE	ECONOMIC UNIT OF MEASURE[7]
Natural	Instream Flow	Gallons/Day; Acre-feet/Year	$80-$120/acre-foot per year[8]
	Water Quality	DO; Temperature; Bacteria; Sediment; Meet/ exceed regulatory target (e.g., TMDL)	Sediment: Up to $11 per ton of sediment[9]
	Riparian, Upland, and/or Forest Habitat Quality/Quantity	Acres; Linear measure; Measure of function (e.g., number of plants; tons of carbon sequestration)	Riparian Habitat: $120 per acre per year[10] Wetland Habitat: $2,000–$4,000 per acre per year[11] Carbon Sequestration: $15 per ton of carbon dioxide equivalent sequestered (increases at a real rate of 2.5% per year)
	Salmonid Population	Change in number of adult fish	Project and species-specific values
Human-Built	Water Supply for Domestic Use	Gallons/Day; Acre-feet/Year	$80-$120/acre-foot per year[12]
	Water Supply for Agricultural Use	Gallons/Day; Acre-feet/Year	$80-$120/acre-foot per year[13]
	Water System Operations	O&M effort/cost; Numbers of violations/fines	Project Specific
	Wastewater System Operations	O&M effort/cost; Numbers of violations/fines	Project Specific
	Road Operations	O&M effort/cost; Miles upgraded; Miles decommissioned;	Project Specific
	Culvert Operations	O&M effort/cost; Changes in risk/ probability of failure;	Project Specific
	Flood Control	Number of structures affected; Other infrastructure affected; Damage characterization	Project Specific
	Critical Infrastructure Reliability	Customers/day of shortage; Emergency response timing;	Water Supply: $19–$27 per household per month[14]

7 For more information about the economic units listed here, see Table 45 "Estimated Project Benefits for Water Supply, Quality, and Services"

8 West Water Research. 2013. 2013 California Spot Market Price Forecast.

9 Hansen, L. and M. Ribaudo. 2008. *Economic Measures of Soil* Conservation Benefits: Regional Values for Policy Assessment. U.S. Department of Agriculture. Technical Bulletin No. 1922.

10 Chaibai, A., C. Travisi, H. Ding, et al. 2009. *Economic Valuation of Forest Ecosystem Services' Methodology and Monetary Estimates*. Fondazione Eni Enrico Mattei Working Paper No. 2009.12.

11 Woodward, W. and Y. Wui. 2001. "Economic Value of Wetland Services: A Meta-Analysis." Ecological Economics. 37:257-270.

12 *West Water Research. 2013.* 2013 California Spot Market Price Forecast.

13 *West Water Research. 2013.* 2013 California Spot Market Price Forecast.

14 Barakat & Chamberlin, Inc. 1994. *The Value of Water Supply Reliability: Results of a Contingent Valuation Survey of Residential Customers*. August.

TYPE OF CAPITAL	INDICATOR OF BENEFIT OR IMPACT	PHYSICAL UNIT OF MEASURE	ECONOMIC UNIT OF MEASURE[7]
	Recreational Facilities	Users/day; Measure of quality (e.g., congestion; uniqueness of experience, etc.)	$128 per camping day, $54 per fishing day, $28 per hiking day, $33 per motorboating day, $61 per mountain biking day, $79 per picnicking day, $25 per sightseeing day, $33 per swimming day, $89 per wildlife viewing day. [15]
	Energy Use	KwH used; Carbon emissions	$15 per ton of carbon dioxide equivalent (increases at a real rate of 2.5% per year)
Human	Loss of life or injury	Number of people affected	Value of a statistical life or avoided cost of injury
	Skill development	Number of people affected; Skills affected	Project Specific; Typically, not monetized
	Education	Number of people affected; Behaviors changed	Project Specific; Typically, not monetized
Social	Conflict Resolution	Describe effect	Project Specific; Typically, not monetized
	Information Development and Sharing	Describe effect	Project Specific; Typically, not monetized
	Cultural Heritage	Describe effect	Project Specific; Typically, not monetized

Table 64 Benefits and Impacts of Proposition 50 Implementation Projects

TYPE OF CAPITAL	INDICATOR OF BENEFIT OR IMPACT	# OF PROJECTS	PHYSICAL CHANGE	ECONOMIC VALUE[16]	BENEFICIARIES	
					DACS	TRIBES
Natural	Instream Flow	7	Increased instream flows to benefit ecosystems and salmon; improved water management		•	•
	Water Quality	17	Sediment reduction (442,000 yd^3 stabilized) Avoided TMDL Enforcement or other projects	>$40 million	•	•
	Riparian, Upland, and/or Forest Habitat Quality/Quantity	8 3	New habitat (332 acres) Invasive species removed (214 acres) Carbon sequestration		•	•
	Salmonid Population	18	Enhanced fisheries and fish populations Improved fish passage and new habitat for fish populations (153 miles)		•	•
Human-Built	Water Supply for Domestic Use	4	Increased availability of water for municipal or domestic use; improved water management		•	
	Water Supply for Agricultural Use	3	Increased availability of water for agricultural use; improved water management		•	
	Water System Operations	3	Avoided water treatment costs and other O&M costs	>$172,000	•	
	Wastewater System Operations	3	Avoided wastewater violations	$60,000	•	
	Road Operations	7	Roads decommissioned (7.76 miles) Roads upgraded (95 miles) Avoided road maintenance costs	>$3 million	•	
	Culvert Operations	8	Changes in culverts to improve fish passage		•	
	Flood Control	4	Flood damage reduction	>$160,000	•	
	Critical Infrastructure Reliability	4	Enhanced firefighting capabilities		•	
	Recreational Facilities	8	Protect and increase recreation access		•	•
	Energy Use					
Human	Loss of life or injury					
	Skill development Education	10	Professional and volunteer training		•	•

15 Loomis, J. 2005. *Updated Outdoor Recreation Use Values on National Forests and Other Public Lands.* U.S. Forest Service. General Technical Report PNW-GTR-658.

16 These values represent a rough estimate of the value associated with some of the effects of the Proposition 50-funded projects, based on preliminary estimates of project outcomes. They may not accurately represent the present value of the benefits, discounted over time.

TYPE OF CAPITAL	INDICATOR OF BENEFIT OR IMPACT	# OF PROJECTS	PHYSICAL CHANGE	ECONOMIC VALUE[16]	BENEFICIARIES	
					DACS	TRIBES
Social	Conflict Reduction and Resolution	5			•	•
	Information Development and Sharing	8	Enhanced monitoring programs		•	•
	Cultural Heritage	10	Enhanced salmonid populations Agricultural preservation		•	•

Table 65 Benefits and Impacts of Proposition 84 Implementation Projects

TYPE OF CAPITAL	INDICATOR OF BENEFIT OR IMPACT	# OF PROJECTS	PHYSICAL CHANGE	ECONOMIC VALUE[17]	BENEFICIARIES	
					DACS	TRIBES
Natural	Instream Flow	30	Increased instream flows to benefit ecosystems and salmon; improved water management	>$85 million	•	•
	Water Quality	17	Sediment reduction (1,210,000 yd³ stabilized) Avoided TMDL Enforcement or other projects (34 projects)	>$7.5 million	•	•
	Riparian, Upland, and/or Forest Habitat Quality/Quantity	20	New habitat (843 acres) Invasive species removed (7 projects, 173 acres) Carbon sequestration (22 projects)	>$100 thousand >$360 thousand	•	•
	Salmonid Population	38	Enhanced fisheries and fish populations Improved fish passage and new habitat for fish populations (4 projects, 9 miles)	>$23 million	•	•
Human-Built	Water Supply for Domestic Use	39	Increased availability of water for municipal or domestic use; improved water management	>$27 million	•	•
	Water Supply for Agricultural Use		Increased availability of water for agricultural use; improved water management		•	
	Water System Operations	33	Avoided costs of emergency repairs Avoided costs	$2 million >$38 million	•	•
	Wastewater System Operations	2	Avoided fines	$110,000	•	•
	Road Operations	9	Roads decommissioned (71 miles) Roads upgraded (11miles) Avoided road maintenance costs ($636,000)		•	•
	Culvert Operations	3	Avoided failure	$41,000	•	•
	Flood Control	7	Avoided flood damage	$270,000	•	
	Critical Infrastructure Reliability	11	Enhanced firefighting capabilities Improved water supply reliability	$17 million	•	•
	Recreational Facilities	13	Protect and increase recreation access	$700,000	•	
	Energy Use	3	Reduced carbon emissions Reduced energy costs	$108,000	•	
Human	Loss of life or injury	2	Avoided loss of life and injury	$20 million	•	
	Skill development Education	26	Professional and volunteer training		•	•
Social	Conflict Reduction and Resolution	31			•	•
	Information Dexdevelopment and Sharing	7	Enhanced monitoring programs		•	•
	Cultural Heritage	31	Enhanced salmonid populations Agricultural preservation Increased forest biodiversity		•	•

17 These values represent a rough estimate of the value associated with some of the projected effects of the Proposition 84-funded projects. They are based on project proponents' initial estimates of the physical effects of the projects before completion, and may not accurately capture the actual value of the benefits achieved by these projects. These values should not be summed to represent the total value of the Proposition 84-funded projects.

Table 66 Estimated Project Benefits for Water Supply, Quality, & Services

WATER SUPPLY BENEFITS					
Potential Benefit	**Physical Amount of Benefit**	**Suggested Physical Units**	**Estimated Economic Value**	**Suggested Economic Units**	**Example of Applying Economic Units**
Increased Instream Flow for Environmental Purposes		Gallons per year; Gallons per minute; Acre-feet per year		*$80–$120 per acre-foot per year*[18] This value represents the market prices paid in California water markets for water in 2013. This value should be applied to the increase in the volume of water that is left instream to support ecological functions. The value of this benefit accumulates over time. A higher value may be appropriate if water is being made available for San Francisco Bay area ($160-$250) or Central Valley ($80-$280) users.	A project helps a farmer install drip irrigation equipment. The farmer is then able to reduce withdrawals from the river by one acre-foot per year, which leaves more water instream to protect habitat for salmon and other species. The value of the benefit is $80 per year, for as many years as the water is guaranteed to remain as instream flow.
Increased Instream Flow for Agricultural Purposes		Gallons per year; Gallons per minute; Acre-feet per year		*$80–$120 per acre-foot per year*[1] This value represents the market prices paid in California water markets for water in 2013. This value should be applied to the increase in the volume of water available to agricultural users. The value of this benefit accumulates over time. A higher value may be appropriate if water is being made available for San Francisco Bay area ($160-$250) or Central Valley ($80-$280) users.	A project covers irrigation ditches, which reduces evaporation by one acre-foot per year. This water is available to irrigate more acreage than before. The value of this benefit is $57 per year, for as many years as the water is available to meet agricultural demands.
Increased Instream Flow for Municipal Purposes		Gallons per year; Gallons per minute; Acre-feet per year		*$80–$120 per acre-foot per year*[1] This value represents the market prices paid in California water markets for water in 2013. This value should be applied to the increase in the volume of water available to municipal users. The value of this benefit accumulates over time. A higher value may be appropriate if water is being made available for San Francisco Bay area ($160-$250) or Central Valley ($80-$280) users.	A project provides rebates for water-efficient toilets, which reduces per-capita water use and overall water use by one acre-foot per year. This water is available to meet municipal demands from population growth than before. The value of this benefit is $121 per year, for as many years as the water is available to meet municipal demands.
Change in Timing and Volume of Instream Flow		Cubic feet per second (cfs) over a particular period (document evidence of scarcity during this period)		*Project specific / Not monetized* Water that provides an increased instream flow during periods of scarcity is particularly valuable. Other benefit categories (e.g., increased instream flow for environmental purposes) already capture some of the benefit associated with increased instream flows. To the extent that increased instream flows occur during periods of scarcity, those values may underestimate the true value of this flow.	A project provides rain tanks that allow a farmer to collect water during the wet season and replace irrigation withdrawals during summer months. This would increase the river's flow during typically drier periods, when water is more scarce and additional flows are more critical for maintaining fish habitat. The exact value of this additional flow, above the average value provided for instream flow for environmental purposes, may not be known, but its importance should be described.
Increased Water Supply Reliability		Number of household customers; Reduction in frequency of water shortages (e.g., once in five years, once in ten years); Reduction in magnitude of shortage (e.g., 10% reduction, 20% reduction)		*$19–$27 per household per month*[19] These values represent how much households are willing to pay to avoid specific types of water shortages. At the low end, respondents said they were willing to pay about $19 per month to avoid a 10% shortage that occurs once every 10 years. At the high end, they were willing to pay about $27 per month to avoid a 50% shortage that occurs once every 20 years. The lower value is appropriate for improvements in reliability in situations where shortage is likely to occur infrequently and/or for short periods of time. The higher value is appropriate for improvements in reliability in situations where shortage occurs frequently and/or for longer periods of time.	A project that installs low-flow appliances results in a decrease in per-capita water demand. This reduces the likelihood the water utility must enforce water rationing, mandating a 10 percent reduction in water consumption when droughts occur, which is about once every 10 years in the watershed this utility depends on. This utility serves 500 customers, so the value of this benefit is about $9,500 per month or $114,000 per year. This is a tricky benefit to quantify. Project-specific conditions should be taken into account and may affect values considerably.

18 West Water Research. 2013. 2013 California Spot Market Price Forecast.

19 Barakat & Chamberlin, Inc. 1994. The Value of Water Supply Reliability: Results of a Contingent Valuation Survey of Residential Customers. August.

WATER SUPPLY BENEFITS					
Potential Benefit	**Physical Amount of Benefit**	**Suggested Physical Units**	**Estimated Economic Value**	**Suggested Economic Units**	**Example of Applying Economic Units**
Increased Groundwater Recharge		Percent increase; Gallons per year; Acre-feet per year		*Project Specific/Not monetized* The benefits that arise from groundwater recharge may be addressed by other benefit categories (e.g., increased instream flow for multiple purposes, improved habitat, avoided costs, etc.) If other categories don't cover the benefit, describe specifics here.	A project diverts stormwater to constructed wetlands, increasing recharge to the aquifer. This may produce a wide range of benefits, including increased instream flows, avoided pumping costs, avoided costs of adapting to subsidence, etc. Where possible, address this effect in these other, direct, benefit categories.
Avoided Water Supply Purchases		Volume of water purchased per year (or at the frequency purchases would be avoided);		*Project specific: $ per unit of raw water purchased per year* This value depends on the types and costs of avoided water purchases. It's best to rely on information from the project area. If water would have been purchased yearly, the benefit accrues annually. If it's every 5 or 10 years, value accrues periodically over time.	A project decreases water demand by installing low-flow appliances. This decrease in water demand means that the community no longer has to purchase $100,000 worth of water from a neighboring water district each year. The value of this benefit is $100,000 per year. It could potentially increase over time if water supply purchases would have increased.
Avoided Water Supply Projects		Description of the avoided project, including physical benefits, and timing of actions		*Project specific: Cost of avoided project(s), including capital, replacement, and operations & maintenance costs, as applicable.* This benefit is equal to the costs of other potential future projects aimed at increasing/improving water supplies that are avoided as a result of the project.	A project covers a reservoir, decreasing evaporation. Since more water is available from the reservoir, a planned expansion that would have cost $500,000 no longer has to take place. The value of this benefit would a one-time avoided cost of $500,000. If the reservoir expansion would have cost $500 per year more to maintain, the annual avoided cost would be $500 dollars, and is additional to the one-time capital cost.
Avoided Water Shortage Costs See also Avoided Water Supply Purchases, Increased Water Supply Reliability		Gallons per year; Acre-feet per year; Percent change in frequency /severity of water shortages		*Project specific: Avoided costs associated with water shortages* The value of this benefit may already be included elsewhere (e.g., avoided water supply purchases, increased water supply reliability). To the extent that the project's capacity to reduce costs attributable to water shortages has not already been captured, it could be included here.	A community increases the efficiency of municipal water use resulting in a decrease in water demand. This decrease in water demand results in an avoided water shortage each summer. Historically, the community had incurred costs of $100,000 during its annual water shortage, from lost business opportunities. This project would have an annual benefit of $100,000.
Avoided Electric Costs		Energy units (kWh) per year; Acre-feet of water pumped per year		Project specific: $ per kWh per year If a project specific change in electricity use is available, it can be multiplied by local electricity prices to estimate the value of the benefit. (PG&E current rates for different customers can be found at: http://www.pge.com/nots/rates/tariffs/rateinfo.shtml)	A project decreases leakage from irrigation piping resulting in a decrease in energy used to pump water for irrigation. The value of the benefit would be equal to the avoided electricity costs.
Avoided Costs Associated with Emergency Repairs		Project Specific		*Project specific: Avoided costs associated with labor and capital to make the emergency repair.* Insofar as the avoided costs have not been included elsewhere, they can be included here. To the extent that the project avoids costs associated with emergency repairs, the value of those costs may be included as a benefit.	For the past 10 years, emergency crews have been called on to repair an old water pipe, on average, every two years. A project that replaces that pipe would provide a benefit equal to the average annual costs of those avoided repairs.
Revenue from Water Sales to New Customers		Gallons per year; Acre-feet per year		*Project specific: $ amount of net increase in revenue*	A utility fixes leaky distribution pipes, which allows it to sell more water to meet demands it currently cannot meet without developing new supplies. The benefit is equal to revenue earned from the additional water sales.

WATER QUALITY BENEFITS					
Potential Benefit	**Physical Amount of Benefit**	**Suggested Units**	**Estimated Economic Value**	**Potential Economic Units**	**Example of Applying Economic Units**
Sediment Reduction		Tons per year		*Project specific/Up to $11 per ton of sediment*[20] This value represents the sum of several avoided costs associated with reducing sedimentation (e.g., avoided reservoir dredging, avoided flood damage, avoided sediment filtration costs). The actual value likely is less than $11 per ton, and depends on the types of downstream users likely to benefit.	A project involves planting 100 trees in a previously barren riparian area resulting in reduced sediment from erosion. The project reduces sedimentation to the stream by one ton per year. The annual value of the benefit is $11 per year. *Alternately, the water treatment plant downstream can document that it will spend $1,000 less per year on treatment supplies to remove the sediment. The benefit in that case will be $1,000 per year. This is a hypothetical, project-specific benefit.*
Decreased Water Temperature		Avoided project; Change in maximum daily temperature, by day		*Project specific* To avoid double counting of habitat benefits, the value of this benefit is equal to the costs of other potential future projects aimed at reducing water temperature that are avoided due to this project's impact. If there are not potential avoided future projects, this benefit may still have biophysical value, but does not necessarily provide an economic benefit.	A project involves planting 100 trees along a stream These trees shade the stream and decrease the water temperature. Due to lower water temperatures from this project, another future project costing $100,000 is no longer necessary. This benefit has a one-time value of $100,000.
Increased Dissolved Oxygen (DO)		Avoided project; Change in DO concentration		*Project specific* To avoid double counting, the value of this benefit is equal to the costs of other potential future projects aimed at increasing DO concentrations that are avoided due to this project's impact. If there are not potential avoided future projects, this benefit may still have biophysical value, but does not necessarily provide an economic benefit.	A project involves planting 100 trees between a farm and a stream. The decrease in nutrient runoff from the farm improves dissolved oxygen concentrations in the stream. Due to the improved dissolved oxygen concentrations from this project, another future project costing $100,000 is no longer necessary. This benefit has a one-time value of $100,000.
Bacteria/ Contaminant Reduction		Avoided project; Change in bacteria/ contaminant concentration		*Project specific* To avoid double counting of habitat- and recreation-related benefits, the value of this benefit is equal to the costs of other potential future projects aimed at decreasing bacteria/contaminant concentrations that are avoided due to this project's impact. If there are not potential avoided future projects, this benefit may still have biophysical value, but does not necessarily provide an economic benefit.	A project involves planting 100 trees between a livestock operation and a stream. The decrease in runoff from the feedlot reduces bacteria concentrations in the stream. Due to the improved bacteria concentrations from this project, a future project costing $100,000 is no longer necessary. This benefit has a one-time value of $100,000.
Additional Water Quality Projects Avoided		Avoided projects		*Project specific* To avoid double counting of habitat- and recreation-related benefits, the value of this benefit is equal to the costs of other potential future projects aimed at improving water quality that are avoided due to this project's impact.	If the project improves water quality in other ways, it provides a benefit by improving aquatic habitat and recreational opportunities. To avoid double counting, the value of habitat- and recreation-related benefits are calculated elsewhere. To the extent that this project can replace other efforts aimed at improving water quality, it provides an additional benefit equal to the costs of avoided projects.
Avoided Water Treatment Costs		Gallons per year; Acre-feet per year		*Project specific: Difference in water treatment costs per unit of water per year* If a local value for water treatment costs is available, multiply it by the relevant quantity to estimate the annual benefit. The mid-range cost of drinking water treatment in the San Francisco area is $65 per acre-foot per year (Chen et al. 2008).	A project involves lining a reservoir that holds municipal drinking water, resulting in improved water quality and decreased treatment costs for the water supply. The value is the difference between what the utility paid to treat the water before the project and after the project.
Reduced stormwater water treatment costs		Gallons per year; acre-feet treated per year		Average cost per unit of water requiring reduced treatment or not needing treatment	

20 Hansen, L. and M. Ribaudo. 2008. Economic Measures of Soil Conservation Benefits: Regional Values for Policy Assessment. U.S. Department of Agriculture. Technical Bulletin No. 1922.

WATER QUALITY BENEFITS					
Potential Benefit	**Physical Amount of Benefit**	**Suggested Units**	**Estimated Economic Value**	**Potential Economic Units**	**Example of Applying Economic Units**
Avoided Culvert Failures		Number of culvert failures avoided		*Project specific: Cost of avoided culvert failures* Use local values describing historical costs associated with culvert failures to estimate the value of reducing future culvert failures. These might include costs of: fixing/ replacing pipes at emergency rates; flood damage to land owners; and user delays for motorists. This is a one-time value applied when the culvert would likely have failed.	A project involves excavating and reinstalling one culvert that is at a risk of immediate failure. Culvert failures in the area have cost an average of $10,000 per failure in emergency repairs and localized damage to roads and structures. This one-time value can be applied to describe the benefit of this project.
Flood Damage Reduction		To determine flood damage reduction benefits, see specific instructions below.		*Project specific* Calculate expected annual damage using relevant model, such as U.S. Army Corps of Engineers HEC-Flood Damage Assessment or the Flood Rapid Assessment Model (F-RAM).	If the project decreases the frequency and/ or magnitude of potential future flood events, it provides a benefit equal to the value of avoided flood damages. The economic costs associated with expected annual damage may include avoided physical damage; avoided costs associated with loss of functions such as income and wages; avoided emergency response and cleanup; and avoided, but unquantifiable, public safety and health impacts.

OTHER ECOSYSTEM SERVICE BENEFITS					
Potential Benefit	**Physical Amount of Benefit**	**Suggested Units**	**Estimated Economic Value**	**Potential Economic Units**	**Example of Calculating Economic Value**
Fishery Improvement See also Increased Instream Flow for Environmental Purposes; Habitat Restoration		Number of fish per year; Percent population increase; Density (fish/m^2)		*Project and species-specific values; Partially captured by other benefits* Some of the value of this benefit is captured in the value of increased instream flow for environmental purposes. If the project makes targeted efforts to improve fish populations, there are several species-specific values applicable from the literature that reflect the commercial, recreation, and existence values of improved fish populations. These values are dependent on site conditions and are not straightforward calculations.	A project installs 50 pieces of large woody debris in a river resulting in a 5% increase in local salmon and steelhead populations over 30 years. The value of this salmon-specific benefit is based on the commercial, recreation, and existence value of this increase in fish populations.
Increased Quantity or Quality of Recreation or Public Access		Number of recreation days, by type of activity		*$128 per camping day,* *$54 per fishing day,* *$28 per hiking day,* *$33 per motorboating day,* *$61 per mountain biking day,* *$79 per picnicking day,* *$25 per sightseeing day,* *$33 per swimming day,* *$89 per wildlife viewing day.*[21] These represent the net value associated with a day spent participating in different recreational activities (not including the costs of participating in the activity). Generally, increases in quality of recreational opportunities are not easily quantifiable, but should be discussed qualitatively.	A project creates a new hiking trail along a river. This new trail attracts more individuals to hike in the area and encourages people who already hike in the area to take more hiking trips. Recreation managers in the area count an average of 10 hikers per day using the trail. Assuming all of these people would not have gone hiking but for this new trail, the value associated with the trail is approximately $280 per day or about $100,000 per year. It is important to recognize that some of these people may have hiked elsewhere, so they would have benefited from their hiking trip either way. For this reason, it is easy to overestimate this benefit, so care should be taken to clearly document assumptions.

21 Loomis, J. 2005. Updated Outdoor Recreation Use Values on National Forests and Other Public Lands. U.S. Forest Service. General Technical Report PNW-GTR-658.

OTHER ECOSYSTEM SERVICE BENEFITS					
Potential Benefit	**Physical Amount of Benefit**	**Suggested Units**	**Estimated Economic Value**	**Potential Economic Units**	**Example of Calculating Economic Value**
Improved Fish Passage *See also* Fishery Improvement; Increased Instream Flow for Environmental Purposes; Habitat Restoration		Number of fish per year; Percent population increase; Density (fish/m^2)		*Project and species-specific values; Partially captured by other benefits* Avoid double counting with the value of increased instream flow for environmental purposes (and, if calculated, the improvement in fisheries). If the project makes targeted efforts to improve fish populations, there are several species-specific values applicable from the literature that reflect the commercial, recreation, and existence values of improved fish populations. These values are dependent on site conditions and are not straightforward calculations.	A project installs an additional culvert under a roadway resulting in 5 stream miles of new steelhead rearing habitat. This is expected to increase steelhead populations in the watershed by 10 percent over 10 years. The value of this salmon-specific benefit is based on the commercial, recreation, and existence value of this increase in fish populations.
Habitat Restoration *See also* Fishery Improvement; Increased Instream Flow for Environmental Purposes		Acres of habitat type		*$120 per acre per year (riparian habitat)[22] $2,000–$4,000 per acre per year (wetland habitat)[23]; Project-specific* These values represent estimates of the total annual economic value associated with riparian and wetland habitat. Other values may be available from the literature to apply to other habitat types and may differ considerably from these values (e.g., upland forest ecosystems, scrubland, etc.).	A project involves removing an abandoned development alongside a river. In the process, trees are planted and the native riparian conditions are restored, increasing riparian habitat by one acre. The value of that new habitat would be $120 per year.
Invasive Plant Removal		Acres of habitat improved		*$120 per acre per year (riparian habitat)[6] 2,000–$4,000 per acre per year (wetland habitat)[7]* To the extent that a project improves the functionality of habitat, it provides benefits proportional to the incremental improvement of the habitat. To avoid double-counting, habitat restoration benefits should not be claimed on the same land that receives benefits for removing invasive plants.	A project removes invasive blackberries from one acre of a riparian area, resulting in better growing conditions for native vegetation and improved wildlife habitat. Biologists estimate the changes improve the productivity of the landscape for supporting native species, from about 50 percent of optimal function to 100 percent of optimal function. The value of the benefit would be equal to half of the value associated with riparian habitat, or about $60 per year.
Flood Control *See also* Flood Damage Reduction		Area and type of land protected; Change in flood probabilities		*Project specific* In order to avoid double counting with previous flood-related benefits, the value of this benefit should be equal to historical costs associated with past floods minus those costs already accounted for in other benefit categories.	If the project decreases the frequency and/or magnitude of potential future flood events, it provides additional benefits beyond those estimated by F-RAM. These benefits are equal to avoided future flood-related costs (e.g., avoided displacement, avoided injuries, avoided municipal opportunity costs, avoided flood preparation costs).
Reduction in Shellfish Closures		Number of days per year of reduced closures; Change in quantity of commercial shellfish production; Change in shellfish-related recreation days		*Project specific* The value of this benefit relies on the type of shellfish closure, its duration, and its total effect on commercial shellfish production and recreational shellfish activity.	Historically, high bacteria levels in a river have resulted in annual closures in a nearby shellfish-producing area. A project effectively reduces bacteria levels resulting in no more shellfish closures. The value of the value of the benefit is equal to the value of commercial and recreational shellfish activities adversely affected by the closure.
Decreased Operation and Maintenance Costs		Project specific		*Project specific: Avoided costs associated with labor and capital for operations and maintenance.* If the project decreases any operation and/or maintenance costs not accounted for in other benefit categories, count those benefits here. The value of the benefit is equal to the avoided operation and maintenance costs per year.	A project upgrades a municipal reservoir, resulting in a reduction in treatment and conveyance costs of $50,000 per year. Insofar as these values have not been accounted for elsewhere, the value of this benefit is $50,000 per year.

22 Chaibai, A., C. Travisi, H. Ding, et al. 2009. Economic Valuation of Forest Ecosystem Services' Methodology and Monetary Estimates. Fondazione Eni Enrico Mattei Working Paper No. 2009.12.

23 Woodward, W. and Y. Wui. 2001. "Economic Value of Wetland Services: A Meta-Analysis." Ecological Economics. 37:257-270.

OTHER ECOSYSTEM SERVICE BENEFITS					
Potential Benefit	**Physical Amount of Benefit**	**Suggested Units**	**Estimated Economic Value**	**Potential Economic Units**	**Example of Calculating Economic Value**
Avoided Costs of Road Maintenance		Miles of road;		*Project specific: Average road maintenance costs per mile including labor and capital.* In order to avoid double-counting with previous maintenance-related benefits, the value of this benefit should reflect only those avoided costs not yet accounted for.	A project re-grades a segment of roadway, decreasing annual costs associated with runoff and erosion. Historically, an average of $5,000 was spent addressing problems related to poor grade. The improvements reduce the annual maintenance efforts by half for 10 years. The value of this benefit is equal to $2,500 per year over 10 years.
Enhanced Fire-Fighting Capabilities		Area protected per year; Avoided costs associated with other sources of water; Avoided costs of delays associated with responding to fires		Project specific FEMA has developed a benefit-cost model that uses project-specific characteristics to estimate the value of avoided costs associated with natural disasters such as fires. If the project improves fire-fighting capabilities, it provides a benefit equal to the avoided costs associated with bringing in water from other sources to fight fires, the costs of delays in responding to fires, and fire-related damage.	A project increases the annual storage capacity of a pretreatment reservoir and reduces annual water demand, expanding the community's capacity to provide water for fighting wildfires in the region. The benefit is equal to the costs of fighting fire associated with hauling water from farther away, and potentially the damage avoided from being able to respond to fires more quickly. If these benefits are difficult to quantify monetarily, describe qualitatively.
Reduced Risk of Wildfire		Amount of fuel load reduced; predicted reduction in annual fire risk		*Project specific; Non Monetized* This benefit may be difficult to quantify. Factors to consider include probability of large fire and changes in potential damage costs, fire fighting costs, insurance costs, etc.	A project thins forests, reducing the risk of a catastrophic wildfire. The benefit is equal to the reduced annual probability of fire times the costs associated with fighting fires, the costs of delays in responding to fires, and fire-related damage.

COMMUNITY AND SOCIAL BENEFITS					
Potential Benefit	**Physical Amount of Benefit**	**Suggested Units**	**Estimated Economic Value**	**Potential Economic Units**	**Example of Calculating Economic Value**
Education or Technology Benefits		Number of people reached; Description of effects of technology (e.g., saved labor, better accuracy, etc.)		*Project specific; Not monetized* This benefit may be difficult to quantify in monetary terms. If the project provides opportunities for people to enhance their education or to develop, test, or document a new technology in a way that should result in water supply, water quality, or flood reduction benefits it results in a benefit associated with education or technology.	A project uses youth volunteers from the local community to conduct stream restoration. The students learn about the river's ecosystem. This represents an investment in the region's human capital, which may improve the individual success of the students and the community's capacity to address related issues in the future.
Avoided Public Water Resources Conflicts		Describe and quantify the conflicts		*Project specific; Not monetized* This benefit may be difficult to quantify in monetary terms. Evidence of an effect may be illustrated through reduced litigation costs or reduced enforcement or regulatory costs.	A project provides opportunities for public collaboration around water conservation efforts. This allows stakeholders to share information, identify and agree on problem definitions, and address issues before they rise to official levels. This may avoid short-run costs and builds a region's social capital, which may increase its capacity to address similar problems more efficiently and cost-effectively in the future.
Social Health and Safety		Describe the effects		*Project specific; Not monetized* These types of benefits are difficult to quantify in monetary terms. If the project reduces the public's exposure to water-related hazards not captured by the benefit categories above, it might provide additional benefits to social health and safety.	A project reinforces a critical water main whose failure, given a seismic event, would disrupt the fire-fighting capacity of the community. The benefit is reduced risk of incurring emergency costs and improved resilience if disruptions occur.
Other Social Benefits		Number of people		*Not monetized* By and large, these types of benefits are difficult to quantify in monetary terms.	Projects may also possess other social benefits, for example, a project might redress inequitable distribution of environmental burdens or have a disproportionate beneficial effect on disadvantaged communities, Native Americans, or other distinct cultural groups.

CLIMATE CHANGE MITIGATION					
Potential Benefit	**Physical Amount of Benefit**	**Suggested Units**	**Estimated Economic Value**	**Potential Economic Units**	**Example of Calculating Economic Value**
Carbon Emissions Reductions from Reduced Electricity Use		Reduction in emissions of CO2 equivalent (CO2E) per year, in tons. Reduced electricity use per year in kWh.		*$15 per ton of carbon dioxide equivalent (increases at a real rate of 2.5% per year)*[24] Reducing emissions has a benefit equal to the value of these avoided costs. If the weight of avoided carbon dioxide equivalent is known, apply the first value to the weight of avoided emissions. If only the amount of avoided electricity is known, apply the second value ($22 per MWh) to the amount of avoided electricity. The value of this benefit accumulates annually.	A project reduces leakage from irrigation piping resulting in a reduction in electricity used to pump and convey water for irrigation. The reduction in energy use results in a reduction in electricity generation, which reduces greenhouse gas emissions by one ton of CO2 equivalent per year. The value of the benefit is $15 for the first year, increasing by 2.5 for every year thereafter.
Carbon Emissions Reductions from Other Reduced Energy Use		Reduction in emissions of CO2 equivalent (CO2E) per year, in tons. Reduced energy use per year (e.g., gallons of diesel fuel). To calculate emissions reductions from different energy sources, go to http://www.epa.gov/cleanenergy/energy-resources/calculator.html#results		*$15 per ton of carbon dioxide equivalent* (increases at a real rate of 2.5% per year)[25] Reducing emissions has a benefit equal to the value of these avoided costs. If only the amount of energy is known, convert the energy to carbon dioxide equivalent, and multiply by the value above.	A project reduces the need to transport water by truck, resulting in a decrease in diesel used for transportation, which reduces greenhouse gas emissions by one ton of CO2 equivalent per year. The value of the benefit is $15 for the first year, increasing by 2.5 for every year thereafter.
Carbon Sequestration		Number of trees planted, by type; Volume of CO2 sequestered per year (in tons) May use the Tree Carbon Calculator to estimate carbon dioxide sequestration from tree planting projects: https://www.fs.usda.gov/ccrc/index.php?q=tools/tree-carbon-calculator-ctcc		*$15 per ton of carbon dioxide sequestered* (increases at a real rate of 2.5% per year)[26] If estimates of carbon sequestration are not available but an estimate of number of trees planted is available, use the following value estimates: $0.64 for per hardwood planted per year; $0.49 per conifer planted per year; These values represent the average annual value of carbon sequestered by different kinds of trees, assuming a moderate growth rate over 50 years, discounted at a rate of 3 percent.	A project involves planting 1,000 coniferous trees along a riparian area. As these trees grow they sequester and store carbon dioxide. This benefit is roughly equivalent to $490 per year.

24 California Environmental Protection Agency, Air Resources Board. 2014. *California Air Resources Board Quarterly Auction 6, February 2014: Summary Results Report.* Retrieved April 29, 2014, from http://www.arb.ca.gov/cc/capandtrade/auction/february-2014/results.pdf; Nordhaus, W. 2008. A Question of Balance: Weighing the Options on Global Warming Policies. New Haven: Yale University Press.; U.S. Department of Energy, Energy Information Administration. 2007. Appendix F. Electricity Emission Factors. Retrieved on October 29, 2012 from www.eia.gov/oiaf/1605/emission_factors.html.

25 California Environmental Protection Agency, Air Resources Board. 2014. *California Air Resources Board Quarterly Auction 6, February 2014: Summary Results Report.* Retrieved April 29, 2014, from http://www.arb.ca.gov/cc/capandtrade/auction/february-2014/results.pdf; Nordhaus, W. 2008. A Question of Balance: Weighing the Options on Global Warming Policies. New Haven: Yale University Press.

26 California Environmental Protection Agency, Air Resources Board. 2014. ***California Air Resources Board Quarterly Auction 6, February 2014: Summary Results Report.*** Retrieved April 29, 2014, from http://www.arb.ca.gov/cc/capandtrade/auction/february-2014/results.pdf; Nordhaus, W. 2008. A Question of Balance: Weighing the Options on Global Warming Policies. New Haven: Yale University Press.; U.S. Department of Energy, Energy Information Administration. 1998. ***Method for Calculating Carbon Sequestration by Trees in Urban and Suburban Settings***. Retrieved April 29, 2014, from https://urbanforestrysouth.org/resources/library/citations/method-for-calculating-carbon-sequestration-by-trees-in-urban-and-suburban-settings-1

APPENDIX N.
PROJECT & PROGRAM MONITORING & EVALUATION

NCRP and staff work with project proponents and responsible parties to develop simple monitoring plans to track project progress toward project-specific goals. The NCRP intends to develop with and provide to project proponents a comprehensive listing, akin to a menu, of accepted monitoring protocols from which they may choose a suite to suit their project monitoring needs and available financial, human, and temporal resources. It is not necessary, nor appropriate, for a project to use *all* the protocols in their monitoring and reporting). In this way, monitoring/evaluation and adaptive management efforts for the NCRIWMP (and potentially other NCRP projects) will be based on a standard set of methods that can produce "apples-to-apples" comparisons between and among individual Plan projects, and of projects' relative contribution to Plan success. The listing below describes the data management responsibilities related to the project and program evaluation.

Table 67 Data Management and Dissemination

TASK	FREQUENCY
Responsible Party: Project Proponents	
Develop QAPP, determine relevant state agency/program/portal for environmental monitoring upload	Upon grant award
Compile, maintain, and upload project monitoring information to relevant state agency/program/portal	Quarterly or as dictated by grant agreement
Perform quality assurance and quality control to ensure validity of monitoring data	Ongoing
Provide project interim implementation reports and final project report to Humboldt County	Quarterly or as dictated by grant agreement
Responsible Party: NCRP Staff	
Consolidate and present regional information, including detailed analyses of socioeconomic factors (including economic benefits) related to project implementation as appropriate or required	Upon conclusion of grant cycles or periodically
Develop spatial data layers of project locations and other attributes specific to the Nort Coast as appropriate and add to NCRP website interactive application	Periodically
Obtain and provide spatial data layers of interest for planning efforts in the North Coast and add to NCRP website interactive mapping application	Periodically
Provide project application data on NCRP website	Periodically
Compile and provide grant application, meeting, conference, and workshop materials online in the NCRP website's library	Periodically when appropriate

Table 68 Monitoring Protocols for NCRP Project Evaluation

The following list of monitoring protocols for NCRP project evaluation provides links to websites that contain the most relevant and useful (to state data integration efforts) monitoring protocols for NCRP implementation projects. Most of the SWAMP, GAMA, and/or CEDEN comparable and compatible monitoring protocols listed below have been used in NCRP projects.

SALMONID HABITAT IMPROVEMENT

- **SWAMP Data Management System.** Provides a database, templates, field data sheets, QAPP guidance and templates, and webinar trainings. https://www.waterboards.ca.gov/water_issues/programs/swamp/bioassessment/sops.html
  Standard Operating Procedures. Provides detailed SOPs for:
- Macroinvertebrate samples and associated physical and chemical data for ambient bioassessments
- Stream algae samples and associated physical habitat and chemical data for ambient bioassessments
- Field measurements and field collections of water and bed sediment samples
- Lab processing and identification of benthic macroinvertebrates

6. **CDFW Aquatic Bioassessment Lab.** Provides a Benthic Macroinvertebrates Digital Reference Collection. https://www.wildlife.ca.gov/OSPR/Science/Aquatic-Bioassessment-Lab
7. **CDFW Salmonid Stream Habitat Restoration Manual. 2010.** Provides assessment and monitoring methods as well as project evaluation and monitoring protocols. https://www.wildlife.ca.gov/Grants/FRGP/Guidance
8. **CDFW Qualitative Implementation and Effectiveness Monitoring of Fisheries Habitat, 2006.** Includes recommendations for field-tested monitoring protocols. http://cesonoma.ucanr.edu/files/27291.pdf
9. **CDFW Protocols for Monitoring the Response of Anadromous Salmon and Steelhead to Watershed Restoration in California, 2006.** Includes methods for all life stages. https://www.wildlife.ca.gov/Grants/FRGP/Guidance
10. **Monitoring the Implementation and Effectiveness of Fisheries Habitat Restoration Projects, 2005.** Provides descriptions of study design, sampling considerations, and monitoring procedures. https://ucanr.edu/sites/cff/files/255193.pdf

WATERSHED/ HABITAT IMPROVEMENT

1. **California Watershed Assessment Manual. Volume II.** Provides sampling guidance, measurement techniques, and discusses limitations of and appropriate use of data. http://cwam.ucdavis.edu/Volume_2/TOC.htm

   Monitoring Methods. Provides detailed information about monitoring and/ or assessing:

   - Water Quality
   - Fluvial and Geomorphological Processes
   - Periphyton
   - Benthic Macroinvertebrates

2. **California Rapid Assessment Method.** Provides a "cost-effective and scientifically defensible rapid assessment method for monitoring the conditions of wetlands throughout California." Provides access to data spatially in an interactive map, data entry, SOPs for several types of wetland habitats, and other informational and guidance documents. http://www.cramwetlands.org/
3. **California Native Plant Society Vegetation Program.** Provides Rapid Vegetation Assessment and Releve Protocol and field forms. Requests that those who use these protocols send a copy of their datasheets to update statewide CNPS database. http://www.cnps.org/cnps/vegetation/protocol.php
4. **CDFW Survey and Monitoring Protocols and Guidelines.** Protocols from various sources that have been tested and reviewed by CDFW. Survey and monitoring protocols provided for plants, invertebrates, specific amphibians, reptiles, birds and mammals. Also provides a photo point monitoring handbook from the US Forest Service. https://www.wildlife.ca.gov/Conservation/Survey-Protocols
5. **USDA Forest Service Photo Point Monitoring Handbook, 2002.** Provides specific field procedures and concepts and analysis techniques. http://www.fs.fed.us/pnw/pubs/gtr526/
6. **SWRCB Methodology for On-the-Ground Photo Monitoring, 2014.** Specific methodology for establishing and documenting monitoring points. http://www.swrcb.ca.gov/centralcoast/water_issues/programs/ag_waivers/docs/resources4growers/photomonitoringprotocol30april2014_.pdf
7. **SWRCB CWT Stream and Shoreline Photo Documentation SOP.** Available as part of the Guidance Compendium for Watershed Monitoring and Assessment, this SOP provides an equipment list, methods, and forms. http://www.waterboards.ca.gov/water_issues/programs/swamp/cwt_guidance.shtml

WATER QUALITY IMPROVEMENT

1. **SWAMP — Clean Water Team Citizen Monitoring Tool Box, 2014.** Provides a tool box with templates to help manage and organize water quality monitoring data. Field data sheets, calibration data sheets, advanced tools, and project monitoring. http://www.waterboards.ca.gov/water_issues/programs/swamp/cwt_toolbox.shtml
2. **SWAMP — Field Methods Course.** This is a training resource for SWAMP Field Methods. Subjects include water quality, flow, water and sediment sampling, and physical assessments. http://swamp.waterboards.ca.gov/swamp/qapp_advisor/FieldMethods/start.html
3. **SWAMP — CWT Guidance Compendium for Watershed Monitoring and Assessment, 2011.** Comprehensive source for monitoring and assessment — from setting up the monitoring strategy to SOPs for water quality, nutrients, bacteria, biological communities, physical attributes, toxicity, and pollution. http://www.waterboards.ca.gov/water_issues/programs/swamp/cwt_guidance.shtml
4. **CDFW Quantitative Effectiveness Monitoring of Bank Stabilization and Riparian Vegetation Restoration, 2007.** Reports on field testing specific protocols for bank stabilization and riparian vegetation restoration. http://cesonoma.ucanr.edu/files/27283.pdf
5. **UCCE Sediment Delivery Inventory and Monitoring**. Contains inventory worksheet and photo records to provide landowners with tools to inventory and monitor sites that have potentially deliverable sediment. https://anrcatalog.ucanr.edu/pdf/8014.pdf

WATER SUPPLY RELIABILITY

1. **SWAMP — CWT Guidance Compendium for Watershed Monitoring and Assessment, 2011.** Section 4. Provides methods and SOPs for measuring flow. http://www.waterboards.ca.gov/water_issues/programs/swamp/cwt_guidance.shtml

Table 69 Monitoring Plans of the North Coast Region

DEPARTMENT/ COMMISSION/ BOARD	PROGRAM	PROGRAM DESCRIPTION/ PURPOSE	PROGRAM APPLICABILITY
State Water Resources Control Board/ Regional Water Quality Control Board	California Water Quality Monitoring Council (CWQMC)	Mandated by SB 1070 to develop specific recommendations to improve coordination and cost-effectiveness of water quality and ecosystem monitoring and assessment; enhance the integration of monitoring data across departments and agencies; and increase public accessibility to information (web portals). Includes beach water quality, CA wetlands, bioaccumulation workgroups.	Statewide
	Surface Water Ambient Monitoring Program (SWAMP)	Monitors and assesses condition of all surface waters. Current focus on bioaccumulation in fish; characterizing "stream health" throughout the state by use of benthic macroinvertebrate (BMI) community composition and physical habitat assessments in high-gradient streams; misc. special studies. SWAMP is "umbrella" and provides ambient context for additional monitoring efforts.	Statewide
	California Rapid Assessment Method (CRAM)	Methodology and software designed for assessing ambient conditions within watersheds, regions, and throughout the State. It can also be used to assess the performance of compensatory mitigation projects and restoration projects.	Statewide
	California Wetland Tracker	Web portal that provides information about the wetlands of selected regions of California (including North Coast). Wetland information currently available for the North Coast region includes: Habitat (modern habitat map); North Coast Projects (exist but information has not yet been compiled)	Statewide
	California Integrated Water Quality System Project (CIWQSP)	Computer system the state uses to track water quality regulatory data. CIWQS makes data available to the public through reports that display the regulatory data that CIWQS contains.	Statewide
	TMDL implementation monitoring	Monitors water quality conditons in some individual streams/ rivers of the North Coast. May include numeric targets for water quality indicators.	Statewide (not systematic)
	Agricultural Waiver Program monitoring	Facilities receiving waivers from waste discharge permits are required to monitor and assess effects of discharge on water quality.	Regional (North Coast)
	Areas of Special Biological Significance (ASBS) monitoring	These are 34 ocean areas monitored and maintained for water quality by the State Water Resources Control Board Opens a New Window. . ASBS cover much of the length of California's coastal waters. They support an unusual variety of aquatic life, and often host unique individual species. ASBS are basic building blocks for a sustainable, resilient coastal environment and economy.	Statewide
	California Wetland Monitoring Workgroup	T he California Wetland Monitoring Workgroup's mission is to improve the monitoring and assessment of wetland and riparian resources by developing a comprehensive stream, wetland, and riparian area monitoring plan for California and through increasing coordination and cooperation among local, state, and federal agencies, tribes, and non-governmental organizations.	Statewide
	Nonpoint Source Program (NPS) ambient monitoring	Ambient water quality monitoring under the NPS	Statewide (not systematic)
	National Pollutant Discharge Elimination System (NPDES) permit ambient monitoring	Ambient water quality monitoring required under NPDES permits the permit program controls water pollution by regulating and monitoring point sources (e.g. stormwater, animal feeding facilities, sewer overflow) that discharge pollutants into waters.	Permit-specific
	Grant project ambient monitoring	Ambient water quality monitoring under various grant projects.	Grant-specific
	Grant project effectiveness monitoring	Effectiveness monitoring of grant-funded implementation projects.	Grant-specific
	Pesticide Use Inventory	Tracks pesticide/ hazardous waste use	Statewide

DEPARTMENT/ COMMISSION/ BOARD	PROGRAM	PROGRAM DESCRIPTION/ PURPOSE	PROGRAM APPLICABILITY
Department of Pesticide Regulation	Surface Water Protection Program	Characterize pesticide residues, identify sources of contamination, determine mechanisms of off-site to surface water, and develop site-specific mitigation strategies.	Statewide
	na	DTSC regulates and provides information about hazardous waste control and clean up. Collects and analyzes data on water, soil, sediment concentrations.	Permit-specific
Department of Toxic Substances Control	Marine Protection Areas Monitoring Action Plan	Addresses an important MLPA requirement to continue long-term monitoring to facilitate adaptive management of the MPA Network. The Action Plan informs next steps for long-term monitoring by compiling work to date, as well as incorporating novel, quantitative, and expert informed approaches. The Action Plan prioritizes key measures and metrics, habitats, sites, species, human uses, and management questions to target for long-term monitoring and aid in the evaluation of the Network in meeting the goals of the MLPA.	Statewide (coast)
California Department of Wildlife	California Natural Diversity Database (CNDDB)	Inventories the status and locations of rare plants and animals in California. Maintains current lists of rare species a database of GIS-mapped locations for these species.	Statewide (non-random, not systematic)
	Department of Wildlife Marine Region	One of seven geographic CDFG regions. Specific statewide projects deal with fisheries and habitat management, environmental review, and water quality monitoring. The Project Review/ Water Quality Unit staff reviews activities that impact marine habitat and resources, such as dredging, new construction, and wave energy. Includes monitoring of marine invasive species.	Statewide (coast) out to approximately three nautical miles , including offshore islands
	Biogeographic Information and Observation System (BIOS)	A system designed to enable the management, visualization, analysis and sharing of biogeographic data collected by the Department of Fish and Game and its Partner Organizations.	Statewide
	Aquatic Bioassessment Laboratory	Performs assessments of water quality based on organisms in the water. Field sampling protocols include targeted riffle and multiple habitat sampling of benthic macroinvertebrates (BMIs), fish and algae as well as associated physical habitat and chemical monitoring. Current research efforts focus on developing IBIs for different regions, developing objective reference condition selection methods and establishing quantitative tolerance values.	Statewide
	California Statewide Wetlands Inventory Initiative	The California Statewide Wetlands Inventory is a State Wetlands Conservation Policy (1993) initiative. Under this initiative, the wetlands inventory will compile U.S. Fish and Wildlife Service National Wetland Inventory and other available data into a comprehensive statewide wetlands datalayer.	
	Invasive Species Program	Involved in efforts to prevent the introduction of invasive species (plant, animal, microbe, terrestrial, aquatic) into the state; detect and respond to introductions when they occur; and prevent the spread of non-native invasive species that have become established.	Statewide
	Office of Oil Spill Prevention and Recovery	Administers the Scientific Study and Evaluation Program that investigates and evaluates new oil spill response and cleanup methods, potential adverse effects of oil spills, and development of natural resource damage assessment tools.	Statewide
	Cooperative Research and Assessment of Nearshore Ecosystems (CRANE)	Involves the integration of several study (e.g., habitat mapping, life history research, oceanography) and sampling approaches (e.g., fishery-dependent and independent CPUE estimates, ROV surveys, plankton-larval surveys) in shallow rocky reef ecosystems.	Central California/ Monterey (only?)
	Critical Coastal Areas Program	Protects high resource-value coastal waters from polluted runoff. Brings awareness to the marine litter problem and provides a community event for direct involvement.	Regional Pilot Projects
California Coastal Commission	Coastal Cleanup Day debris tracking	Protects high resource-value coastal waters from polluted runoff. Brings awareness to the marine litter problem and provides a community event for direct involvement. Emphasizes technology to measure and map surface currents.	Statewide (coast)
	Coastal Oceans Currents Monitoring Program		Statewide (coast)
Coastal Conservancy	Marin Invasive Species Program	Updates on regulations, statutes, communications, technical advisory groups, and legislation.	Statewide (coast)

DEPARTMENT/ COMMISSION/ BOARD	PROGRAM	PROGRAM DESCRIPTION/ PURPOSE	PROGRAM APPLICABILITY
State Lands Commission	The Inventory, Monitoring, and Assessment Program (IMAP)	Evaluates the natural resources of the State Park System. Data are generally quantitative. Examples include measuring stream water quality; the distribution of various species of plants in an area; and counting the number of offspring of endangered animals. The data can be used to make status assessments of a unit's natural resources, such as what resources are present, where the resources are distributed, and how much of a resource is present.	Regional pilot projects; not yet statewide [as of 2008]
Department of Parks and Recreation	The Fire and Resource Assessment Program (FRAP)	Provides a variety of products including the Forest and Range Assessment, a detailed report on California's forests and rangelands. FRAP provides extensive technical and public information for statewide fire threat, fire hazard, watersheds, socio-economic conditions, environmental indicators, and forest-related climate change.	Statewide, including monitoring at the Caspar Creek watershed, Judd Creek, SF Wages Creek, Garcia River, Elk River, Little Creek.
Department of Forestry and Fire Protection (CalFire)	Monitoring Study Group	The MSG has, and continues, to: (1) develop a long-term program testing the effectiveness of California's Forest Practice Rules, and (2) provide guidance and oversight to the California Department of Forestry and Fire Protection (CAL FIRE) in implementing the program.	Statewide
	Integrated Water Resources Information System (IWRIS)	Data management tool for water resources data. Web based GIS application allows one to access, integrate, query, and visualize multiple sets of data. Some of the databases include DWR Water Data Library, California Data Exchange Center (CDEC), USGS streamflow, Local Groundwater Assistance Grants (AB303), and data from local agencies.	Statewide
Department of Water Resources	Division of Environmental Services	Provides data related to drinking water quality and provides a central focal point for the collection and dissemination of water quality information.	Regional (Sacramento-San Joaquin Delta and the State Water Project)
	Division of Operations and Maintenance	Routinely monitors chemical, physical and biological parameters including more than 40 sites and over 200 individual chemicals. Both discrete grab samples and continuous automated station data comprise a comprehensive water quality monitoring program.	Regional (throughout the SWP from the Feather River drainage in the north and to Lake Perris in the south)
	Real-time Data and Forecasting-Comprehensive Program	Produces weekly reports with current and forecasted water quality conditions.	Regional (Lower San Joaquin River)
	Fish Passage Improvement Program (FPIP)	Interdisciplinary team of biologists and engineers identifies and evaluates the potential to modify or remove structures that impede the migration of anadromous fish within the Central Valley.	Regional (Central Valley)
	Flood Emergency Response Information Exchange (FERIX)	Provides participating agencies an online system to access and exchange current flood information in real-time through Web GIS interface. It integrates geo-referenced databases, a real-time data collection and exchange system, and a decision support system supporting other DWR programs, various hydrologic and hydraulic computer models and tools, and applicable flood-related documents.	Statewide
	Farmland Mapping and Monitoring Program	The Farmland Mapping and Monitoring Program (FMMP) produces maps and statistical data used for analyzing impacts on California's agricultural resources. Agricultural land is rated according to soil quality and irrigation status. The maps are updated every two years with the use of aerial photographs, a computer mapping system, public review, and field reconnaissance.	Statewide
Department of Conservation	California Geological Services	Provides data on seismic, as well as landslide and erosion hazards. It develops and maintains watershed maps of geologic and geomorphic features.	Statewide
	Marine Biotoxin Monitoring Program	Surveys, classifies & monitors commercial shellfish growing areas	Statewide (coast)

DEPARTMENT/ COMMISSION/ BOARD	PROGRAM	PROGRAM DESCRIPTION/ PURPOSE	PROGRAM APPLICABILITY
California Department of Public Health	Drinking Water Source Assessment and Protection Program	Assess risks to public drinking water sources. Provides guidance and information to local communities to delineate the area around a drinking water source through which contaminants might move and reach that drinking water supply; to inventory possible contaminating activities that might lead to the release of microbiological or chemical contaminants within the delineated area; and to determine the possible contaminating activities to which the drinking water source is most vulnerable.	Statewide
	California Beaches and Recreational Waters Program	The California Beaches Program provides guidance and methods for monitoring recreational beaches (ocean, and fresh water).	Statewide (coast)
	na	Collects data by testing the untreated, raw water in different types of wells for naturally-occurring and man-made chemicals. GAMA compiles these test results with existing groundwater quality data from several agencies into a publicly-accessible internet database, GeoTracker GAMA.	Statewide
Groundwater Ambient Monitoring and Assessment (GAMA)	Environmental Monitoring Program	Provides necessary information for compliance with flow-related water quality standards specified in the water right permits	Regional (San Francisco Estuary)
Interagency Ecological Program	na	Provides a consistent scientific foundation for collaborative watershed restoration efforts and to better meet the State needs for protecting and restoring salmon species and their habitats. NCWAP is one of the sources of data used in regional TMDL development to understand existing conditions within a watershed	Regional (North Coast)
The North Coast Watershed Assessment Program (NCWAP)	Anadromous Abundance	Data collected by a variety of agencies and organizations and reflect current and historic abundance of anadromous fish in a selected stream or river.	Statewide
CalFish	Anadromous Distribution	Recently developed a method for deriving salmonid distribution from existing observation data. Distribution and Range datasets are now available for winter and summer steelhead and coho salmon.	Statewide
	Passage Assessment Database (PAD)	Contains information on actual, potential and remediated barriers to anadromous fish distribution.	Statewide
	California Habitat Restoration Project Database	Contains data and information about stream restoration projects funded by a variety of agencies and organizations in California; the most complete source of California stream restoration projects' data.	Project-specific
	California Hydrography	California Hydrography datasets fulfill California's need of hydrography for visualization and mapping, as well as a common spatial base for in depth analysis of multiple data sets.	Statewide
	Stream Habitat Database	Historic and current reach summaries of in-stream habitat data.	Regional (Del Norte to Santa Cruz counties)
	California Ecological Restoration Projects Inventory; Watershed Projects Inventory; and Noxious Weed Control Inventory	Online information resource for maps, models, reports, and other related information regarding environmental protection in California.	Statewide
Natural Resources Project Inventory	na	Forum for coordinating state, federal, and tribal aquatic habitat and salmonid monitoring programs. Includes watershed and project effectiveness monitoring.	Pacific Northwest, including Northern California
Pacific Northwest Aquatic Monitoring Partnership	na	Annual reports website has the latest Watershed condition evaluations, field protocols, watershed boundary maps and data summaries.	Northern California, Oregon, Washington

Table 70 Indicators to Measure Attributes of Social & Environmental Equity

ATTRIBUTE	QUALITATIVE/ QUANTITATIVE INDICATOR	EXAMPLE METRICS
Quality of Life	Access to parks and open space	# new public access points in DACs
	Access to water-contact recreation	# of water quality warnings/ beach closures on public beaches — both coastal and inland — for DACs
	Presence of living wage jobs	# FTE funded by NCRP project implementation
Preservation of Local Heritage and Autonomy	Projects that support/ maintain local heritage or local autonomy	# local individuals — farmers, ranchers, property owners, voluntarily participating to implement TMDLs prior to enforcement/fines
		# DACs receiving assistance for critical water supply/ wastewater treatment infrastructure repair
		# energy efficiency and energy independence projects funded or enabled through the NCRP
Community Empowerment	Alliance building	# partners in NCRP/ signatories to MOMU
		Increased levels of collaboration for project types (local to regional/state/Tribal/federal)
		Increased breadth/diversity of partnership — sections of community represented
		# of groups who come together to work on a project
		# new connections formed between groups — e.g., WS/ WWTP outreach — documentation of meeting attendance, partnerships formed (potential resource pooling), etc.
Public Participation	Increased levels of participation in decision-making	# meeting/ conference attendees
		Increased breadth of participation (i.e., the extent to which participants reflect community diversity)
		# comments on draft NCRP documents/ policies
	Increased number of grant applications	# applicants
Public Knowledge	Increased awareness of community-wide issues	% knowledgeable survey respondents
		# visits to NCRP website
		# downloads of specific documents from NCRP website

APPENDIX O. REPORTS COMMISSIONED FOR THE NCRP

Since its inception in 2005, the NCRP has generated supplemental reports to inform NCRP decision-makers and stakeholders and to support the NCRP Plan and processes. Reports are commissioned at the request of and with approval from the PRP and TPRC and are generally produced by professional consultants, with the participation of NCRP staff and with advisory input from the PRP and TPRC. The reports produced or in development for the NCRP Plan (as of summer 2019) can be found at the NCRP website[27]. Reports include

- Biomass Energy in the North Coast Region: Report, The Watershed Center, 2011
- Climate Change Vulnerability Assessment for the North Coast, 2[ND]Nature, 2013
- Climate Change and Agriculture in the North Coast, Rose Roberts, 2009
- NCRP Energy Independence, Emissions Reduction, Job Creation, and Climate Adaptation Initiative, NCRP, 2011
- NCRP Regional Strategy for Small Disadvantaged Water and Wastewater Providers, Humboldt County, 2013
- Northwest California Sustainable Energy and Water Conservation Outreach, Five County Salmonid Conservation Program, 2010
- North Coast Floodwater and Stormwater Management Plan, NCRP, 2014
- North Coast Land Use and Regional Planning Report: Partners and Planners Interviews Synthesis, 2013
- A Review of Economic and Financial Issues for the NCRP, NCRP, 2009
- Healthy Watersheds, Vital Communities, Thriving Economies: Actionable Strategies for the North Coast Region, NCRP, 2018
- Climate Mitigation Report for the North Coast Region of California, 2018
- North Coast Regional Climate Adaptation Strategies, 2018
- Climate and Natural Resources Analysis and Planning for the North Coast Resource Partnership, 2018
- Carbon Inventory Estimates for the North Coast, Dogwood Springs Forestry, 2017
- North Coast Irrigation Water and Regtigation Management Tool, 2017
- A Review and Assessment of Potential Funding Sources for the North Coast Resource Partnership, 2017
- North Coast Resource Partnership Integrated Strategic Plan: Climate Change Mitigation, GHG Emissions Reduction and Energy Independence, 2017
- Greenhouse Gas Emissions Assessment Roadmap for the NCRP, 2017
- Assessment to Improve late Spring/ Summer Stream Flows, Reduce Fire Intensity and Fire Related Carbon Emissions in the Trinity River Watershed, 2017
- Economic Valuation of Natural Capital and Economic Analysis for Trinity River Water, 2017
- Biomass Energy in the North Coast Region, The Watershed Research and Training Center, 2017
- Site Resilience and Critical Essentail Services Model Toolkit, 2016
- Guide for Tribal Renewable Energy Sovereignty Master Planning, 2016
- Decentralized Wastewater Treatment System Planning Model, 2016
- Planning Guide for Development of Tribal Environmental Protection Ordinances, 2016
- Model Tribal Environmental Enforcement Response Plan, 2016
- Technical Report for the North Coast of California Ecosystem Valuation, 2016

27 Searchable by filter on the NCRP website at https://northcoastresourcepartnership.org/resources/

APPENDIX P. PUBLISHED REFERENCES

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