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Appendix A

Glossary of Terms

Glossary of Terms

50-Year Flood: A flood whose flow has a two percent chance of being exceeded in any given year and has smaller peak flows than a 100-year flood.

100-Year Flood: A flood whose flow has a one percent chance of being exceeded in any given year.

303(d) List: Section 303(d) of the Clean Water Act requires states to identify waters that do not meet water quality standards and to classify them by category. States must submit their lists to the U.S. EPA for review and approval. These state-developed lists are known as Section 303(d) lists of impaired waterbodies (stream/river segments, lakes).

Acre-foot (AF): The amount of water necessary to cover an acre (43,560 square feet) to a depth of one foot, or 43,560 cubic feet, which is equivalent to roughly 326,000 gallons.

Adaptation: Adjustments to actual or anticipated climate changes and their impacts. Human intervention to reduce harm or take advantage of beneficial opportunities may help facilitate adjustments to expected climate changes and their effects.

Adaptive Capacity: The ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.

Asset: A resource, structure, facility, or service that is relied on by a community.

Atmospheric River: A flowing column of condensed water vapor in the atmosphere that produces significant rain and snow, especially in the Western United States. When these systems move inland and over mountains, the water vapor rises and cools to create heavy precipitation. While many atmospheric rivers bring beneficial rain or snow, stronger ones can cause extreme rainfall, floods, mudslides, and severe damage to life and property.

Baseflow: The portion of streamflow sustained between precipitation events via delayed pathways (e.g., shallow groundwater), critical for maintaining dry-season flow and aquatic habitat. In the Ventura River, groundwater pumping influences baseflow in critical reaches.

Backwater Flooding: A type of flooding that occurs when the flow of a river to the ocean is "backed up" by exceptionally high ocean water or sand berms. This phenomenon is exacerbated by rising sea levels and can increase coastal flooding hazards at river mouths.

Cascading Impact: The effects of climate hazards that compromise infrastructure or disrupt critical services (such as power supply or water conveyance), thereby expanding the scope of impact beyond a single entity to interconnected subsystems and populations.

Climate Change: A change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties, which persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use.

Climate Drivers: The processes, variables, and phenomena in the atmosphere and ocean that influence weather patterns over multiple spatial and temporal scales. Key drivers include precipitation and temperature, as they influence long-term weather patterns in an area and determine the region's climate characteristics. Changes in climate drivers can result in extreme weather events (i.e., climate hazards) that can impact people, services, infrastructure, and natural systems. Changes in climate

drivers are caused by an increase in the proportion of greenhouse gasses in the atmosphere from human-caused sources of change to the earth's climate.

Climate Hazard: An occurrence of a physical event or physical trend, like an extreme heat event, extreme rain event, sea level rise or wildfire, that arises from changes in climate drivers. A climate hazard poses risk to people, services, infrastructure or natural systems in the watershed. Hazards are usually the immediate physical precursors to negative climate impacts.

Climate Impact: The immediate felt effect of a climate hazard on the people, services, infrastructure, and natural systems. Climate impacts could include flooding of homes, seawater intrusion in groundwater aquifers, habitat and biodiversity loss, and degraded air quality. For example, if droughts (a climate hazard) are likely to become more frequent and severe, a potential climate impact to farmers is less water available for irrigation.

Climate Indicator: A measure of a particular aspect of the Earth's climate that can be tracked over time to show trends and changes.

Co-benefit: A beneficial effect (ecological, economic, or social) that occurs in addition to the primary objective of a project or policy.

Compounding Risk: When two or more extreme events or average events occur simultaneously and increase the scope of impact or severity of the event; an additional risk brought about by increased frequency of events from climate change.

Consequences: Damages (full or partial), injuries, and losses of life, property, environment, and business that can be quantified by some unit of measure, often in economic or financial terms. For example, if a flood damages a factory, the consequences include the cost to repair the building, replace damaged equipment, and the loss of production during recovery.

Cultural Resources System: Includes Native American practices, such as subsistence fishing, and historical sites, ethnobiologically significant natural resources, and culturally important landscape elements. These resources play a vital role in local cultural practices and offer insights into the region's prehistory and history.

Discharge: In the context of water quality regulations, "discharge" is the release of waste to surface water or to the ground.

Drought: When supply does not meet demand for water, which has been met in the past. Drought tends to be associated with lower-than-average precipitation periods, though it can be driven by increases in demand and ambient temperatures. Dry or warm periods can lead to reduced surface water flows, reduced surface and groundwater storage, and increased water quality challenges, such as harmful algal blooms.

Ecosystems: A complex network of all organisms in a given area, as well as the abiotic factors with which they interact; a community and its physical environment.

El Niño: Characterized by weakened trade winds and warm water moving east toward the Americas, the El Niño climate phenomenon typically results in drier, warmer conditions in the northern U.S. and Canada, and wetter conditions with increased flooding in the U.S. Gulf Coast and Southeast. El Niño and La Niña (defined below) are opposing climate patterns within the El Niño-Southern Oscillation cycle that disrupt normal Pacific Ocean conditions, impacting global weather, wildfires, ecosystems, and economies.

Environmental Water: Water serving environmental purposes, including instream fishery flow needs, wild and scenic river flows, water needs of fresh-water wetlands, and Bay-Delta requirements. It also encompasses the minimum flow levels of specific quality needed to ensure the continued viability of fish and wildlife resources for a particular water body.

Ethnobiologically Significant Natural Resources: Encompass plants, animals, and geographic features such as mountains and sloughs which are associated with the cultural practices or beliefs of a living community, rooted in that community's history, and important for maintaining its continuing cultural identity.

Eutrophication: Nutrient enrichment causing excessive primary productivity, reduced dissolved oxygen, and potential fish kills. Addressed through the Ventura River nutrient TMDL.

Exposure: The degree to which assets, services, resources, and infrastructure are susceptible to adverse effects from climate hazards. It encompasses the projected severity of climate change impacts on populations and community assets, including the number, types, qualities, or monetary values of properties, infrastructure, and lives that may be affected by hazardous events.

Extreme Heat: Temperatures that are significantly hotter and/or more humid than average. It typically includes periods of high heat and humidity with temperatures exceeding 90 degrees Fahrenheit for at least two to three days.

Extreme Precipitation: Instances during which the intensity or amount of rain or snow experienced in a location substantially exceeds what is normal. These events can be measured by tracking their frequency, examining their return period (the chance that the event will be equaled or exceeded in a year), or directly measuring the amount of precipitation in a certain time period (for example, inches of rain falling within 24 hours).

Fire Regime: The pattern, frequency, and intensity of wildfire disturbance in an area over long periods of time. Drought can create a more aggressive fire regime with an increased occurrence of "megafires" by increasing dry vegetation, which raises ignition risk and leads to rapidly spreading wildfires.

Flood: A temporary condition of partial or complete inundation of normally dry land or properties due to overflow of waters, rapid accumulation or runoff of surface waters, mudflow, or land collapse/subsidence caused by erosion or undermining from waves or currents exceeding expected levels.

Flood Management System: The network of natural and engineered structures that conveys high flows or prevents inundation of land with the intent of reducing the impacts of flooding on communities, infrastructure, and the environment. Major components of the Flood Management System in the watershed include reservoirs, levees, floodplains, wetlands, and local drainage infrastructure.

Floodplain Function: The capacity of floodplains to store floodwaters, support riparian habitat, recharge groundwater, and improve water quality.

Fosberg Fire Weather Index (FFWI): A metric estimating fine-fuel fire potential from temperature, relative humidity, and wind speed; often summarized as "days above critical threshold" for fire-weather risk screening.

Groundwater Budget: An accounting of recharge, withdrawals (discharge), and changes in storage for an aquifer system. The WRP summarizes basin-specific components for Upper Ojai, Ojai Valley, Upper Ventura River, and Lower Ventura River basins.

Groundwater Management System: Includes water stored in underground aquifers (i.e., groundwater basins or subbasins) and the collection of natural and engineered infrastructure, natural processes, and management practices that contribute to recharge, storage, and withdrawal.

Harmful Algal Bloom (HAB): A rapid growth of algae or cyanobacteria that can impair water quality, harm aquatic life, and threaten human health. The watershed's nutrient TMDL targets these conditions.

Hazard: An event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural losses, environmental damage, interrupted business, or other types of harm or loss.

Hydrograph: A graph of stream discharge versus time at a specific location, used to understand flood peaks, recession, and baseflow contributions.

Hydrologic Drought: A period of below-normal water availability in rivers, reservoirs, and groundwater due to extended precipitation deficits and/or elevated evapotranspiration, often reflected in reduced streamflow and groundwater levels. Reduced baseflow during drought is a key local effect.

Hydrologic Unit Code (HUC): A USGS system for delineating and classifying drainage areas at nested spatial scales.

Impact: Effects on natural and human systems or assets, such as lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure, resulting from the interaction between climate hazards and the vulnerabilities of the affected system or asset.

Indicator: An observable phenomenon that can be used to monitor progress towards the ability of a system in the watershed to withstand, adapt to, and recover from climate hazards, land use changes, and other environmental stressors. For example, if a watershed resilience outcome is "efficient use of water" an indicator would be "reuse of water supply."

La Niña: A climate phenomenon characterized by stronger trade winds pushing warm water toward Asia, increased upwelling of cold, nutrient-rich water off the Americas' west coast, and resulting in drought in the southern U.S., heavy rains and flooding in the Pacific Northwest and Canada, warmer winter temperatures in the South, cooler temperatures in the North, and potentially more severe hurricane seasons.

Managed Aquifer Recharge (MAR)/Spreading Grounds: Engineered practices and facilities that enhance infiltration of surface water (e.g., stormflows, treated water) to groundwater; locally exemplified by the San Antonio Creek Spreading Grounds. The reconstructed basins recharge the Ojai Valley Groundwater Basin, contingent on hydrology and approvals.

Marine Stratus (Coastal Fog): Low-level coastal clouds that moderate temperature and evaporative demand, reduce drought stress for vegetation, and can temper coastal heat waves. Long-term observations indicate declining fog along the Southern California coast, with implications for higher evaporative stress and heat extremes in low-lying coastal areas.

Maximum Contaminant Level (MCL): Enforceable drinking water quality standards.

Meteorological Drought: A prolonged period of precipitation below the long-term average for a region, typically the earliest stage of drought that can propagate to hydrologic and agricultural impacts.

Mitigation: An act or sustained actions to reduce, eliminate, or avoid negative impacts or effects. General mitigation refers to strategies aimed at reducing risks and negative impacts in contexts such as disaster risk reduction or pollution control. Climate change mitigation refers to a human intervention to

reduce human impacts on the climate system, including strategies to reduce greenhouse gas emissions and enhance greenhouse gas sinks.

Nighttime (Minimum) Temperature: The daily minimum temperature, used to assess limited nocturnal cooling that compounds heat stress and health risk.

Nonpoint Source: Diffuse contamination of water or air that does not originate from a single, identifiable source. Instead, it results from various widespread activities, such as land runoff, precipitation, atmospheric deposition, drainage, and seepage.

Nutrient Loading: Inputs of nitrogen and phosphorus to waterbodies from point and nonpoint sources, driving eutrophication and harmful algal blooms. In the Ventura River, nutrient impairments are a central problem addressed via TMDLs.

Oak Woodland: An oak stand with a greater than 10 percent canopy cover or that may have historically supported greater than 10 percent canopy cover.

Outcome: The tangible, long-term result of implementing strategies and actions to enhance a watershed's ability to adapt to and recover from environmental and climatic changes. For example, “efficient use of water”, or the “ability of people to evacuate or otherwise avoid harm.”

Overburdened Community: a population that experiences **disproportionate environmental and climate risks due to cumulative exposure to pollution, environmental hazards, and social vulnerabilities such as low income, language barriers, or limited access to resources and services.**

Pathogen: Microorganisms (e.g., bacteria, viruses) that can cause disease in humans, animals, or plants; often elevated downstream of septic failures and some livestock/urban sources. Elevated indicator bacteria are a documented local impairment.

Point Source: Contaminants that enter the environment from a single, identifiable source. Examples include discharge pipes, smokestacks, and drainage ditches from factories, sewage treatment plants, and other industrial facilities.

Potential Evapotranspiration (PET): The combined loss of water through the plant’s transpiration process via its vascular system, and evaporation of water from the earth’s surface.

Resilience: The capacity of an entity (an individual, community, organization, or natural system) to prepare for disruptions, recover from shocks and stresses, and to adapt and grow from disruptive experiences, while maintaining essential functions, identity, and structure.

Resilience Portfolio: A bundled set of adaptation strategies and actions—organized by system, geography, or hazard—to achieve targeted outcomes and co-benefits.

Return Period: The average interval (in years) between events of a given magnitude or greater (e.g., a “100-year” event has a 1% annual chance), often paired with Annual Exceedance Probability to avoid misinterpretation.

Riparian Buffer: Vegetated areas adjacent to streams that filter pollutants, stabilize banks, provide shade (cooling), and support habitat connectivity. Loss of riparian function is a documented local challenge.

Risk: Commonly considered to be the combination of the likelihood of an event and its consequences – i.e., risk equals the probability of climate hazard occurring multiplied the consequences a given system may experience.

Runoff: The flow of water across the land surface that accumulates when the rainfall rate exceeds the infiltration capacity of soil. It is the water from precipitation that flows down gradient and does not seep into the ground to replenish groundwater. It is a major transporter of nonpoint-source pollutants, such as fertilizers, pesticides, and heavy metals, to rivers, streams, and lakes. These pollutants can harm aquatic ecosystems and degrade water quality.

Sea Level Rise: An increase in ocean water levels due to climate change, such as ocean warming and glacier melting. Past and future sea level rise at specific locations on land may be more or less than the global average due to local factors (e.g., ground settling, upstream flood control, erosion, regional ocean currents).

Secondary Maximum Contaminant Level (SMCL): Non-mandatory water quality standards related to esthetic factors, such as taste, staining, and color. These standards are important because they ensure drinking water is acceptable to consumers, as poor taste, odor, or appearance can lead to public dissatisfaction and reduced usage, even if the water is safe to drink.

Sediment Transport: The movement of sediment by flowing water that maintains channel form, habitats, and coastal sediment supply; interruptions (e.g., dams) contribute to downstream habitat loss and erosion.

Sedimentation: The process of particles suspended in water settling to the bottom, forming a layer of sediment. Sedimentation poses risks such as reducing the water storage capacity of dams or accumulating in excess downstream, increasing channel instability and creating new erosion areas.

Sensitivities: The degree to which a system or species is affected, either adversely or beneficially, by climate variability or change. The effect may be direct, such as higher temperatures changing crop yield, or indirect, such as sea level rise causing damages due to coastal flooding.

Siltation: The accumulation of fine particles, such as silt and clay, in water bodies, often resulting from soil erosion. Wildfires can increase siltation in watersheds by depositing ash and debris into reservoirs, which can affect water quality and aquatic habitats. Siltation is a form of water pollution, with effects such as harming fish spawning habitats by reducing oxygen-rich water flow to fish eggs.

Snow Water Equivalent: The depth of water that would cover the ground if the snow cover were in a liquid state.

Soil Moisture Deficit: The shortage of water in the soil profile available to plants, contributing to agricultural drought and increased irrigation demand.

Standardized Precipitation Index (SPI): A precipitation-only index that quantifies wet and dry conditions over selectable time scales.

Standardized Precipitation-Evapotranspiration Index (SPEI): A drought index incorporating precipitation and temperature to represent climatic water balance.

Storm Surge: The temporary increase, at a particular locality, in the height of the sea due to extreme meteorological conditions (low atmospheric pressure and/or strong winds). It is the excess sea level above what is expected from tidal variation alone at that time and place.

Stormwater Management System: Natural features and built infrastructure that collect, convey, and treat runoff from storms to reduce flood and water-quality impacts.

Subwatershed: A smaller watershed within a larger watershed, each defined by topographic ridgelines that channel water into the main river system.

Surface Water-Groundwater Interaction: Bidirectional exchanges where shallow groundwater sustains baseflow and surface waters recharge aquifers; pumping can reduce baseflows and affect critical habitat. Documented as a key issue in the Upper Ventura River Basin.

Take: To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect any threatened or endangered species. Incidental take permits authorize the incidental take (i.e., take that occurs incidentally during an otherwise lawful activity) of a listed species, such as steelhead.

Viable Population: A population with a negligible (less than five percent) risk of extinction over 100 years due to demographic, environmental, and genetic factors. It must be spatially dispersed yet close enough to ensure long-term persistence and evolutionary potential over 1,000 years.

Vulnerability: The degree to which systems, individuals, or communities are susceptible to harm due to exposure to stressors and their inability to adapt. In disaster risk management, vulnerability includes the characteristics and situations that influence the capacity to anticipate, cope with, resist, and recover from adverse physical events. In the context of climate change, vulnerability is the degree to which a system is susceptible to and unable to cope with adverse effects, including climate variability and extremes.

Wastewater: Includes any combination of water, soap, food scraps, and human excrement that is flushed down toilets, sinks, and shower drains. Wastewater can contain a wide variety of constituents known to affect water quality, including pathogens, bacteria, nutrients, pharmaceuticals, perfumes, and toxic chemicals. Wastewater includes both “blackwater” (wastewater from toilets) and “graywater” (all used household water except blackwater).

Watershed Network: The convening of interested parties (anchored by the Ventura River Watershed Council) to provide insight on watershed conditions and priorities at key WRP milestones.

Water Quality System: The set of parameters and properties measurable in natural water bodies, aquifers, and associated built infrastructure. As opposed to other water resource systems which consist of infrastructure and other physical components, the Water Quality System is comprised of the metrics, indicators, and regulatory constituent levels of surface water and groundwater resources themselves.

Watershed Connectivity: The hydrologic and ecological linkages among streams, wetlands, floodplains, and aquifers that enable flow, sediment movement, and species passage; disconnection (e.g., armoring/channelization) degrades habitat and recharge potential.

Watershed Performance Indicator: A metric used to track the success of specific actions, projects, or policies in achieving targeted goals. Measures short- and mid-term effectiveness of interventions and implementation progress.

Watershed Resilience Metric: A specific, measurable value or data point used to evaluate progress toward achieving a watershed resilience performance indicator and outcome. For example, if an outcome is to achieve “efficient use of water,” and the indicator is “reuse of water supply” a metric would be “annual volume of recycled water produced.”

Water Supply System: The sources of local and imported water and the network of infrastructure that collects, treats, stores, and distributes water to meet water demand.

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Appendix B

Related Reports, Resources, and Programs

Ventura River Watershed Resilience Plan Related Reports, Resources and Programs

Entity Name	Document or Program Title	Year Published	Website Link
Agricultural Partners (multiple)	Resilient Agricultural Lands Initiative Strategic Plan	2023	https://s44345.pcdn.co/agricultural-commissioner/wp-content/uploads/sites/15/2024/02/Ventura-County-Resilient-Agricultural-Lands-Initiative-RALI.pdf
Agricultural Partners (multiple)	Resilient Agricultural Lands Initiative Strategic Plan - Appendix	2023	https://s44345.pcdn.co/agricultural-commissioner/wp-content/uploads/sites/15/2024/02/RALI-Appendix.pdf
Barbareño/Ventureño Band of Mission Indians (BVBMI)	BVBMI is a self-governing group of Chumash people from Santa Barbara and Ventura counties in California. The tribe's members trace their ancestry to the Barbareño, Ventureño, and Island Chumash territories, and they live on their unceded ancestral homelands	–	https://www.bvbmi.com/
California Department of Fish and Wildlife	California Fish and Wildlife Ventura River Instream Flow Studies; models to assess Steelhead passage	2021	https://wildlife.ca.gov/Conservation/Watersheds/Instream-Flow/Studies/Ventura-River-Studies
California Department of Water Resources	Watershed Resilience Program (part of California Water Plan)	2023	https://water.ca.gov/Work-With-Us/Grants-And-Loans/Watershed-Resilience-Program
California State Water Resources Control Board	Groundwater-Surface Water Flow Model for Ventura River	2024	https://www.waterboards.ca.gov/waterrights/water_issues/programs/instream_flows/cwap_enhancing/ventura_river.html
City of Ventura – Ventura Water	Relevant Documents: 2025 Comprehensive Water Resources Report; 2024 Comprehensive Water Resources Report – see climate change considerations and resilience (Table 5-3), and programs/policies including water conservation (Section 6); 2021 Water Efficiency Plan; 2020 Water Shortage Event Contingency Plan; 2020 Urban Water Management Plan; Annual Consumer Confidence Reports; State Water Interconnection planning documents	Various	https://www.cityofventura.ca.gov/1081/Library-of-Reports
City of Ventura Community Development	General Plan Update Development Process	2024	https://www.planventura.com/
City of Ventura Community Development	Current General Plan/ Local Coastal Program	–	https://www.cityofventura.ca.gov/485/General-Plan
City of Ventura Community Development	Climate Action and Resilience Plan (includes Climate Vulnerability Assessment)	2022	https://www.planventura.com/related-projects

Entity Name	Document or Program Title	Year Published	Website Link
City of Ventura Sustainability Division	Miscellaneous programs for city residents and businesses to promote sustainable resource use	Ongoing	https://www.cityofventura.ca.gov/194/Environmental-Sustainability
County of Ventura – Resource Management Agency	General Plan Update 2040 – Includes Water Resources Element, Agricultural Element and Climate Action Plan, Environmental Justice and more	2020	https://egeneralplan.venturacounty.gov/
County of Ventura – Office of Emergency Services	Multi-Jurisdiction Hazard Mitigation Plan	2022	https://www.readyventuracounty.org/county-plans/
County of Ventura	Sustainability Programs – Focus on Energy and Climate Change	Ongoing	https://sustain.venturacounty.gov/
County of Ventura – Public Works Agency	Matilija Dam Ecosystem Restoration Project (MDERP) Information	Ongoing	https://matilijadam.venturacounty.gov/
Paul Jenkin Blog on behalf of Surfrider Foundation	A "web log" (blog) record of issues affecting the Ventura River watershed and coast. Developed to illustrate the interconnectedness of various actions and the need for a coordinated strategy often referred to as "ecosystem-based management," the site contains references and comments on technical issues relating to coastal management, dam removal, stormwater and water management. Topics dating back to 2007 may be sorted by label or searched within the site.	Ongoing	https://www.venturariver.org/
Merito Foundation	Focus on protecting the ocean by facilitating education, conservation, and scientific research opportunities to multicultural youth and their communities	Ongoing	https://www.meritofoundation.org/
Ojai Basin Groundwater Sustainability Agency	OBGMA Groundwater Sustainability Plan	2022	https://www.obgma.com/files/7cec7cf1a/FINAL+GSP_Combined_reduced.pdf
Ojai Valley Fire Safe Council	Community Wildfire Protection Plan	2024	https://firesafeojai.org/wp-content/uploads/2024/09/CWPP_FINAL_FullVersion.pdf
Ojai Valley Fire Safe Council	Project #4 – Fine Scale Hazard, Risk and Vulnerability Mapping; Embercast Modeling Report	Ongoing	https://firesafeojai.org/wp-content/uploads/2024/09/Fine_Scale_Risk_Mapping.pdf
Ojai Valley Land Conservancy	Program information regarding stewardship, rewilding, native plants, removal of invasives. Includes focus topics: fire, water, habitat and biodiversity and community character	–	https://ovlc.org/about
Once Upon a Watershed	Education Program	Ongoing	https://www.onceuponawatershed.org/
Santa Barbara Channelkeeper	Stewardship and Citizen Science – monitoring, enforcement, education, research	Ongoing	https://www.sbck.org/our-work/advocacy/ventura-river/

Entity Name	Document or Program Title	Year Published	Website Link
Sierra Institute	Report with Assessment of Cal-Fed Watershed Coordinator Grant Program (includes Case Study on Ventura River Watershed)	2019	https://www.conservation.ca.gov/dlrp/grant-programs/watershed/Documents/Sierra%20Institute%20CalFed%20Watershed%20Program%20Report%202019.pdf
South Coast Habitat Restoration	Fire and Flow Forum Strategic Plan	2019	https://schabitatrestoration.org/projects/fire-and-flow
UCSB – Bren School of Environmental and Science Management	Sustainable Water Use in the Ventura River Watershed – Group Project on Water Budgets	2013	https://bren.ucsb.edu/projects/sustainable-water-use-ventura-river-watershed
Upper Ventura River Groundwater Agency	Upper Ventura River Groundwater Sustainability Plan	2022	https://uvrgroundwater.org/
Ventura County Farm Bureau	Ventura County Agricultural Irrigated Lands Group (Driven by Regional Water Quality Control Board Ag Waiver)	Ongoing	https://www.farmbureauvc.com/vcailg/
Ventura County Farm Bureau	Sustainable Agricultural Lands Conservation (SALC) Data Basin	–	https://vcsalc.databasin.org
Ventura County Resource Conservation District	Ventura River Instream Flow & Water Resilience Framework and Toolkit	2019 – Present	https://vcrcd.org/ventura-river-in-stream-flow/
Ventura County Wildfire Collaborative	Regional coordination with communities and fire safe councils	Ongoing	https://vcrcd.org/vcwc/
Ventura Land Trust	Ventura Land Trust is dedicated to protecting and conserving open space resources through the acquisition of land and easements, stewardship of protected lands, and public education about local natural resources.	–	https://www.venturalandtrust.org/
Ventura Regional Fire Safe Council	Community based wildfire resiliency programs and resources, data, plans, grants	Ongoing	https://venturafiresafe.org/
Ventura River Groundwater Adjudication Process Ventura River Groundwater Adjudication Process	Pending legal process to determine groundwater pumping rights and physical solutions for involved parties	Ongoing	https://www.venturariverwatershedadjudication.com/
Ventura River Watershed Council (VRWC)	Ventura River Watershed Management Plan	2015	https://venturawatershed.org/the-watershed-plan
VRWC	Ventura River Watershed Council Website	–	https://venturawatershed.org
Watersheds Coalition of Ventura County (WCVC)	Integrated Regional Water Management Plan – 2019 Amendment (Please Section 13, Appendices K and L for climate related information	2019	https://watershedscoalition.org/2019-irwm-plans/

Entity Name	Document or Program Title	Year Published	Website Link
WCVC Proposition 1 – IRWM Disadvantaged Community and Tribal Involvement (DATI) Program	Numerous program elements including needs assessments, outreach and education, technical assistance, project development, Tribal engagement	2017 – 2024	https://watertalksca.org/ventura
WCVC	Website	–	https://watershedscoalition.org

Appendix C

Watershed Council Charter

Ventura River Watershed Council Charter

Purpose

The Ventura River Watershed Council (hereinafter "Council") was formed to provide a framework for enhancing communication and collaboration among diverse stakeholders in order to better address the Ventura River watershed's many complex and cross-jurisdictional issues.

Mission

The mission of the Ventura River Watershed Council is to facilitate and support efforts by individuals, agencies, and organizations to maintain and improve the health and sustainability of the Ventura River watershed for the benefit of the people and ecosystems that depend upon it.

Scope of Powers

The Ventura River Watershed Council is a voluntary organization and has no powers or authorities other than those already possessed by its member agencies. The agencies, organizations, and interests represented on the Council are not obligated to adopt or carry out the recommendations of the Council, but will give due consideration to the recommendations and take actions they consider appropriate.

Strategies

1. Collaborate on the implementation of a comprehensive, integrated watershed management plan to guide watershed priorities and implementation strategies.
2. Facilitate communication between public, private, and nonprofit stakeholders.
3. Provide a forum for collecting, sharing, and analyzing information about, and creatively responding to, watershed issues.
4. Refine understanding—among Council members, decision-makers, and the general public—of the watershed's conditions, processes, interrelationships, and challenges from a variety of perspectives, including scientific, cultural, economic, regulatory, and more.
5. Identify opportunities for Council members to leverage resources and work together toward common goals.
6. Promote the priorities and projects of the watershed management plan to local, state, and federal officials.
7. Seek funding and other support to implement priority watershed management projects.
8. Monitor the effectiveness of, and regularly update, the watershed management plan.
9. Facilitate coordination of watershed education activities.

Members and Committees

The Ventura River Watershed Council is a public forum open to anyone interested in the watershed, and the Council shall actively seek diverse membership broadly representative of watershed partners. There

are two categories of members: general members and Leadership Committee members, with the primary difference being that Leadership Committee members are voting members. Some of the Leadership Committee members will form the advisory Leadership Executive Committee.

General Members

General members are all interested parties who attend the Watershed Council meetings and who are not Leadership Committee members. General members are not voting members.

Leadership Committee

The Leadership Committee's purpose is to ensure that a balance of perspectives and interests are represented in the Council's decisions. There are five categories of members within the Leadership Committee: government, water and sanitary, land management/recreation, environmental, and business/landowner. There shall be a maximum of 21 members on the Leadership Committee, and the maximum number of members in each of the five categories shall be as follows:

Government.....5
Water and Sanitary 5
Land Management/Recreation.....3
Environmental.....4
Business/Landowner.....4

These numbers are meant to generally represent an ideal balance of representation and to ensure parity among the categories. At any given time, through a consensus quorum, the Leadership Committee may agree to include more than the maximum number of members. New members may be self-nominated or nominated by any member of the Council. The final list of representatives in each category of members shall be determined by the various participants from that category. If there is not consensus among those members, the Leadership Committee will make the final determination. Representation of interests from both the upper/Ojai part of the watershed and the lower/Ventura part of the watershed shall be sought. An organization or entity may be represented by only one member on the Leadership Committee; for the purposes of this rule different divisions of local government shall be considered separate entities.

Leadership Committee members are encouraged to designate an alternate who will participate on the Leadership Committee in the members' absence. Changes to the specific person (primary member or alternate) representing a given organization do not need to be approved in advance by the Leadership Committee. The Leadership Committee will act to replace members who resign or are unable to continue serving and will strive to maintain continuity and the balance of interests by giving preference to representation from the same agencies and organizations.

The Leadership Committee's responsibilities shall include:

1. Provide direction to the Council in order to achieve the Council's purpose, mission, and objectives.
2. Elect representatives and alternates from the watershed to serve on the Watersheds Coalition of Ventura County Leadership Committee and determine the term of that service.
3. Contribute to updates of the Ventura County Integrated Regional Water Management Plan and revisions and provide feedback to Watersheds Coalition of Ventura County.
4. Set and weigh criteria for grant project ranking.
5. Form subcommittees on any issue as needed.

6. Fund ongoing financial support for Watershed Coordinator staff position(s) yearly.
7. Review this charter and the Leadership Committee and Leadership Executive Committee membership annually and make changes as appropriate.

Current Leadership Committee members are shown in the table below.

Leadership Committee	Primary	Alternate
Government		
Ventura County Board of Supervisors	Matt Levere	
Ventura County Watershed Protection District	Arne Anselm	
City of Ventura – Ventura Water	Jennifer Tribo	
City of Ojai	James Vega	
California Coastal Conservancy	Sam Jenniches	
Approved 7/1/2024 Barbareno/Ventureno Band of Mission Indians	Dayna Barrios	
Water and Sanitary		
VACANT AS OF 7/1/2024 Previously held by Casitas Municipal Water District	Tyrone LaFay	Kelly Dyer
Ventura River Water District	Alma Quezada	Bert Rapp
Ojai Valley Sanitary District	Alison Young	Ron Sheets
Meiners Oaks Water District	Justin Martinez	Christy Cooper
Ojai Basin Groundwater Management Agency	CeCe Vandermeer	
Land Management/Recreation		
Ventura County RCD	Heidi Ortloff	Lauren Zaragoza
Ojai Valley Land Conservancy	Tom Maloney	Vivon Crawford Sedgick
Ventura Land Trust	Melissa Baffa	Dan Hurst
Environmental		
Surfrider Foundation	Paul Jenkin	Kathy Bremer
Santa Barbara Channelkeeper	Molly Troup	
Friends of the Ventura River	Diane Underhill	Kathy Bremer
VACANT AS OF 7/1/2024 previously held by Ojai Valley Green		
Business/Landowner		
Ventura County Farm Bureau	Jodi Switzer	
Ojai Pixie Growers Association	Mike Sullivan	
Ventura County Coalition of Labor, Agriculture and Business	Louise Lampara	
Vacant as of 7/1/2023 previously held by Area Energy		

Decision-Making

The Leadership Committee will strive to make its decisions and recommendations by consensus, except that election of WCVC Steering Committee representatives shall be by simple majority. A quorum is required to make a consensus decision. A quorum is a minimum of five of the current members on the Leadership Committee. A consensus decision is one that all members either support, or are neutral about, and that no members explicitly cannot support.

When a decision is requested, Leadership Committee members will indicate their level of consensus with their thumbs or the numbers 1 through 4, as described below.

1/thumbs up = Agree/support

2/thumbs sideways = Neutral

3/thumbs down = Cannot support

4 = Recuse*

* Recusal: Members may choose to abstain from indicating any level of consensus but are encouraged to participate in the Leadership Committee discussion on the issue. Member abstention will not affect the ability of the Leadership Committee to reach consensus.

When the Leadership Committee agrees that it has exhausted all efforts to reach consensus on a particular issue, it has the option to

1. Table the item for a period of time or until new information is provided.
2. Allow the issue to be decided by a 75 percent majority vote, meaning 75 percent of the members present support the motion.

Whenever consensus cannot be reached on an item proposed, that item will be scheduled for further discussion, drafting, information gathering, etc. as appropriate. The group will not resort to a 75 percent majority vote until it has given serious effort and time to addressing the concerns of those not consenting.

The decision-making process should include the following elements:

1. Issue/Item introduction with necessary background or supporting information
2. Council discussion
3. Straw poll – non-binding (is there consensus or is further discussion necessary to address concerns)
4. Further discussion – if necessary
5. Official binding vote

Behavior, Attendance, and Membership

1. Members will treat each other with respect, will not monopolize meeting time, and will listen to and try to understand one another's views.
2. Members will encourage ideas that are new and creative.
3. In order to provide space for everyone to contribute, members will keep their statements as brief and clear as possible and no one person or subgroup will dominate the exchange.
4. Members will search for opportunities to develop group solutions and to resolve conflicts.
5. Members will strive to adhere to the charter and will be responsible for its enforcement.

6. Leadership Committee members must demonstrate their commitment to the Council through attendance and involvement. Leadership Committee members who miss three consecutive meetings without sending an alternate may be considered inactive and may be removed from the committee. A majority vote of a quorum of the Leadership Committee is required to remove an inactive member. The Leadership Committee can replace the inactive member with any other organization that is classified within the appropriate membership category.. Membership dues for the new member will be implemented during the next approved work plan.
7. Leadership Committee members are paying members of the Council. The Leadership Committee is expected to vote on and adopt a work plan prior to the start of every fiscal year to fund staff positions; this work plan will include a yearly budget that is supported by Leadership Committee membership dues and any other revenues. If a Leadership Committee member does not pay the dues in full by the end of the fiscal year, an opportunity penalty will be enacted upon that member.
8. Opportunity penalties are not fiscal penalties. These penalties only apply to Leadership Committee members that do not pay dues in full by the end of a fiscal year. Enacting this penalty will result in the penalized member missing grant and funding opportunities and any other fundamental opportunities available to paid-in-full Leadership Committee members. Opportunity penalties can temporarily or permanently become withdrawn by a majority vote of a quorum of the Leadership Committee.
9. If the Watershed Managers are on the Leadership Committee, membership dues are still applicable. The Watershed Managers can either pay membership dues directly with cash or through in-kind services or a combination of both.
10. In the event of an emergency, as declared by the County of Ventura or State of California, resulting in Leadership Committee members not allowed to meet, necessary Council business including approvals, may be conducted by individual personal communication rather than in a meeting of the Leadership Committee. A deadline for voting by personal communication will occur at the end of the fifth business day following the initial email notification. A consensus decision is still required among voting members.

Leadership Executive Committee

The Leadership Executive Committee (LEC) shall consist of six members; one member and one alternate nominated from each of the five Leadership Committee categories, plus a representative from Ventura County Watershed Protection District. Leadership Executive Committee members must be funding supporters of the Council. The Leadership Executive Committee's responsibilities shall include:

1. Provide direction to and provide input on the performance of the watershed coordinator.
2. Assist the watershed coordinator in setting Council meeting dates and agendas Hold yearly meetings at the beginning of each calendar year to decide on VRWC General meeting topics.
3. Recommend positions on administrative, budget, and policy issues to the Leadership Committee.
4. Review and approve requests for letters of support from the Council. A majority approval of the LEC is required for support. Said approval may be by individual personal communication rather than in a meeting of the LEC.A deadline for voting by personal communication will occur at the end of the fifth business day following the initial email notification.

Leadership Executive Committee	Primary	Alternate
General Member	Arne Anselm	
Government	Jennifer Tribo	Jennifer Tribo
Water and Sanitary	Kelley Dyer	**TBD**
Land Management/Recreation	Melissa Baffa	Tom Maloney
Environmental	Paul Jenkin	Molly Troup
Business/Landowner	Jodi Switzer	Mike Sullivan

1: The Ventura County Watershed Protection District member serves on the LEC as a general member.

Other Committees

The Leadership Committee may appoint other committees or work groups to assist in achieving its objectives. Each committee chair or work group leader shall be a member of the Leadership Committee.

Staff

The Ventura River Watershed Council is served by a part-time watershed coordinator. This contractor position is currently supported by contributions from the Leadership Committee. Additional staff support is provided by the Watersheds Coalition of Ventura County program director.

Meetings

The Ventura River Watershed Council, consisting of general members and Leadership Committee members, will attempt to meet at least 5 times per year. Technical advisory committees, ad hoc committees, or other committees formed by the Leadership Committee will meet on an as-needed basis. Each regular Council meeting shall be announced at least one week in advance via the Council's email distribution list, and at least two weeks in advance on the Council's website (www.venturawatershed.org) calendar.

Amendments

The Leadership Committee may adopt, amend, or repeal any portion of this charter with a Leadership Committee quorum at a meeting of the Leadership Committee or any regular meeting of the Council provided the nature of the proposed changes are provided to all Council members at least seven days prior to the meeting.

- Approved May 9, 2012
- Amended September 6, 2012 (updated Mission; Objectives changed to Strategies)
- Amended June 6, 2013 (updated decision-making procedures and membership structure)
- Re-Approved June 5, 2014
- Amended December 11, 2014
- Amended January 26, 2017
- Amended and adopted December 5, 2019
- Amended and proposed adoption on June 4, 2020
- Amended July 2024

Appendix D

Advisory Group Policies and Procedures

Advisory Group Policies and Procedures (Adopted 3/17/2025)

Introduction and Purpose

Introduction

The **Ventura River Watershed Council** (the "Council") has a history of fostering collaboration and enhancing coordination among diverse watershed stakeholders. It has successfully advanced watershed health and sustainability, including through the development of the Watershed Management Plan and its participation in the Integrated Regional Water Management (IRWM) Program.

This legacy makes the Council a strong foundation for the Ventura River Watershed Resilience Project (VRWRP), and provides an existing network to support collaboration, equity, and long-term sustainability in watershed resilience planning. The Council has been adopted as the broader network supporting watershed for the Watershed Resilience Project.

Purpose

The Council provides a framework for broad stakeholder engagement in watershed resilience planning, while a more focused Advisory Group was formed to provide collaborative guidance and recommendations that strengthen the VRWRP. The Advisory Group advises both the VRWRP technical consultant team and the Ventura River Watershed Council, which holds the final decision-making authority.

The Advisory Group was formed by vote of the Watershed Council's Leadership Committee in January 2025. This document outlines the responsibilities and procedures for the Advisory Group, ensuring alignment with the Council's existing structure and supporting equitable, collaborative, and sustainable watershed resilience planning.

Responsibilities

Advisory Group Responsibilities

Key Responsibilities and Guiding Principles:

- Provide consensus-based recommendations to:
  - The VRWRP technical consultant team, including affirming outputs and approach
  - The Council, which holds final decision-making authority for VRWRP adoption
- Strengthen collaboration, elevate shared knowledge, and support equitable and sustainable decision-making for the watershed
- Ensure decisions reflect diverse watershed interests and geographic representation

- Provide recommendations to the Council at major milestones, including plan adoption and funding strategies
- Participate in Advisory Group meetings, Council meetings, workshops, focusing on issues such as establishing a baseline water budget, establishing climate risk scenarios, quantitative climate modeling approach, and refining implementation strategies.
- Provide timely response when requested input or feedback on materials is required to keep the project moving smoothly
- As part of the VRWRP network development the Advisory Group will review the existing Charter and provide recommendations for future changes to the Leaderships Committee and/or Council to strengthen inclusiveness, equity, and alignment with watershed management needs.

Watershed Council Responsibilities

The Watershed Council remains the public forum for sharing information and engaging diverse partners and interested parties in watershed issues. The Council plays a key role in the final review of the draft chapters of the VRWRP and major decisions through regular Council meetings and designated workshops.

- Council retains final decision-making authority on affirming the VRWRP, following the Council's Charter
- Council will approve, affirm, endorse, or adopt the VRWRP as determined by the Council
- Receive and consider AG recommendations
- Provide input and approval for VRWRP milestones and final documents.

Advisory Group Membership

The Advisory Group membership mirrors the Leadership Committee, and all current Leadership Committee members were invited to participate on the Advisory Group, ensuring balanced representation across key sectors and geographic area. Additional members were identified and added to ensure diverse and equitable representation.

The membership categories include government (including Tribes), water & sanitation agencies, land management & recreation, environmental organizations, business & landowners, frontline communities & youth. See current membership list (*need to attach or insert*)

- Members are encouraged to designate an alternate to participate in their absence.
- Invited members may participate at any time, but participation is encouraged to be consistent to support continuity.
- At the conclusion of the project, the final Advisory Group list will reflect members who actively and consistently engaged and confirmed participation, while acknowledging those who were invited but did not choose to formally participate on the AG.

Chairperson: The Advisory Group Chair will be a member of the Watershed Council's Leadership Committee.

Decision-Making Procedures

Advisory Group Decision-Making

The Advisory Group will strive for **consensus-based approach to recommendations and decisions,** meaning all members either support or are neutral about a recommendation or decision, with no explicit opposition.

Routine decisions may be made by simple majority present, while other recommendations (priority setting, approval of draft chapters, framework endorsement, and strategic direction) require consensus.

When a recommendation is requested or formed, members will be asked if there is any disagreement. If consensus cannot be reached after all reasonable efforts, any disagreements will be noted to ensure constructive input is captured.

The recommendation process should include the following elements:

1. Issue/Item introduction with necessary background or supporting information.
2. Advisory Group discussion
3. Straw poll – is there consensus or is further discussion necessary to address concerns
4. Further discussion – if necessary
5. Final recommendation, with any dissention noted

Watershed Council Decision-Making

The Council strives to make decisions by consensus, meaning all members either support or are neutral about a decision, with no explicit opposition. **Refer to the Ventura River Watershed Council's Charter for more details.**

The Watershed Council will engage in consensus-based decision-making on key VRWRP milestones primarily at designated workshops. The Advisory Group will provide a recommendation to the Council on such decisions when asked. After considering Advisory Group recommendations, final decisions will be made by the Council following the decision-making procedures in the Charter. Dissenting views will be documented.

Code of Conduct

The Advisory Group is committed to fostering a collaborative and respectful environment to advance the VRWRP for overall watershed resilience. Members agree to:

- Treat others with respect, as you hope to be treated.
- Create a constructive positive space by encouraging idea sharing.
- Participate actively in meetings and discussions.
- Provide space for everyone to contribute by keeping their statements as brief and clear as possible and listening to and trying to understand one another's views.
- Members will search for opportunities to develop group solutions and to resolve conflicts.
- Provide advice that supports big picture, long-term thinking, and leads towards the most meaningful community and watershed benefits, not just achieving the minimum requirements.

- Allow audio/visual recording of meetings for purposes of generating meeting summaries and minutes, agree to these recordings being available to advisory group members, and VRWRP project managers, and commit to not sharing beyond the group.

Staff & Support

The VRWRP project management team, including the Watershed Coordinator, provides staff support for the Advisory Group and facilitates VRWRP meetings.

VRWRP technical consultants and advisory consultants may assist in decision-making by providing non-biased expert advice and technical information.

Meeting Dates & Communication

The Advisory Group will meet at least six times per calendar year, every-other month, for the duration of the VRWRP. Meetings will be announced one week in advance via email and posted on the VRWRP website and the Watershed Council website. Advisory Group meetings are open to all Council members to observe or provide meaningful input following the Code of Conduct.

Smaller technical committees or work groups may meet as needed.

Proposed meeting dates in 2025:

March 17, 2:00pm – Decision-making structure, network assessment survey
May 19, 2:00 pm – Finalize vision and goals, climate scenarios
July 21, 2:00 pm – Water budget
September 15, 2:00 pm – Quantitative modeling
November 17, 2:00 pm – Prioritize strategies
January 19, 2:00 pm – Finalize implementation strategies

Appendix E

Engagement Materials

Appendix:

This appendix compiles engagement materials used during development of the Ventura River Watershed Resilience Plan, including recurring council and advisory group meetings, community forums, workshops, and supporting online materials. It is intended both as documentation of the engagement process and as a practical reference for other regions developing similar watershed resilience planning efforts.

Watershed Council Meetings

August 1, 2024 — Ventura River Watershed Council
Focus: Project introduction and team roles
Materials: Presentation Slides

October 3, 2024 — Ventura River Watershed Council
Focus: Project updates and consultant selection
Materials: Presentation Slides

December 5, 2024 — Ventura River Watershed Council
Focus: Key climate concerns from interviews and website launch
Materials: Presentation Slides

January 30, 2025 — Leadership Committee
Focus: Advisory Group formation and governance
Materials: Agenda; Presentation Slides; Meeting Summary

February 6, 2025 — Ventura River Watershed Council
Focus: Advisory Group role, engagement plan, and schedule
Materials: Agenda; Presentation Slides

April 3, 2025 — Ventura River Watershed Council
Focus: Advisory Group updates, Forum #1 preview, and survey launch
Materials: Agenda

June 5, 2025 — Ventura River Watershed Council
Focus: Project updates, draft vision, and upcoming technical work
Materials: Agenda

September 4, 2025 — Ventura River Watershed Council
Focus: Project updates, preliminary water budget findings and data sources
Materials: Agenda; Presentation Slides

October 2, 2025 — Ventura River Watershed Council
Focus: Regional network assessment and climate hazard modeling and heat mapping results
Materials: Agenda; Presentation Slides

December 4, 2025 — Ventura River Watershed Council Network Assessment Workshop with CSU
Focus: Network assessment tools and findings
Materials: Agenda; Presentation Slides

March 19, 2026 — Ventura River Watershed Council
Focus: Council and public review of full draft plan
Materials: Agenda; Presentation Slides

Advisory Group Meetings

March 17, 2025 — AG Meeting #1
Focus: Network assessment approach and Advisory Group role
Materials: Agenda; Meeting Summary; Presentation Slides

May 19, 2025 — AG Meeting #2
Focus: Vision and goals reflections; hazard metrics
Materials: Agenda; Meeting Summary; Presentation Slides

July 21, 2025 — AG Meeting #3
Focus: Water budget approach and draft problem statements
Materials: Agenda; Meeting Summary; Presentation Slides

September 15, 2025 — AG Meeting #4
Focus: Vulnerability assessment method and draft results
Materials: Agenda; Meeting Summary; Presentation Slides

November 17, 2025 — AG Meeting #5
Focus: Quantitative assessment approach
Materials: Agenda; Presentation Slides

December 15, 2025 — AG Meeting #6
Focus: Indigenous Knowledge Systems presentation and draft adaptation strategies and actions
Materials: Agenda; Meeting Summary; Presentation Slides

March 2, 2026 — AG Meeting #7
Focus: Advisory Group review of full draft plan
Materials: Agenda; Presentation Slides

Forums & Workshops

April 30, 2025 — Forum #1
Focus: Shared vision and priority watershed resources
Materials: Agenda; Forum Summary; Flyer; Presentation Slides

July 30, 2025 — Forum #2
Focus: Watershed assets, vulnerabilities, and community impacts
Materials: Agenda; Forum Summary; Flyer; Presentation Slides

October 23, 2025 — Special Session on Adaptation Strategies (Ventura River Watershed Council & Advisory Group)
Focus: Adaptation strategies workshop
Materials: Agenda; Presentation Slides; Meeting Summary

February 4, 2026 — Forum #3
Focus: Adaptation strategies and implementation pathways
Materials: Agenda; Flyer; Presentation Slides

Other Materials

Ventura River Watershed Resilience Project Newsletter – August 2025
Materials: Newsletter

Project Website Screenshots
Materials: Website Screenshots

Network Assessment Dashboard Tutorial Video Screenshot
Materials: Screenshot

Community Profiles and Map Tutorial Video Screenshot
Materials: Screenshot

Ventura River Watershed Council Meeting

Thursday, August 1st, 2024
9:00 am – 11:00 am
555 Mahoney Ave, Oak View CA
Parking available at corner of Mahoney and Valley Rd.

Meeting Agenda

Facilitated by Heidi Ortloff & Lauren Zaragoza

Ventura County Resource Conservation District

Please note, this is a hybrid meeting.zoom information on the last page of this document

Item No.	Timeframe	Topic	Desired Outcome/Description
1	9:00 - 9:10	**Welcome** *Heidi Ortloff & Lauren Zaragoza* *Ventura County Resource Conservation District (VCRCD)*	Call to order & welcome. Attendees invited to share relevant updates.
2	9:10-10:05	**Farm Bureau of Ventura County** *Jodi Switzer*	Ag Order & Other Farm Bureau Updates
3	10:05 – 10:15	**Break**	
4	9:15-11:00	**Department of Water Resources Pilot Project** *Lynn Rodriguez, Jamie Whiteford, Heidi Ortloff, Lauren Zaragoza*	DWR Watershed Resiliency Pilot Project Funding Announcement

Watershed Resilience Pilot Program

California Department of Water Resources

Awarded February 13, 2024
Ends April 30, 2026

VENTURA COUNTY RESOURCE CONSERVATION DISTRICT



Proposal to VRWC

Establish the Ventura River Watershed Council as the "Watershed Network" in the Watershed Resilience Pilot Program

- Brief overview of Pilot Project
- Progress made to date
- Explanation of Watershed Network Component
- Alignment with VRWC
- Proposal

Overview

Watershed Resilience Pilot Program
Ventura River Watershed

- $10 million for pilot projects in five watersheds across California;
- $ 2 million per pilot
- Work must completed by February 28, 2026
- RCD is grantee
- Funded by DWR through state budget funds authorized in 2022-23 budget
- Collaboration with DWR and other pilots
- Collaboration with other watersheds in Ventura County and Santa Barbara

Purpose of Watershed Resilience Pilots

- Build stronger **community-based networks**
- Assess local **climate vulnerability and risks**
- Develop **adaptation strategies**
- Strengthen **vulnerable communities**
- **Build on previous regional planning efforts** (i.e. VR Watershed Management Plan and IRWM Plan)

Benefits

- Match-free state funding and partnership with state and other pilot watersheds
- Reinvigoration of VR Watershed Council and potential for increased funding support in the future
- Update to VR Watershed Management Plan
- New partnerships

Scope of Work

Task 3 - Identify and Assess Existing Regional Networks

Task 4 - Develop Watershed Network

Task 5 – Delineate Watershed Area

Task 6 – Watershed Resilience Vision

Task 7- Assess Climate Vulnerability and State of Watershed

Task 8 – Assess Vulnerabilities and Risks

Task 9 – Develop Adaptation Strategies

Task 10 – Develop Implementation Strategies

Task 11 – Performance Tracking

Task 12 – Watershed Resilience Plan

Progress

Network Assessment in Progress

- Meetings with Partners
- Inventory and Review of Existing Documents/Studies/Initiatives

Meetings Held With:

- Casitas MWD
- County Watershed Protection
- County Office of Sustainability
- Friends of SCR
- Bruce Kuebler
- Ventura Water
- Watershed Protection District
- Ojai Land Conservancy, Ventura Land Trust and Trust for Public Land

Upcoming Meetings Will be Held With:

- Surfrider
- Farm Bureau
- Groundwater Sustainability Agencies (UVRGSA and OBGMA)
- Additional Land Trusts/ Land Conservancies
- Community-Based Organizations
- Tribal Members

Progress



- **Meetings with DWR; Technical Assistance**
- **RFQ for Technical Help Released**
- **Selection of Ventura Watershed Boundary for Pilot**

Watershed Network

- Identify key participants representing the areas important to the planning effort including vulnerable communities, Tribes, and water related sector partners.
- Determine **roles and expectations** for watershed network participants.
- Develop **outreach** and engagement strategies for the watershed network and for informing the public on progress.
- Form a **watershed network consisting of representative participants** for the development of the watershed resilience plan.
- Develop an equitable and inclusive **decision-making structure** to guide the development of the watershed resilience plan.
- **Charter a network team** to ensure common understanding, vision, and objectives.



Ventura River Watershed Council

MISSION: To facilitate and support efforts by individuals, agencies, and organizations to maintain and improve the health and sustainability of the Ventura River watershed for the benefit of the people and ecosystems that depend upon it.

- The Ventura River Watershed Council was formed in 2006 to work on **watershed planning.**
- Between 2011 and 2014, the Council established its **Leadership Committee; developed a mission statement, a logo, and a governance charter.**
- The Council provides a **structure for continued input from and dialogue** between stakeholders.
- The Council's meetings, website resources, e-newsletters, and other services offer opportunities for improved community understanding, interest, and leadership in watershed issues.

Proposal

The Watershed Resilience Pilot Team is seeking to use the Ventura River Watershed Council as the "Watershed Network" as outlined in the project documents.

The VCRCD Team understands that these tasks are already conducted through the Ventura River Watershed Council and that the Council membership represents most of the key partners we need to engage in this Pilot. Given this, the VCRCD Team would like the Council membership to consider designating the Council to serve as the "Network". This will not replace the existing funding for - or mission of - the Council or supplant existing priorities or goals. The expansion of the Council to serve as the Network will benefit from additional funding through the grant.

Benefits

Benefits of the Council Serving as the Network:

- **reinforcing that the Council is Ventura River's "Watershed Network"**
- expanded Council outreach and engagement
- avoiding community fatigue by integrating activities and meetings
- more easily updating the Council's leadership on project progress
- increased efficiency by engaging Council members through working groups as needed
- providing an updated management plan and special Council meetings

Approval

- "The Leadership Committee will strive to make its decisions and recommendations by consensus"
- The DWR Watershed Resiliency Project Team would like to hear opinions from both Leadership Committee members and as well as anyone in the audience.

Leadership Committee Members:
Coastal Conservancy
City of Ojai
Barbareño/Ventureño Band of Mission Indians
Ventura Water
VC Watershed Protection District
County Board of Supervisors
Ventura River Water District
Ojai Valley Sanitary District
Meiners Oaks Water District
Ojai Basin GMA
VC Resource Conservation District
Ojai Valley Land Conservancy
Ventura Land Trust
Surfrider
Santa Barbara Channelkeeper
Farm Bureau
Ojai Pixie Growers Association
VC Coalition of Labor, Agriculture, and Business

Ventura River Watershed Council Meeting

Thursday, October 3, 2024
9:00 am – 12:00 pm
555 Mahoney Ave, Oak View CA
Parking available at corner of Mahoney and Valley Rd.

Meeting Agenda

Facilitated by Heidi Ortloff & Lauren Zaragoza

Ventura County Resource Conservation District

Please note, this is a hybrid meeting.zoom information on the last page of this document

Item No.	Timeframe	Topic	Desired Outcome/Description
1	9:00 - 9:10	**Welcome** *Heidi Ortloff & Lauren Zaragoza* *Ventura County Resource Conservation District (VCRCD)*	Call to order & welcome. Attendees invited to share relevant updates.
2	9:10-10:00	**Ojai Valley Land Conservancy** *Vivon Crawford Sedgwick*	Arundo Removal Updates
3	10:00 – 10:10	**Break**	
4	10:10-10:50	**Ventura River In-Stream Flow Project Team** *Jamie Whiteford* *VCRCD*	Updates on VRIF program
5	10:50 – 11:50	**DWR Watershed Resiliency Pilot Project Update and Watershed Network** *Lynn Rodriguez*	Presentation Action item to approve using Watershed Council as the Watershed Network for DWR Pilot Project

Ventura County RCD is inviting you to a scheduled Zoom meeting.

Watershed Resilience Pilot Program

California Department of Water Resources

Awarded February 13, 2024
Ends February 28, 2026

VENTURA COUNTY RESOURCE CONSERVATION DISTRICT

Ventura River Watershed Council



Topics

- Overview
- Project Elements and Goals
- Scope of Work
- Budget and Timeline

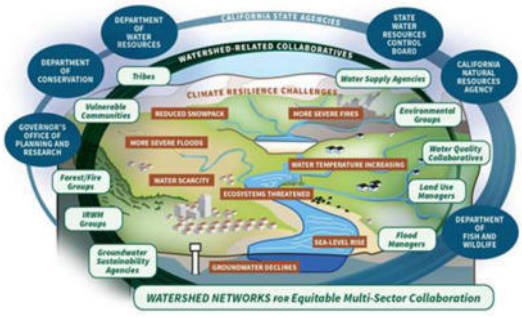
Purpose of Watershed Resilience Pilots

- Build stronger **community-based networks**
- Assess local **climate vulnerability and risks**
- Develop **adaptation strategies**
- Strengthen **vulnerable communities**
- **Build on previous regional planning efforts** (i.e. VR Watershed Management Plan and IRWM Plan)

Overview

Ventura River Watershed Pilot – Ventura River Watershed Resilience Grant Program

-
- $10 million for pilot projects in five watersheds across California;
- $ 2 million per pilot
- Expires February 28, 2026
- RCD is grantee
- Funded by DWR through state budget funds authorized in 2022-23 budget
- Collaboration with DWR and other pilots
- Collaboration with other watersheds in Ventura County during pilot



Meet the Team

Ventura County Resource Conservation District
Lead Agency
Heidi Ortloff
Lauren Zaragoza
Jamie Whiteford

Lynn Rodriguez
Project Manager
Consultant

Department of Water Resources
Grantor

Lara Shellenbarger
Consultant

Why the Ventura River Watershed?

- Priority Watershed in State
- Watershed Coordinator Grant in 2010
- Watershed Management Planning
- Active and Engaged Community
- Recent Studies and Research
- Independent of Outside Water Sources
- Relatively Small Size
- Diverse Topography

Goals

- Updated and expanded 2015 VR Watershed Management Plan (Watershed Resilience Plan)
- Successful collaboration to address climate challenges
- Expanded understanding about climate changes and risks
- Deeper engagement with Tribes and underserved communities (building on DACTI grant program)

Benefits

- Match-free state funding and partnership with state and other pilot watersheds
- Reinvigoration of VR Watershed Council and potential for increased funding support in the future
- New partnerships

Scope of Work

Task 3 - Identify and Assess Existing Regional Networks

- Identify and assess existing regional networks
- Evaluate engagement, inclusivity, and health of networks
- Include diverse regional resource management groups and entities
- Identify and engage vulnerable communities, California Tribes, and watershed participants

Scope of Work

Task 4 - Develop Watershed Network

- Building off Task 3, convene and develop watershed network to conduct the work of this Pilot Project.
- Engage and gather input from all Watershed Network participants, including vulnerable communities and California Tribes

Scope of Work

Task 5 – Delineate Watershed Area

Following formation of watershed network , delineate the watershed area for Pilot Project

Task 6 – Watershed Resilience Vision

- Work with watershed network to develop problem statements
- Establish watershed resilience vision and goals

Scope of Work

Task 7 - Assess Climate Vulnerability and State of Watershed

- Compile **existing climate vulnerability** assessments
- Identify critical historical weather-related events and their impacts
- Document **major regional climate drivers** and trends
- Describe **key climate challenges and opportunities** for increasing future resilience.
- Document information in **watershed problems and challenges** chapter.

Scope of Work

Task 8 - Assess Vulnerabilities and Risks

- Develop **vulnerability metrics and thresholds**
- Prepare updated historical **watershed water budget**
- Assess and **organize existing modeling tools** for water resources vulnerability
- Conduct **climate vulnerability and risk assessments**, both qualitative and quantitative
- Prepare comprehensive **vulnerability and risk assessment report**

Scope of Work

Task 9 – Develop Adaptation Strategies

- Determine **priority risk areas**
- Develop **watershed-specific adaptation strategies**
- Utilize **quantitative methods to determine risk reduction** potential of strategies
- Document recommended adaptation strategies**, inclusive of benefits and costs;** demonstrate how equity was considered

Scope of Work

Task 10 – Develop Implementation Strategies

- Identify and develop **implementation plan for adaptation** strategies
- Build public support
- Develop, review, and approve strategies in **open public forums**

Scope of Work

Task 11 – Performance Tracking

- Identify watershed-specific **performance tracking indicators**
- Document data sources and methods

Scope of Work

Task 12 – Watershed Resilience Plan

Prepare comprehensive Watershed Resilience Plan documenting process, approaches, findings, and recommendations

Timeline

February 13, 2024 – May 30, 2026

Budget

Budget

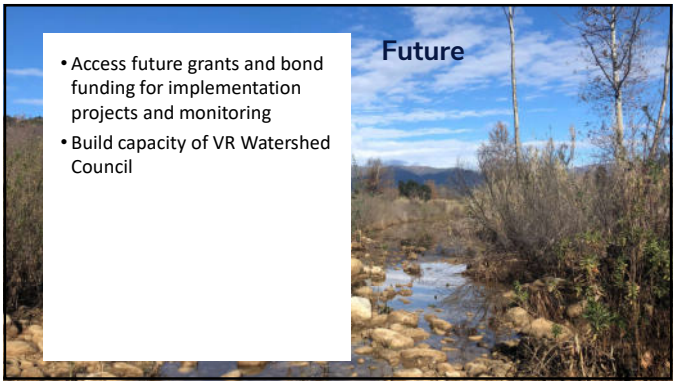
BUDGET CATEGORY	Grant Amount	All Other Cost	Total Cost
(a) Project Administration	$236,234	$0	$236,234
(b) Watershed Network Coordination	$581,428	$0	$581,428
(c) Climate Change Analysis	$709,790	$0	$709,790
(d) Watershed Resilience Plan	$472,548	$0	$472,548
TOTAL COSTS	$2,000,000	$0	$2,000,000

Role of VR Watershed Council

- Review and oversight
- Serve as decision making group for key project elements and milestones
- Enhance community engagement
- Potential role as Watershed Resilience Network

Future

- Access future grants and bond funding for implementation projects and monitoring
- Build capacity of VR Watershed Council



Thank you!

Ventura River Watershed Council Meeting

Thursday, December 5th, 2024
9:00 am – 11:30 am
555 Mahoney Ave, Oak View CA
Parking available at corner of Mahoney and Valley Rd.

Meeting Agenda

Facilitated by Heidi Ortloff & Lauren Zaragoza

Ventura County Resource Conservation District

Please note, this is a hybrid meeting,zoom information on the last page of this document

Item No.	Timeframe	Topic	Desired Outcome/Description
1	9:00 - 9:10	**Welcome** *Heidi Ortloff & Lauren Zaragoza* *Ventura County Resource Conservation District (VCRCD)*	Call to order & welcome. Attendees invited to share relevant updates.
2	9:10-10:45	**Watershed Resilience Project Updates** *Lynn Rodriguez*	Progress updates on pilot program tasks
3	10:45 – 11:00	**Break**	
4	11:00-11:20	**California State Parks Updates** *Katharine Wilson*	Learn about restoration efforts at Emma Wood State Beach

Watershed Resilience Pilot Program

California Department of Water Resources

Awarded February 13, 2024
Ends April 30, 2026



Communication and Outreach Plan

Goal to describe the intent of the Watershed Resilience Plan at a high level in a publicly accessible manner.

Outreach materials (brochures, other handouts)

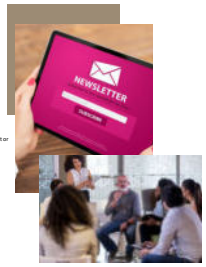
Website

Social Media, VCRCD account or others?

Newsletters

Community Meetings

Webinars



Partner Help Requested

- Encourage signing up for mailing list
- Newsletters as needed
- Email identified representatives as needed
- Leverage parallel outreach and engagement efforts by key partners
- Personally follow up with representatives from historically excluded communities.





Equitable Decision Making

Examine rules and procedures to address equity and make recommendations on actions that may lead to better engagement with vulnerable communities and Tribal partners. Our Council has a strong charter which aims for a balance of interests and opinions.

Our governance structure will be part of the Watershed Resiliency Plan that is submitted to DWR. We will be reviewing the charter, making recommendations to the Leadership Committee before approving of a version to include in the plan.







Upcoming Timeline

January - April, table at 2-3 events
hold a webinar for the public

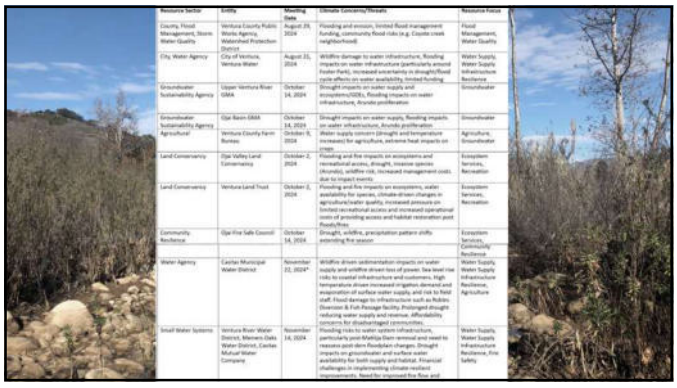
Draft assessment of our engagement and charter. Share Draft in Spring 2025

Review charter and make recommendations, Feb/March 2025

Refine Watershed's Vision, Goals, and Problem Statements

Partner Engagement and Watershed Network Assessment





Resource Sector	Entity	Meeting Date	Climate Concerns/Threats	Resource Focus
County, Flood Management, Storm Water Quality	Ventura County Public Works Agency, Watershed Protection District	August 29, 2024	Flooding and erosion, limited flood management funding, community flood risks (e.g. Coyote creek neighborhood)	Flood Management, Water Quality
City, Water Agency	City of Ventura, Ventura Water	August 22, 2024	Wildfire damage to water infrastructure, flooding impacts on water infrastructure (particularly around Foster Park), increased uncertainty in drought/flood cycle effects on water availability, limited funding	Water Supply, Water Supply Infrastructure Resilience
Groundwater Sustainability Agency	Upper Ventura River GMA	October 14, 2024	Drought impacts on water supply and ecosystems/GDEs, flooding impacts on water infrastructure, Arundo proliferation	Groundwater
Groundwater Sustainability Agency Agricultural	Ojai Basin GMA Ventura County Farm Bureau	October 14, 2024 October 9, 2024	Drought impacts on water supply, flooding impacts on water infrastructure, Arundo proliferation Water supply concern (drought and temperature increase) for agriculture, extreme heat impacts on crops	Groundwater Agriculture, Groundwater
Land Conservancy	Ojai Valley Land Conservancy	October 2, 2024	Flooding and fire impacts on ecosystems and recreational access, drought, invasive species (Arundo), wildfire risk, increased management costs due to impact events	Ecosystem Services, Recreation
Land Conservancy	Ventura Land Trust	October 2, 2024	Flooding and fire impacts on ecosystems, water availability for species, climate-driven changes in agriculture/water quality, increased pressure on limited recreational access and increased operational costs of providing access and habitat restoration post floods/fires	Ecosystem Services, Recreation
Community Resilience	Ojai Fire Safe Council	October 14, 2024	Drought, wildfire, precipitation pattern shifts extending fire season	Ecosystem Services, Community Resilience
Water Agency	Casitas Municipal Water District	November 22, 2024*	Wildfire driven sedimentation impacts on water supply and wildfire driven loss of power. Sea level rise risks to coastal infrastructure and customers. High temperature driven increased irrigation demand and evaporation of surface water supply and risk to field staff. Flood damage to infrastructure such as Robles Diversion & Fish Passage facility. Prolonged drought reducing water supply and revenue. Affordability concerns for disadvantaged communities,	Water Supply, Water Supply Infrastructure Resilience, Agriculture
Small Water Systems	Ventura River Water District, Meiners Oaks Water District, Casitas Mutual Water Company	November 14, 2024	Flooding risks to water system infrastructure, particularly post-Matilija Dam removal and need to reassess post-dam floodplain changes. Drought impacts on groundwater and surface water availability for both supply and habitat. Financial challenges in implementing climate-resilient improvements. Need for improved fire flow and	Water Supply, Water Supply Infrastructure Resilience, Fire Safety

Shared Concerns Across Partners

Recurring Climate Concerns Across Partners

- Drought and Water Supply Reliability: Prolonged drought affecting water availability for supply, ecosystems, and agriculture.
- Flooding and Erosion Risks: Threats to water infrastructure and habitats, particularly with changes following Matilija Dam removal.
- Wildfire Risks: Increased fire frequency and severity, compounded by invasive species like Arundo, were highlighted as significant risks to water infrastructure, habitats, and community safety.
- Extreme Heat: Concerns for vulnerable communities and challenges for water operations workforce.

Shared Challenges

- Financial Barrier: Difficulty aligning regulatory requirements and funding opportunities has created challenges in addressing climate vulnerability proactively.
- Collaboration Needs: Partners expressed the need for greater collaboration on public engagement efforts and shared outreach strategies, particularly for building community awareness of climate risks and resilience efforts, and stronger engaging with Tribes.

Watershed Resilience Vision

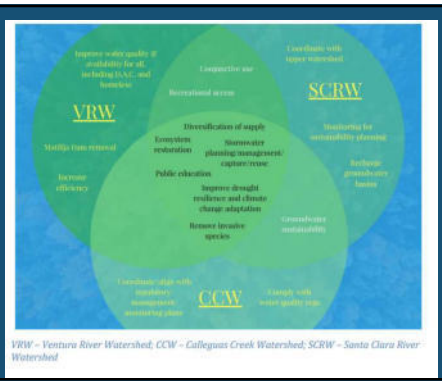
Establish overarching vision and feasible goals.

- Network will convene, discuss, and establish watershed-specific problem statements, resilience vision, and resilience goals
- Problem statements, vision, and goals to be documented and serve as a guide for development of Watershed Resilience Plan
- Desired outcomes from planning effort to be discussed from technical and policy perspectives and be documented
- Potential pitfalls to be discussed and initial strategies be developed to overcome these challenges.

Existing Regional Goals

2019 IRWM Plan Goals

1. Protect, conserve, and augment local water supply portfolio to increase local water resilience.
2. Protect and improve water quality
3. Protect people, property and the environment from adverse flooding impacts
4. Protect and restore habitat and ecosystems in watersheds
5. Provide water-related recreational, public access, stewardship, engagement and educational opportunities
6. Prepare for and adapt to climate change



VRW – Ventura River Watershed; CCW – Calleguas Creek Watershed; SCRW – Santa Clara River Watershed

Existing Watershed Goals

2015 Ventura River Watershed Management Plan

1. Sufficient Local Water Supplies
2. Clean Water
3. Integrated Flood Management
4. Healthy Ecosystems
5. Access to Nature
6. Responsible Land and Resource Management
7. Coordinated Watershed Planning

Consultation Selection

RFQs – September
SOQs – received October
Review, Interview, Selection – November
Onboarding and Detailed Scope of Work - December

Questions

Next Meeting Feb 6

- Contact Lynn Rodriguez at lynn.rodriguezwcvc@outlook.com

Thank you!

Scope of Work

Task 3 - Identify and Assess Existing Regional Networks

- Identify and assess existing regional networks
- Evaluate engagement, inclusivity, and health of networks
- Include diverse regional resource management groups and entities
- Identify and engage vulnerable communities, California Tribes, and watershed participants

Scope of Work

Task 4 - Develop Watershed Network

- Building off Task 3, convene and develop watershed network to conduct the work of this Pilot Project.
- Engage and gather input from all Watershed Network participants, including vulnerable communities and California Tribes

Scope of Work

Task 4 - Develop Watershed Network

- Building off Task 3, convene and develop watershed network to conduct the work of this Pilot Project.
- Engage and gather input from all Watershed Network participants, including vulnerable communities and California Tribes

Scope of Work

Task 4 - Develop Watershed Network

- Building off Task 3, convene and develop watershed network to conduct the work of this Pilot Project.
- Engage and gather input from all Watershed Network participants, including vulnerable communities and California Tribes

Scope of Work

Task 5 – Delineate Watershed Area

- Following formation of watershed network , delineate the watershed area for Pilot Project

Task 6 – Watershed Resilience Vision

- Work with watershed network to develop problem statements
- Establish watershed resilience vision and goals

Scope of Work

Task 7 - Assess Climate Vulnerability and State of Watershed

- Compile **existing climate vulnerability** assessments
- Identify critical historical weather-related events and their impacts
- Document **major regional climate drivers** and trends
- Describe **key climate challenges and opportunities** for increasing future resilience.
- Document information in **watershed problems and challenges** chapter.

Scope of Work

Task 8 - Assess Vulnerabilities and Risks

- Develop **vulnerability metrics and thresholds**
- Prepare updated historical **watershed water budget**
- Assess and **organize existing modeling tools** for water resources vulnerability
- Conduct **climate vulnerability and risk assessments**, both qualitative and quantitative
- Prepare comprehensive **vulnerability and risk assessment report**

Ventura River Watershed Council
Leadership Committee Meeting

Thursday, January 30, 2025
9:00 am – 11:00 am
Virtual Meeting
Zoom Information Provided On Last Page

Meeting Agenda

Facilitated by Heidi Ortloff & Lauren Zaragoza

Ventura County Resource Conservation District

Please note, this is a hybrid meeting.zoom information on the last page of this document

Item No.	Timeframe	Topic	Desired Outcome/Description
1	9:00 - 9:05	**Welcome** *Heidi Ortloff & Lauren Zaragoza* *Ventura County Resource Conservation District (VCRCD)*	Call to order & welcome. Attendees invited to share relevant updates.
2	9:05-09:10	**Confirm 2025 Meeting Schedule**	Options: 3rd Monday afternoon or 3rd Thursday morning March, May, July, Sept, Nov.
3	9:10 – 9:20	**Update on WRP Accomplishments To Date**	
4	9:20-9:30	**Update on Consultant Roles**	CSU, Rincon, Project Managers
	9:30 – 10:10	**Overview of Leadership Committee's Role and Schedule for the WRP**	a. Outline Leadership Committee's role in upcoming project phases · LC – review materials before public/council workshops · LC – review draft chapters of WRP b. WRP-specific technical working group chaired by a Leadership Committee member

			· Proposed working group to focus on Water Budget, Climate Vulnerability and Risk Analysis and Adaptation Strategies · Identify chair – or possibly rotate this function · Determine entity participation we want to involve in technical task advisory role not currently on the LC
	10:10-10:40	**Upcoming Tasks Preview**	· Preparing for Watershed Vision Process (Task 6) – March Meeting · Assessment of Existing Networks Approach; Draft survey of network member organizations · Watershed Council Charter Revisions – March Meeting

Ventura River Watershed Resilience Pilot Program

Leadership Committee – January 30, 2025



Agenda

1. Welcome - *Heidi*
2. Confirm 2025 Meeting Schedule - *Heidi*
3. Update on WRP Accomplishments
4. Update on WRP Consultant Roles
5. Overview of Leadership Committee's Role and Schedule for WRP
   - Schedule and Proposed Meeting Topics
6. Upcoming Tasks Preview

2025 Meeting Schedule

- 3rd Monday afternoon **OR** 3rd Thursday morning
- March, May, July, September, November, January
  (subject to change as tasks progress)
- Likely all virtual

Highlights of Work Completed Since July 2024

- Convened **three Watershed Council meetings** (August, October, December) to support network development
- Submitted NAHC request for **updated Tribal contacts and initiated coordination** with Tribal members, including BVBMI Tribal Council
- Met with **20+ watershed partner entities** to gain insights on climate risks and watershed resilience priorities
- Compiled **comprehensive list of interested parties/partners** for network assessment and foundational inventory of relevant studies and plans
- Collaborated with consultants **Rincon and CSU** to refine **detailed scopes of work**; contracts are imminent
- Secured agreement that the **Ventura River Watershed Council will serve as the Watershed Network**
- Assessment of network decision-making structure - potential revisions to the Council charter
- Created project logo and website
- Maintained ongoing coordination with related regional efforts (LCW, Landscape Transformation, VRIF, and Rivers to Ridges)
- Held **monthly and quarterly meetings with DWR** and engaged with **four WRP pilot watersheds** (Russian River, Calaveras River, American River, Pajaro River)
- Prepared justification for **Watershed Area Boundary** (Ventura River Watershed)

Shared Concerns Across Partners

Conducted 15 "key partner" interviews and small group meetings from August to December

Identified recurring climate risks and concerns across interested organizations and entities

- Drought and Water Supply Reliability: Prolonged drought affecting water availability for supply, ecosystems, and agriculture.
- Flooding and Erosion Risks: Threats to water infrastructure and habitats, particularly with changes following Matilija Dam removal.
- Wildfire Risks: Increased fire frequency and severity, compounded by invasive species like Arundo, were highlighted as significant risks to water infrastructure, habitats, and community safety.
- Extreme Heat: Concerns for vulnerable communities and challenges for water operations workforce.
- Sealevel rise: Concerns for vulnerable water related infrastructure

Shared Challenges

- Financial Barrier: Difficulty aligning regulatory requirements and funding opportunities has created challenges in addressing climate vulnerability proactively.
- Collaboration Needs: Partners expressed the need for greater collaboration on public engagement efforts and shared outreach strategies, particularly for building community awareness of climate risks and resilience efforts, and stronger engaging with Tribes.

Onboarding of Consultants

- Detailed scopes of work nearly complete – final negotiations and contracting pending
- Refining budgets and schedules
- Establishing communication among teams
- Consultants to begin February 1st

Leadership Committee's Role in WRP

The Ventura River Watershed Council will serve as the Watershed Network (agreed upon at the October 3rd, 2024 Watershed Council meeting)

DWR Requirements for Watershed Network Decision-Making

✅ Have **written policies and procedures**
✅ Establish an **equitable and inclusive** decision-making structure
✅ Ensure that all **stakeholders have a voice**, including **historically underrepresented communities**

Proposal for the Leadership Committee's Role – to serve as the core advisory body for the WRP

Consideration: Forming an Advisory Group

We recommend creating a **WRP Advisory Group** consisting of Leadership Committee members **plus additional advisors**. To ensure that **frontline and disadvantaged communities** have a meaningful voice in resilience planning, we want to include **additional advisors** beyond the current Leadership Committee members.

We ask the Leadership Committee to consider:

- **Should additional advisors be formally added to the group?**
- **Who should be invited?** (e.g., another **Tribal representative**, a **CAUSE representative**, or others who can represent frontline communities)
- **How should we integrate these advisors into the decision-making process?**

Consideration: Forming an Advisory Group

The Advisory Group would operate as follows:

- Serve in an advisory role to guide Water Resilience Plan development, to provide focused input on key WRP topics, including problem statements, goals, vulnerabilities, and adaptation strategies.
- Chaired by a member of the Leadership Committee
- Meet regularly (virtual meetings every other month)
- Utilize a consensus approach for decision-making. While we value diverse perspectives, we will move forward based on general consensus while ensuring any dissenting views are documented.

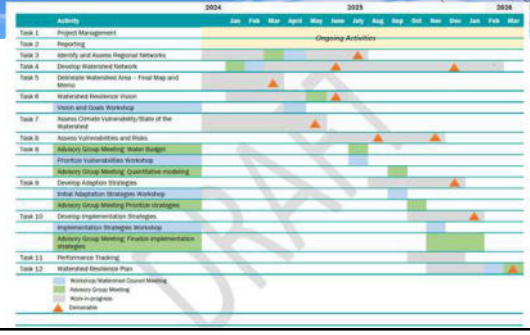
Consideration: Do we need any Charter revisions to give the Advisory Group full decision-making participation for the purpose of the WRP process only (in replacement of the Leadership Committee)?

(Discussion)

Tentative Schedule of Work Ahead Feb-April 2025

- **Conduct Council Leadership Meeting – establish working group for WRP and revise charter**
- **Conduct 2-3 network meetings (Feb. 6, March 6 or April 3) – Includes visioning process**
- **Conduct Leadership Committee/Advisory Group Meeting – March 27th (Tentative)**
- **Onboard consultants in February**
- **Onboard CAUSE to work with underserved communities**
- **Begin developing deliverables**
- **Activate formal Tribal engagement phase**
- **Activate formal engagement with underserved communities – establish process for bringing on Tribal members as paid advisors**

Tentative Schedule



Work Ahead: Watershed Resilience Vision for WRP

Establish overarching vision and feasible goals.

- Network will convene, discuss, and establish watershed-specific problem statements, resilience vision, and resilience goals
- Problem statements, vision, and goals to be documented and serve as a guide for development of Watershed Resilience Plan
- Desired outcomes from planning effort to be discussed from technical and policy perspectives and be documented
- Potential pitfalls to be discussed and initial strategies be developed to overcome these challenges.

Network Assessment Survey Overview

- Purpose of the Survey
  - Support work for Task 3 Identify and Assess Regional Networks and Task 4 Watershed Network Development
  - Identify and evaluate organizations working on water-climate resiliency in the Ventura River Watershed
  - Expand existing datasets to better understand: 1) Organization goals and expertise, 2) Projects, locations, and timelines, 3) Partnerships and collaboration networks, 4) Financial limitations and support needs
  - Inform the development of a STEW-MAP network assessment
- Who will be surveyed?
  - All organizations involved in water-climate resilience within the watershed and project area of interest (the Watershed Council email list will serve as a starting place)
- How it will be conducted?
  - Web-based survey
  - Distributed in March-April

STEW-MAP Overview

- STEW-MAP (Stewardship Mapping & Assessment Project) is designed to identify and assess organizations involved in environmental stewardship, broadly defined as activities that conserve, manage, and improve the environment.
  - Applied locally for the WRP to analyze networks of water-centric stewardship organizations
  - Will help visualize and map relationships between organizations in the Ventura River Watershed
- Key Outcomes from STEW-MAP Analysis
  - Social network insights: Identify organizational connections and gaps
  - Spatial analysis: Understand service areas and project locations
  - Database of watershed organizations for future planning efforts
  - Interactive network map using KUMU tool
- Survey -> STEW-MAP
  - Survey development (1-2 months)
  - Survey Launch & Outreach – Leadership Committee will receive the draft survey soon
  - Network Analysis & Mapping – Results will inform the Watershed Network Assessment Report



Your Role
Be on the lookout for the draft survey!
Help distribute and provide input.

January 30th Ventura River Watershed Council Leadership Committee Meeting Summary

Key Discussion Points and Outcome:

- Formation of an Advisory Group: The Leadership Committee agreed to form the WRP Advisory Group to support the Watershed Resilience Plan development.
    - The Advisory Group will consist of Leadership Committee members and additional advisors.
    - All Leadership Committee members will be invited to join but can opt out if desired.
    - Additional members will be invited to enhance representation, including CAUSE, MERITO Foundation, and tribal representatives - additional suggestions can be sent to Lynn or Lara
- Decision-Making & Advisory Group Structure:
    - The Advisory Group will be chaired by a Leadership Committee member. Vivon Sedgwick (Ojai Valley Land Conservancy) volunteered to serve as the Chair.
    - The group will provide focused input on key topics, review technical approaches, and refine draft WRP content before broader Watershed Council, DWR, and public review.
    - A written decision-making framework for the WRP will be developed to clarify roles of the Advisory Group and the Watershed Council and processes.
    - Meeting summaries will be prepared and shared with the Watershed Council.
    - Meetings will remain open to interested Council members and watershed partners to attend.
- Next meeting of Advisory Group is March 17th at 2 pm and will be virtual.
    - We will share draft written policies and procedures prior to that meeting for group discussion and consensus
- We will use SharePoint as the platform for sharing WRP materials with Advisory Group members.

Note: Advisory Group membership evolved following formation. Final membership is documented in the Plan Acknowledgements and described in the Watershed Network Chapter.

Following the January 30, 2025 meeting, written Advisory Group Purpose and Protocols were developed to clarify roles, procedures, and alignment with the existing Watershed Council Charter.

See Next Page for Current Leadership Committee Membership

Ventura River Watershed Council Leadership Committee Contacts
Updated January 2025

Ventura County Board of Supervisors	Matt LaVere	Matt.LaVere@ventura.org
Ventura County Board of Supervisors	Lourdes Solorzano	Lourdes.Solorzano@ventura.org
Ventura County Watershed Protection District	Arne Anselm	arne.anselm@ventura.org
City of Ventura	Jennifer Tribo	Jtribo@venturawater.net
City of Ventura	Sarah Mulder	smulder@cityofventura.ca.gov
City of Ojai	TBD	
California Coastal Commission	Sam Jenniches	sam.jenniches@scc.ca.gov
Upper Ventura River Groundwater Agency	Bryan Bondy	bbondy@uvrgroundwater.org
Ventura River Water District	Alma Quezada	Alma@venturariverwd.com
Ventura River Water District	Bruce Kuebler	bkuebler@venturariverwd.com
Ojai Valley Sanitary District	Alison Young	alison.young@ojaisan.org
Ojai Valley Sanitary District	Scott Meckstroth	scott.meckstroth@ojaisan.org
Meiners Oaks Water District	Justin Martinez	Justin@meinersoakswater.com
Meiners Oaks Water District	Christy Cooper	cooper@meinersoakswater.com
Ojai Basin Groundwater Management Agency	Cece Vandermeer	obgma@aol.com
Ventura County Resource Conservation District	Heidi Ortloff	Heidi.Ortloff@vcrcd.org
Ventura County Resource Conservation District	Lauren Zaragoza	Lauren.Zaragoza@vcrcd.org
Ojai Valley Land Conservancy	Tom Maloney	tom@ovlc.org
Ojai Valley Land Conservancy	Vivon Crawford	vivon@ovlc.org
Ventura Land Trust	Melissa Baffa	melissa@venturalandtrust.org
Ventura Land Trust	Dan Hulst	dan@venturalandtrust.org
Surfrider Foundation	Paul Jenkin	pjenkin@surfrider.org
Surfrider Foundation	Kathy Bremer	kathy@kathybremer.com
Santa Barbara Channel Keeper	Molly Troup	molly@sbck.org
Santa Barbara Channel Keeper	Nate Irwin	nate@sbck.org
Friends of Ventura River	Diane Underhill	dunderhill@sbcglobal.net
Friends of Ventura River	Kathy Bremer	kathy@kathybremer.com
Ojai Valley Fire Safe Council	Chris Danch	Chris@firesafeojai.org
Ojai Valley Fire Safe Council	Kalli O'Conner	Kalli@firesafeojai.org
Ventura County Farm Bureau	Jodi Switzer	jodi@farmbureauvc.com
Ojai Pixie Growers Association	Mike Sullivan	essickmgt@gmail.com
Ventura County Coalition of Labor, Agriculture and Business	Louise Lampara	LLampara@colabvc.org

Tribes	TBD	

Ventura River Watershed Council Meeting

Thursday, February 6, 2025
9:00 am – 11:30 am
501 Poli St.
2nd Floor
Ventura, CA 93001
Community Meeting Room
Parking Available, view map at end of this document

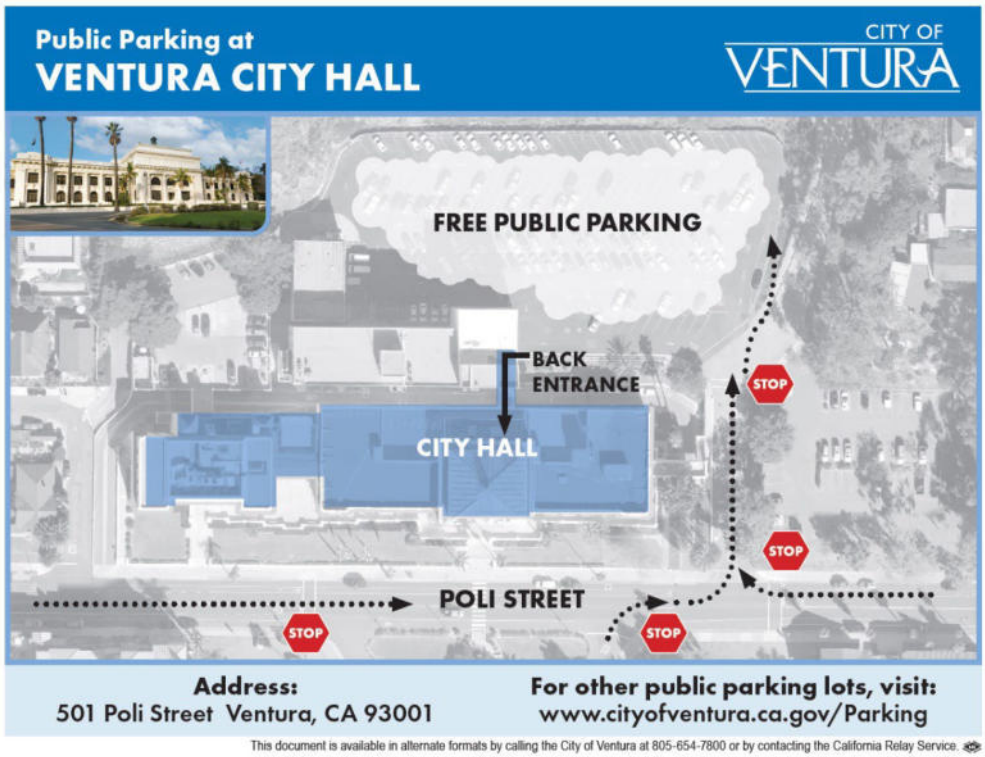
Meeting Agenda

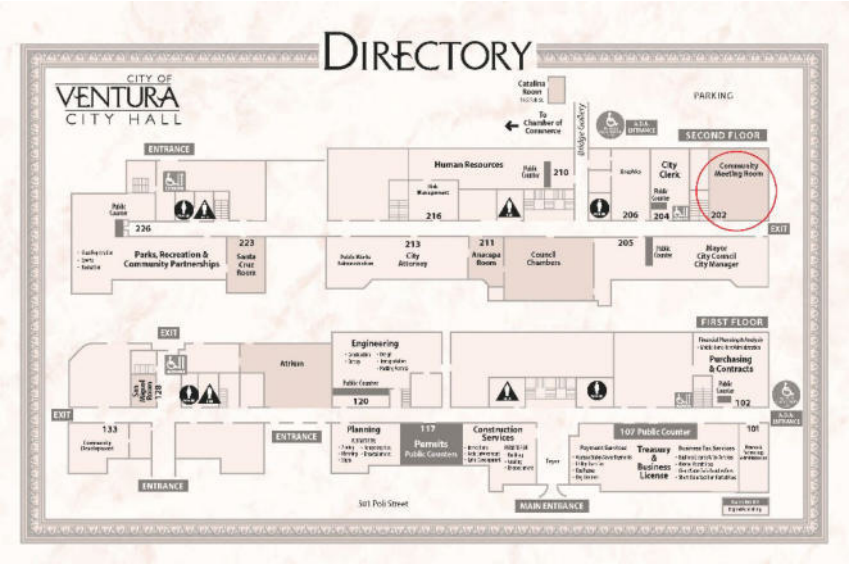
Facilitated by Heidi Ortloff & Lauren Zaragoza

Ventura County Resource Conservation District

Please note, this is a hybrid meeting.zoom information on the last page of this document

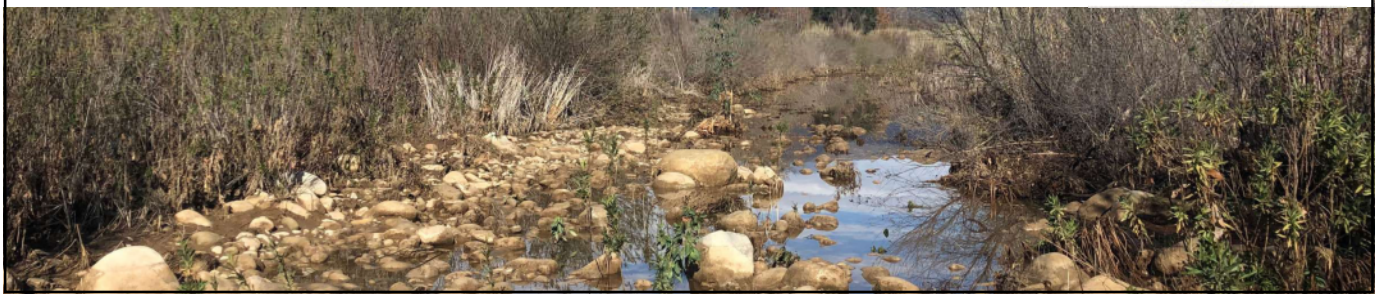
Item No.	Timeframe	Topic	Desired Outcome/Description
1	9:00 - 9:10	**Welcome** *Heidi Ortloff & Lauren Zaragoza* *Ventura County Resource Conservation District (VCRCD)*	Call to order & welcome. Attendees invited to share relevant updates.
2	9:10-09:40	**Ojai Valley Fire Safe Council**	Program updates on wildfire mitigation projects
3	9:40 – 9:50	**Break**	
4	9:50-11:00	**DWR Watershed Resiliency Pilot Project** *Lynn Rodriguez and Lara Shellenbarger*	Discuss updates on pilot project and setting goals for the upcoming year

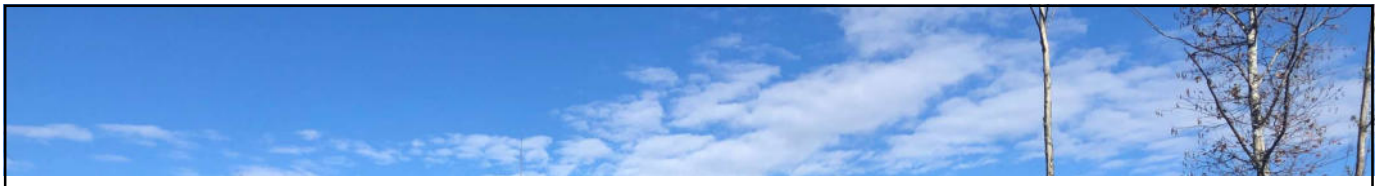

Public Parking at
VENTURA CITY HALL
CITY OF VENTURA
FREE PUBLIC PARKING
BACK ENTRANCE
CITY HALL
STOP
STOP
STOP
STOP
POLI STREET
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Ventura River Watershed Resilience Pilot Program

Ventura River Watershed Council,
February 6, 2025





1. **Update on WRP Accomplishments**
2. **Update on WRP Consultant Roles**
3. **Overview of Leadership Committee's Role and Schedule for WRP**
   - **Schedule and Proposed Meeting Topics**
4. **Upcoming Tasks Preview**

Update on Recent Activity

- **Met with additional key partners in watershed** (Surfrider, State Parks, CAUSE)
- Collaborated with consultants **Rincon and CSU** to refine **detailed scopes - of work and schedules**; contracts are imminent - work to begin in February
- **Conducted Leadership Committee Meeting** – January 30th – formed WRP Advisory Group
- Maintained **ongoing coordination with related regional efforts** (LCW, Landscape Transformation, VRIF, and Rivers to Ridges)
- **Tribal Engagement update** and DWR Tribal Outreach Webinar
- Held **quarterly meeting with DWR** and engaged with **four WRP pilot watersheds** (Russian River, Calaveras River, American River, Pajaro River)

Network Development Update

The Ventura River Watershed Council agreed to serve as the Watershed Network (agreed upon at the October 3rd, 2024 VRWC meeting)

DWR Requirements for Watershed Network Decision-Making

✅ Have **written policies and procedures**
✅ Establish an **equitable and inclusive** decision-making structure
✅ Ensure that all **stakeholders have a voice**, including **historically underrepresented communities**

🗓️ **Leadership Committee Meeting Held: January 30, 2025**

The Leadership Committee discussed serving as the core advisory body for the WRP, while recognizing that additional representation may be needed to engage diverse perspectives and be intentional about inclusion.

Leadership Committee Meeting – Key Outcomes

✅ **WRP Advisory Group Established**

- Leadership Committee agreed to form a **WRP Advisory Group** to support WRP development.
- Advisory Group will include **Leadership Committee members + additional advisors** (e.g., Tribal representatives, CAUSE, Merito Foundation).
- A **Leadership Committee member will chair the Workgroup** to maintain continuity.

✅ **Purpose of WRP Advisory Group**

- Advisory Group will provide **focused input on key WRP topics**, including problem statements, vulnerabilities, and adaptation strategies and implementation strategies.
- Members will review and inform and refine **technical materials and WRP workshop content** before broader Council engagement.
- A **decision-making framework will be developed** to clarify Advisory Group and Watershed Council's roles in WRP development and process.

✅ **Next Steps & Timeline**

- **First Advisory Group Meeting:** March 17, 2025, at 2:00 PM (Virtual).
- **Draft written policies & procedures** for WRP will be shared for review.
- A **SharePoint folder** will be created to provide Advisory Group members with document access
- Identify and invite additional members to the Advisory Group

Next Steps & Watershed Council Engagement

📌 **For Watershed Council Members**

- The **Watershed Council remains the broader network** guiding WRP efforts.
- The newly formed **WRP Advisory Group** will provide technical and strategic input.
- All Council/network members will have **opportunities to review and provide input** as the WRP develops.

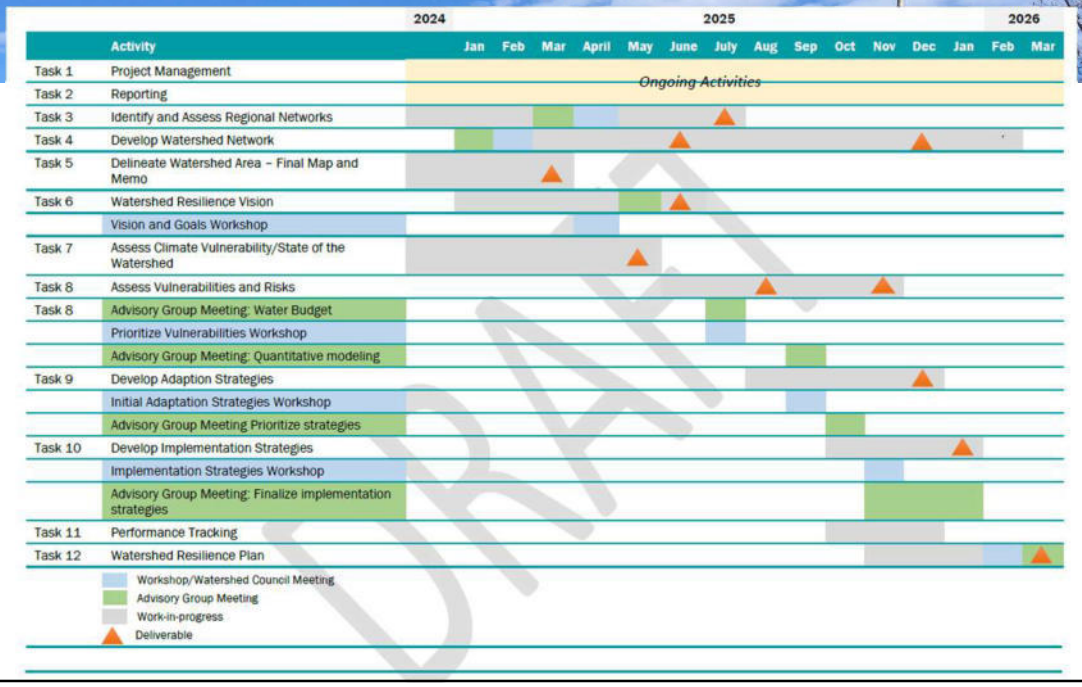
🗓️ **Upcoming Key Dates**

- **February 6, 2025 – Watershed Council Meeting** (Discussion on WRP progress and next steps).
- **March 17, 2025 – First WRP Workgroup Meeting** (Technical review and policy guidance).
- **Late March or April 3, 2025 – Network Engagement & Visioning Workshops**

Work Ahead (Feb – April 2025)

- **Onboard consultants in February**
- **Develop survey questions for network assessment (slides below)**
- **Onboard CAUSE to work with underserved communities**
- **Tribal and underserved community engagement**
- **Begin developing deliverables**

Tentative Schedule



Work Ahead: Watershed Resilience Vision for WRP

Establish overarching vision and feasible goals.

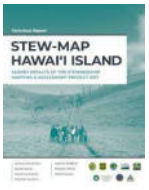
- Network will convene, discuss, and establish watershed-specific problem statements, **resilience vision, and resilience goals**
- Problem statements, vision, and goals to be documented and serve as a guide for development of Watershed Resilience Plan
- Desired outcomes from planning effort to be discussed from technical and policy perspectives and be documented
- Potential pitfalls to be discussed and initial strategies be developed to overcome these challenges.

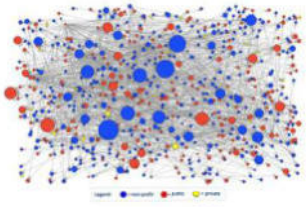
Work Ahead: Network Assessment Survey Overview

- Purpose of the Survey
  - Support work for Task 3 Identify and Assess Regional Networks and Task 4 Watershed Network Development
  - Identify and evaluate organizations working on water-climate resiliency in the Ventura River Watershed
  - Expand existing datasets to better understand: 1) Organization goals and expertise, 2) Projects, locations, and timelines, 3) Partnerships and collaboration networks, 4) Financial limitations and support needs
  - Inform the development of a STEW-MAP network assessment
- Who will be surveyed?
  - All organizations involved in water-climate resilience within the watershed and project area of interest (the Watershed Council email list will serve as a starting place)
- How it will be conducted?
  - Web-based survey
  - Distributed in March-April

STEW-MAP Overview

- STEW-MAP (Stewardship Mapping & Assessment Project) is designed to identify and assess organizations involved in environmental stewardship, broadly defined as activities that conserve, manage, and improve the environment.
  - Applied locally for the WRP to analyze networks of water-centric stewardship organizations
  - Will help visualize and map relationships between organizations in the Ventura River Watershed
- Key Outcomes from STEW-MAP Analysis
  - Social network insights: Identify organizational connections and gaps
  - Spatial analysis: Understand service areas and project locations
  - Database of watershed organizations for future planning efforts
  - Interactive network map using KUMU tool
- Survey -> STEW-MAP
  - Survey development (1-2 months)
  - Survey Launch & Outreach – Leadership Committee will receive the draft survey soon
  - Network Analysis & Mapping – Results will inform the Watershed Network Assessment Report





Your Role
Be on the lookout for the draft survey!
Help distribute and provide input.

Preparing for WRP Vision & Goal Setting

Our Watershed Resilience Plan will establish a **shared vision and key goals to guide adaption efforts**. This workshop will focus on:

- Identifying and confirming key climate challenges
- Defining shared priorities across stakeholders
- Developing actionable goals to enhance watershed resilience

Common Themes Across Watershed Resilience Plans:

Integrated Water Management – Combining flood control, water supply resilience, and ecosystem restoration
Nature-Based Solutions – Restoring habitats, wetlands, and urban forests as climate adaptation strategies
Equity and Environmental Justice – Centering frontline communities in climate resilience planning
Multi-Stakeholder Collaboration – Engaging local governments, Tribes, NGOs, and the private sector
Scientific and Data-Driven Approaches – Using climate models and risk assessments to inform decision-making

Climate Resilience Goals - Examples

1. **Strengthen Water Supply and Infrastructure Resilience**
   - **Address drought impacts** by improving groundwater recharge, water conservation, and stormwater capture.
   - Enhance **infrastructure resilience** to flooding, erosion, sea level rise, and wildfire damage.
   - Improve **fire protection and emergency water supply capacity** in vulnerable communities, such as Casitas Springs.
2. **Increase Climate Adaption to Extreme Weather and Disasters**
   - Develop strategies to reduce risks from **wildfires, extreme heat, and post-fire sedimentation impacts** on water supply and ecosystems.
   - Improve **flood management approaches** to address increasing storm intensities and evolving watershed dynamics (can we get more specific and actionable?)

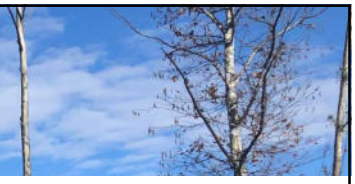
Climate Resilience Goals - Examples

3. **Restore and Protect Natural Ecosystems and Open Space**
   - Enhance riparian corridors and habitat connectivity to support native species, particularly endangered steelhead trout.
   - Address invasive species threats, such as Arundo, to reduce wildfire risk and improve riparian ecosystem health.
   - Implement nature-based solutions to mitigate flood and drought impacts while enhancing biodiversity.
   - Support adaptive land management strategies for open spaces, balancing conservation, recreation, and climate resilience.
4. **Promote Equitable and Community-Driven Climate Resilience**
5. **Develop Science-Based Adaption Strategies and Regional Coordination**

Suggested Climate Resilience Goals

1. Enhance Watershed and Water Supply Resilience – strengthen groundwater recharge, water conservation, and sustainable management.
2. Increase Adaption to Climate Risks – Reduce vulnerability to extreme heat, drought, wildfire, and flooding.
3. Restore and Protect Natural Ecosystems – Improve riparian habitats and support biodiversity
4. Promote Equity and Community Resilience – Engage underserved communities and build local capacity for adaption.
5. Develop Science-Based Adaption Strategies – Use data, modeling, and collaborative science to inform decision-making.

Shared Concerns Across Partners



Conducted 15 "key partner" interviews and small group meetings from August to December

Identified recurring climate risks and concerns across interested organizations and entities

- Drought and Water Supply Reliability: Prolonged drought affecting water availability for supply, ecosystems, and agriculture.
- Flooding and Erosion Risks: Threats to water infrastructure and habitats, particularly with changes following Matilija Dam removal.
- Wildfire Risks: Increased fire frequency and severity, compounded by invasive species like Arundo, were highlighted as significant risks to water infrastructure, habitats, and community safety.
- Extreme Heat: Concerns for vulnerable communities and challenges for water operations workforce.
- Sealevel rise: Concerns for vulnerable water related infrastructure

Shared Challenges

- Financial Barrier: Difficulty aligning regulatory requirements and funding opportunities has created challenges in addressing climate vulnerability proactively.
- Collaboration Needs: Partners expressed the need for greater collaboration on public engagement efforts and shared outreach strategies, particularly for building community awareness of climate risks and resilience efforts, and stronger engaging with Tribes.

Ventura River Watershed Council Meeting – WRP Network
Meeting #4
February 6, 2025
501 Poli St., Ventura CA (Hybrid Meeting)

Facilitators: Heidi Ortloff & Lauren Zaragoza (Ventura County Resource Conservation District - VCRCD)

Attendees

In-Person: Lynn Rodriguez, Lara Shellenbarger, Sarah Mulder (Ventura Water), Kalli O'conner, Chris Danch (Ojai Fire Safe Council), Brian Brennan, Burt Handy, Bruce Kuebler, Vivon Crawford (OVLC), Angie Heald

Online: Alicia Miramontez (VCRCD), Christy Cooper, Julie Clark (UCANR), Justin Martinez (MOWD), Kadie McShirley, Khagendra Bharambe, Mary Bergen, Martin Schenker (OVLC), Mohammed Hasan, Peter Deneen (Keep Sespe Wild), Rhett Walker, Rob Hampson (FCGMA), Russell Marlow (CalTrout), Scott Meckstroth (Ojai Valley Sanitation District), V Peters (Ojai Valley Green Coalition), Tyrone LaFay (Casitas Municipal Water District), Sophie ___, Kate Daniels (VLT), Sam Jenniches (State Coastal Conservancy), 18058905226

Action Items

- **Vision Workshop Date Selection:** Consider creating a Google form to gauge see which date is best for a Vision Workshop (March evening or April 3rd General VRWC meeting) *(Responsible: Heidi)*
- **Advisory Group Expansion:** Add Martin Schenker (OVLC) to Advisory Group martin@ovlc.org *(Responsible: Lara/Lynn)*
    - Those interested in joining the WRP advisory group at any point during the duration of the WRP Project should contact **Heidi.Ortloff@vcrcd.org**
- **Watershed Planning Tool Integration:** Align WRP tools with OVFSC's Online Dashboard
- **Event Collaboration:** Identify upcoming community workshops or forums where WRP can participate; send opportunities to **Heidi.Ortloff@vcrcd.org** (*All members)*

- **Association of Water Agencies Coordination:** Bruce Kuebler will reach out to Association of Water Agencies of Ventura County to engage them in the WRP and suggest WRP give a presentation at a future meeting
- **VRWC Future meeting topic ideas:** Look for someone to present research on grazing practices in riparian corridors
- Ojai Valley Green Coalition is hosting **Green Drinks** community conversations in Ojai; see OVGC website for the schedule; everyone is welcome to join the conversation Saturday Feb 8th at Three Birds in Ojai: 8:30-10:00 AM
- Two students are seeking internships

Meeting Agenda and Summary

1) **Welcome and Introductions**
    a) Meeting Called to order by Heidi Ortloff and Lauren Zaragoza (VCRCD)
    b) Attendees shared relevant updates
        i) Students seeking internships
        ii) OVGC Green Drinks event
2) **Ojai Valley Fire Safe Council (OVFSC) Presentation – Chris Danch**
    a) Updates on wildfire mitigation projects, including fuel reduction and community resilience initiatives, and wildfire risk dashboard (reference slides)
    b) Discussion/Questions from the attendees
        i) Is the dashboard being expanded to cover the entire County? Yes, eventually will be hosted by VCFD, Management Plan is being worked on. Eventually the dashboard will have an interactive element down to the parcel level.
        ii) Grazing Corridor – There were questions raised about grazing in riparian areas, and how it improves watershed health. Research on grazing in riparian areas ongoing in Russian River area. Julie Clark from UCANR suggests a presentation on research at an upcoming meeting.
        iii) Barriers to the Fire Safe Council's work - Competition for funding (grants), working with a highly fragmented landscape, property owners, etc. One goal to overcome the funding challenge is to fund in nontraditional ways such as sharing bioregional financing,

iv) Discussion about the importance of soil health and ability to retain water.

3) **Ventura River Watershed Resilience Project (WRP) Updates – Lynn Rodriguez and Lara Shellenbarger**
   a) Reviewed progress on WRP, including Advisory Group formation and proposed schedule and milestones for the year. (Reference Slides)
   b) Vivon Crawford (OVLC) is the confirmed **Chair of the Advisory Group**.
   c) Discussion/Questions from Attendees
      - If you would like to join the advisory committee at any point during the duration of the WRP please contact Heidi.Ortloff@vcrcd.org
      - Is a Network goal oriented or information sharing oriented? It can be both. The Ventura River Watershed Council has been operating in the recent past as more of an information sharing Network.
      - Ojai Valley Green Coalition hosted a community brainstorming workshop last fall in Ojai. It was well attended, and they were good at facilitation discussion. Vivon can help coordinate (Besant?) They are good at facilitating good discussion
      - For WRP workshops evening meetings could be considered
      - Bruce K. – Association of Water Agencies of Ventura County – Will reach out
      - Goals for WRP – Informed and engaged public

4) **Community Announcements & Next Steps**
   a) **Ojai Valley Green Coalition:** Hosting 'Green Drinks' community conversation on February 8th at Three Birds in Ojai (8:30-10:00 AM).
   b) **Students seeking internships:** Reach out to **Heidi.Ortloff@vcrcd.org** if you are interested in hosting an intern.
      i) Julie Clark UCANR - Internship sought by an undergrad senior Cal Poly Humboldt who has academic focus on restoration ecology, native plant nursery, & geospatial.
      ii) Kadie McShirley - A first year Master's student at the University of Michigan studying Geospatial Data Science and Environmental Policy and Planning with a focus in water resources is looking for a summer internship on the Central Coast.
   c) **Next Meeting:** April 3rd, 2025.

Ventura River Watershed Council Meeting

Thursday, April 3, 2025
9:00 am – 12:00 pm
Zoom Meeting information provided on next page of agenda
Optional Field Trip After Meeting
Field Trip RSVP Link

Meeting Agenda

Facilitated by Heidi Ortloff & Lauren Zaragoza

Ventura County Resource Conservation District

Please note, this meeting is Zoom only! An optional field trip will occur after the Zoom Meeting.See Details Below.

Item No.	Timeframe	Topic	Desired Outcome/Description
1	9:00 - 9:10	**Welcome** *Heidi Ortloff & Lauren Zaragoza* *Ventura County Resource Conservation District (VCRCD)*	Call to order & welcome. Attendees invited to share relevant updates.
2	9:10-09:50	**DWR Watershed Resilience Project Update** *Lynn Rodriguez, Lara Shellenbarger*	1. Report from the Advisory Group 2. Overview of networks 3. Report out on the Vision and Goals workshop 4. Update on consultant activities 5. Other announcements
3	9:40 – 9:50	**Wrap Up, Other Updates**	
4	10:30 – 11:30	**Optional Field Trip (RSVP in Advance)** *Casey Horgan, California Fish and Wildlife*	CDFW will share updates on their monitoring efforts.

Ventura River Watershed Council Meeting

Thursday, June 5th, 2025

9:00 am – 12:00 pm

Virtual Meeting

Meeting Agenda

Facilitated by Heidi Ortloff & Lauren Zaragoza

Ventura County Resource Conservation District

Please note, this is a virtual only meeting.zoom information on the last page of this document

Item No.	Timeframe	Topic	Desired Outcome/Description
1	9:05 - 9:10	**Welcome** *Heidi Ortloff* *Ventura County Resource Conservation District (VCRCD)*	Call to order & welcome. Attendees invited to share relevant updates.
2	9:10-9:35	**Watershed Resilience Project Update** *Jamie Whiteford - VCRCD*	Provide update on April 30th Forum and next steps for project
3	9:35 – 9:50	**Break**	
4	9:50-11:30	**Ventura River Adjudication Update** David Ceppos – Public Policy Mediation and Facilitation	Provide an overview of the current status of the watershed adjudication
5	11:30 – 11:45	**Closing Remarks**	

Ventura River Watershed Council Meeting

Thursday, Sep 4, 2025
9:00 am – 12:00 pm
555 Mahoney Ave, Oak View CA
Parking available at corner of Mahoney and Valley Rd.

Meeting Agenda

Facilitated by Heidi Ortloff & Lauren Zaragoza

Ventura County Resource Conservation District

Please note, this is a hybrid meeting.zoom information on the last page of this document

Item No.	Timeframe	Topic	Desired Outcome/Description
1	9:00 - 9:10	**Welcome** *Heidi Ortloff & Lauren Zaragoza* *Ventura County Resource Conservation District (VCRCD)*	Call to order & welcome. Attendees invited to share relevant updates.
2	9:10-9:40	**Ojai Valley Land Conservancy** *Vivon Crawford Sedgwick*	Forest Health Grant Update
3	9:40 – 10:10	**Ventura Land Trust** *VLT Staff*	Program Updates
4	10:10-10:50	**Break**	
5	10:50 – 11:50	**DWR Watershed Resiliency Pilot Project Update and Watershed Network** *Lynn Rodriguez, Lara Shellenbarger* *Stantec*	Water Budget Presentation

Ventura River Watershed Resilience Pilot Program

Ventura River Watershed Council Meeting
September 4, 2025



Overview for Today

- **Project Update Highlights**
- **Water Budget (Stantec)**

Grant Overview

Watershed Resilience Pilot Program Grant

- $10 million for pilot projects in five watersheds across California;
- $ 2 million
- Expires April 30, 2026
- RCD is grantee
- Funded by DWR through state budget funds authorized in 2022-23 budget
- Collaboration with DWR and four other pilots
- Collaboration with other watersheds in Ventura County during pilot

Foundations for the Watershed Resilience Plan

- Network Assessment
- Vision Statement
- Building on 2015 Watershed Management Plan
- Building on 2019 IRWM Plan and Climate Projections



Foundations of Collaboration

- Ventura River Watershed Council Serves as Network
- Advisory Group formed to review and provide input on technical elements
- Enhanced engagement with frontline communities and Tribes (build on WaterTalks Program) through CAUSE outreach (surveys and focus groups)
- Public outreach – forums, Council newsletter, WRP website





Network Engagement & Development

Frontline Communities Engagement

- **CAUSE** led survey and will conduct focus groups this summer in Westside Ventura and Casitas Springs communities.
- **Goal**: Identify community climate hazards, adaptation ideas, and perceived vulnerabilities.
- **Status** - 100 community members surveyed so far – analysis underway
- Two focus groups: Spanish-speaking adults and English-speaking Latinx youth.
- Outcomes will inform adaptation strategies.

Tribal Collaboration

- Working with Tribal Council, Tribal Elder Julie Tumamait – Stenslie and Native Coast Action Network ito integrateTribal perspective and practices in WRP – e.g. Keeper of the Flame, Open Rivers



Watershed Resilience Vision Statement

We envision a resilient and thriving Ventura River Watershed—where water, communities, ecosystems, and cultural practices are interconnected and sustained for future generations, and where the benefits of resilience are shared equitably.

Through proactive collaborative planning, inclusive engagement, and science-informed strategies, we will strive to restore natural systems and processes, protect local water resources and enhance water security, and strengthen our collective capacity to adapt to increasing climate challenges. Our efforts will support sustainable watershed management that benefits both ecological health and community well-being.

(*This vision is supported by guiding principles and co-equal goals that will shape our collective actions.*)

Goals:

1. Restore and Protect Ecosystem Health
2. Safeguard and Sustain Local Water Resources
3. Advance Climate Resilience through Action and Innovation
4. Promote Equity and Cultural Connection
5. Foster Stewardship and Education
6. Support Collaborative, Informed Decision Making

Project Website:
https://vcrcd.org/venturawatershedresilience/

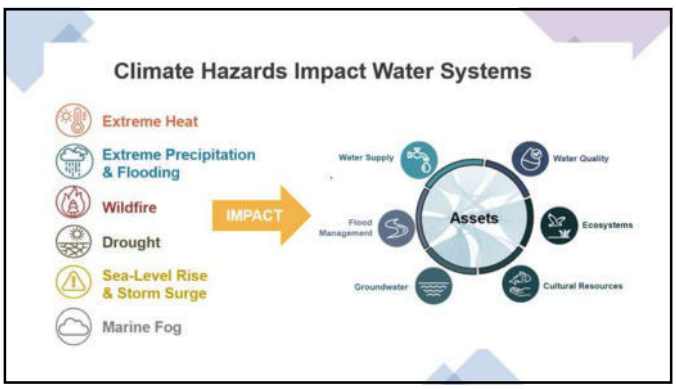
- Scope of work
- Advisory Group meeting materials
- Forum summaries
- Meeting schedule
- Watershed maps



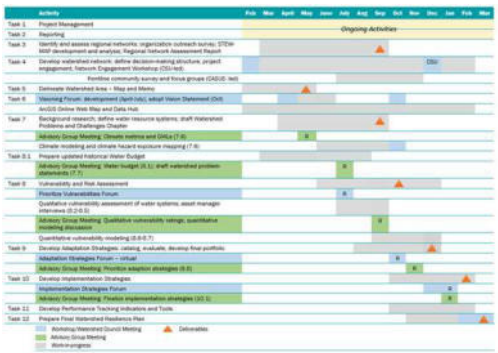


Technical Work Underway

- State of the Watershed and Problem Statements Chapter
- Watershed Water Budget
- Climate Hazards Analysis
- Vulnerability Assessments; qualitative and quantitative



Looking Ahead



Watershed Resilience Plan Preview



- Create Addendum to 2015 Watershed Management Plan as a Bridge to Watershed Resilience Plan
- Include a "crosswalk" of topics between two plans
- Include in Watershed Resilience Plan connections back to Watershed Management Plan

Looking Ahead – Next Steps

- Adaptation Strategies
- Implementation Strategies
- Newtwork Assessment Results and Workshop
- Tribal workshop



Upcoming Meetings

- **Watershed Council Meetings**
  September 4th at 9:00 a.m. (hybrid)
- October 2nd at 9:00 a.m. (hybrid)
- **Forum #3 – Adaptation Strategies**
  - October 23rd (virtual)



For more information about upcoming meetings visit: venturawatershed.org

Future

- Access future grants and bond funding for implementation projects and monitoring
- Build capacity of Ventura River Watershed Council

Project Update Highlights

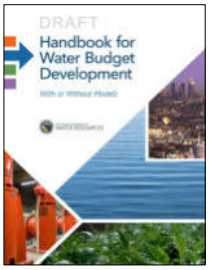
Water Budget (Stantec)

Water Budget

Purpose (text paraphrased from DWR Water Budget Handbook)

A water budget serves a critical element of water management planning by:

- Providing an understanding of historical conditions, and
- Illustrating how future changes to supply, demand, hydrology, population, land use, and climatic conditions will affect a geographic area.

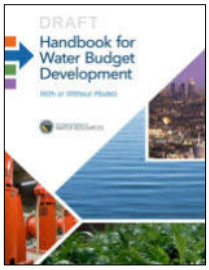


Water Budget

Purpose (text paraphrased from DWR Water Budget Handbook)

Water budgets may be useful for a variety of purposes:

- Water supply planning,
- Preparing feasibility studies,
- Facilitating integrated water resources management,
- Estimating and quantifying water resources,
- Identifying data gaps, and/or
- Forecasting optimum water management actions.



Water Budget

Method

- Using DWR water budget methodologies and relationships among different water budget components

- 4 (interrelated) water budgets:
  - Land System
  - Surface Water
  - Groundwater
  - Total (Watershed)



Water Budget

Data

Ventura GSFLOW Model - Existing Conditions Simulation

- Similar fundamental assumptions and limitations
- Requires translating model inputs and outputs into water budget components

Additional Data Sources

- Opportunity to improve understanding of watershed
- Investigate watershed-wide information



Water Budget

Major Watershed Features

- 2 reservoirs
- 4 groundwater basins
- No imported water
- Minimal groundwater inflow from outside watershed
- Minimal exports from watershed
- Outlet to ocean/estuary

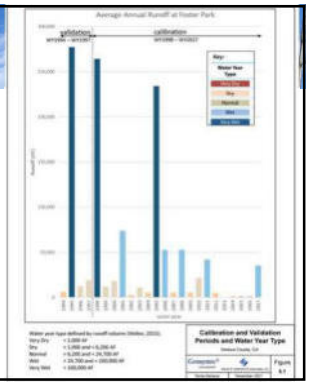


Water Budget

GSFLOW Period of Simulation

- Water Years 1994-2017
  - 24 simulated years
  - 1 PDO climate cycle = 20-30 years

- Year Types
  - 3 very wet years
  - 3 very dry years
  - Includes 2012-2016 drought

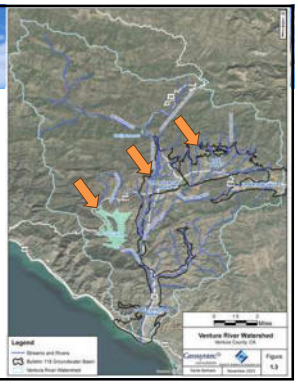


Water Budget

Presentation of Results

- Surface water budget
  - Lake Casitas water budget ↘

- Groundwater water budget
  - Upper Ventura Basin ↘
  - Ojai Basin ↘



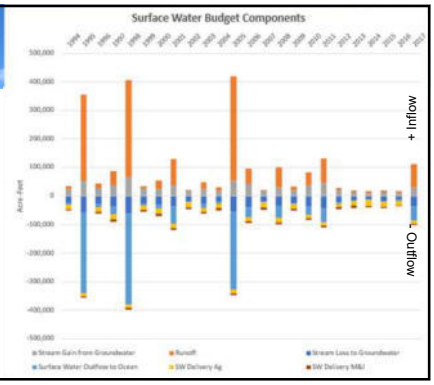
SW Water Budget

Observations

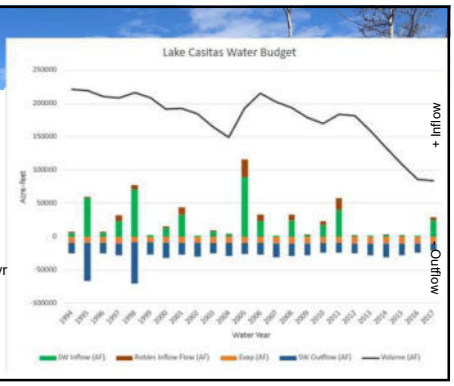
- Runoff-dominated system
- Significant SW-GW interaction
- Limited SW storage

Takeaways

- Variation in inflow by WY type
- Demand varies by WY type
  - AG requires more deliveries in drier WYs



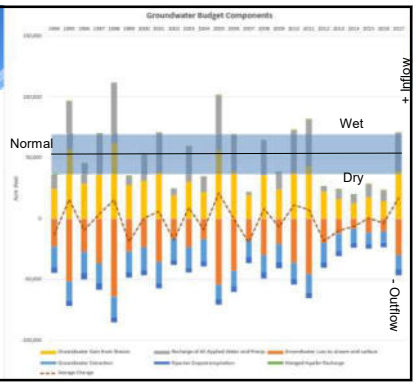
Lake Casitas Water Budget



Observations
- Storage fills in wet WY
- Consistent withdraw

Takeaways
- Max storage: 222,000 AF
  - Historical max
  - Ongoing storage loss to sedimentation
- Typical outflow: 27,000 AF/yr
  - Total outflow = deliveries/spill + evap.
- Drought: deliveries are reduced

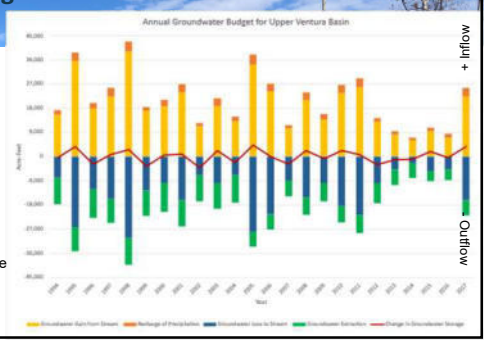
GW Water Budget



Observations
- Significant GW-SW interaction
- Storage variability driven by WY type
- Average GW extraction:
- Watershed geology/topography -> rapidly draining groundwater basins

Takeaways
- Limited effective groundwater storage
- Investigate variability in storage

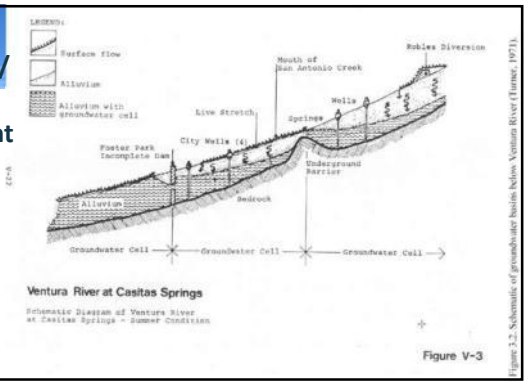
GW Water Budget: Upper Ventura



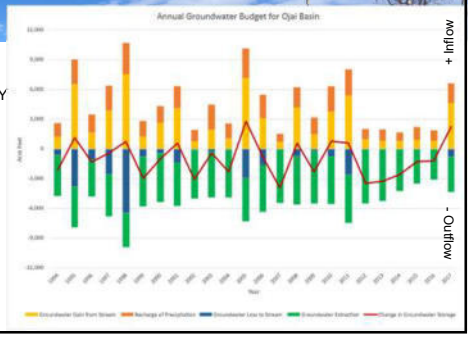
Observations
- GW-SW interaction in all WY types
- Typical withdrawal ~7000 AF/yr
- Storage fluctuates but is not overall negative, i.e. not in a state of overdraft

Takeaways
- Rapidly draining storage

Ventura Topography/ Geology – GW Gradient



GW Water Budget: Ojai Basin



Observations
- GW loss to SW in wet WY
- Typical extraction ~5000 AF/yr
- Extraction is a major component of the GW water budget

Takeaways
- Rapidly draining storage

Water Budget

Themes
- Inflows (water supply) driven by precipitation
- GW-SW interaction is a significant characteristic of the watershed
- Limited SW and GW storage
- Variable demand (AG/pumping) by WY type

WY Type	VD	D	N	W	VW
Runoff	-76%	-72%	0%	157%	1027%
Stream Gain from Groundwater	-60%	-39%	0%	27%	95%
Stream Loss to Groundwater	-51%	-37%	0%	23%	81%
Surface Water Outflow to Ocean	-83%	-72%	0%	178%	1645%
SW Delivery Ag	4%	7%	0%	-14%	-21%
SW Delivery M&I	-19%	-2%	0%	-8%	-18%
Recharge of All Applied Water and Precip	-62%	-64%	0%	34%	92%
Groundwater Gain from Stream	-51%	-37%	0%	23%	81%
Manged Aquifer Recharge	1%	0%	0%	0%	-1%
Groundwater Loss to Stream and Surface	-60%	-39%	0%	27%	95%
GW Extraction All	-34%	-7%	0%	-15%	-10%
Riparian Evapotranspiration	-19%	-4%	0%	1%	-10%

Water Budget

Discussion

- Based on feedback, we updated water budget component refinements – requesting feedback
  - Detail added for specific diversions and storage facilities
  - Detail added for different regions of watershed
  - Estimated exported water types/quantities
- Next Steps: water budget may be used in additional analyses for the WRP
  - Vulnerability assessments (e.g., impacts of hazards on water systems)
  - Adaptation strategy assessments (e.g., imported water, conservation)
  - Other?



Thank you!

VENTURA COUNTY RESOURCE CONSERVATION DISTRICT

WRP Team

Project Managers (consultants to RCD):
Lynn Rodriguez
Lara Shellenbarger

VENTURA COUNTY RESOURCE CONSERVATION DISTRICT

CAUSE

rincon

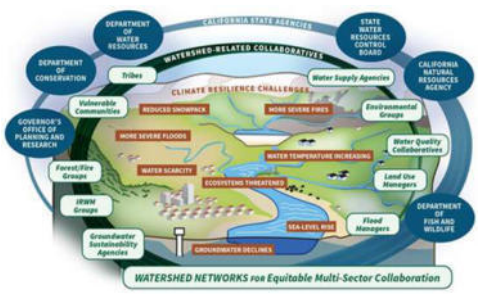
Institute for Watershed Resiliency

EAGLE ROCK ANALYTICS

Loyola Marymount University Center for Urban Resilience

CGST CENTER FOR GEOSPATIAL SCIENCE & TECHNOLOGY

Stantec



Ventura River Watershed Council Meeting

Thursday, October 2, 2025

9:00 am – 12:00 pm

Meeting Agenda

Facilitated by Lauren Zaragoza

Ventura County Resource Conservation District

Please note, this is a ZOOM meeting.

Item No.	Timeframe	Topic	Desired Outcome/Description
1	9:00 - 9:10	**Welcome** *Lauren Zaragoza* *Ventura County Resource Conservation District (VCRCD)*	Call to order & welcome. Attendees invited to share relevant updates.
2	9:10 - 9:25	**Wheeler Gorge Fish Passage Project Updates:** *South Coast Habitat Restoration*	Organization Overview & Pertinent Project Updates
3	9:25 – 9:40	**Infrastructure Projects, Impacts, Water Rates Review:** *Ventura Water, The City of Ventura*	Updates on three infrastructure projects that will affect how the City relies on water from the Ventura River and Lake Casitas
3	9:40 – 10:40	**Climate Hazards and Heat Mapping:** *Eagle Rock Analytics*	Evaluating climate related risks in the Ventura River Watershed
4	10:40 - 10:50	**Break**	
5	10:50 - 11:15	**Community Survey Results:** *CAUSE*	Share Community Survey Results

6	11:10 - 11:30	**Regional Network Assessment:** *Center for Geospatial Science & Technology, CSU Northridge; Institute for Watershed Resiliency, CSU San Bernardino; Center for Urban Resilience, Loyola Marymount University*	Share results of regional watershed network assessment analysis
7	11:30 - 12:00	**Closing Remarks**	Upcoming Meetings: October 23 and December 4th

Regional Network Assessment

Danielle Bram
Director

Ben Chou
Project Manager

Center for Geospatial Science & Technology
California State University, Northridge

Jennifer Alford, PhD
Director, Institute for Watershed Resiliency

California State University, San Bernardino

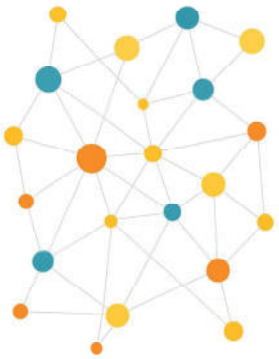
Michele Romolini, PhD
Managing Director, Center for Urban Resilience

Loyola Marymount University

Ventura River Watershed Council Meeting
October 2, 2025

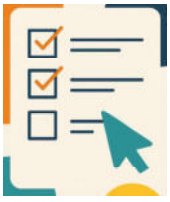
Goals/Objectives

- **Identify and Assess Existing Regional Network**
  - Assess level of current activity of groups working in the watershed
  - Evaluate participant engagement and contribution, inclusivity, and health of the networks
  - Identify spatial and organizational gaps in engaging historically excluded communities



Methods

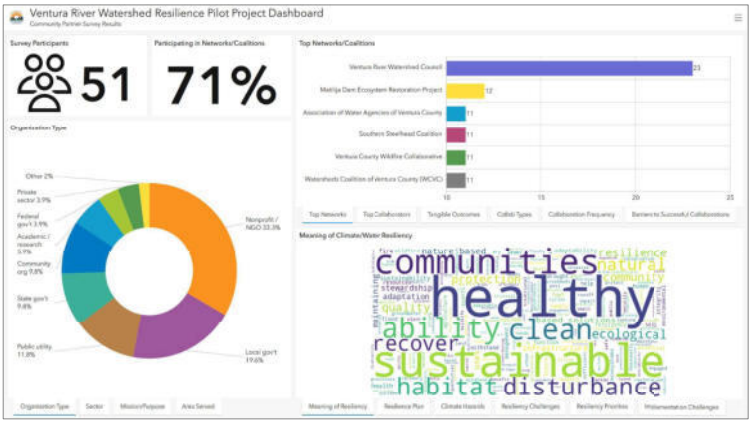
- **Community Partner Survey** (Summer 2025)
  - Organization Information
  - Existing Networks and Collaboration
  - Water & Climate Resilience



- **Focused Outreach** (Fall/Winter 2024)
  - Key Partner Meetings



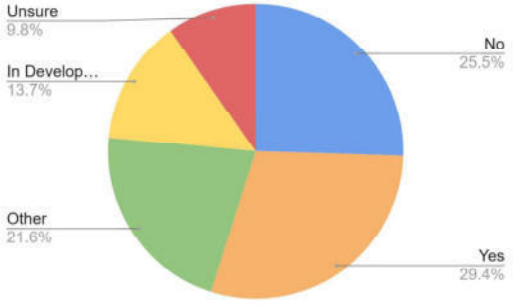
Overall Survey Results



Defining Watershed Resiliency

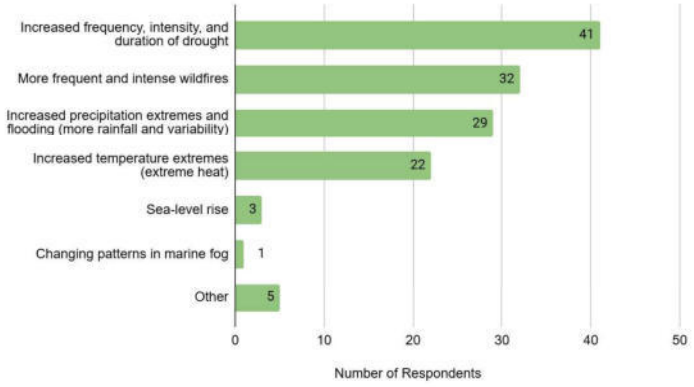


Q24. Has your organization developed a climate resilience vision or plan?

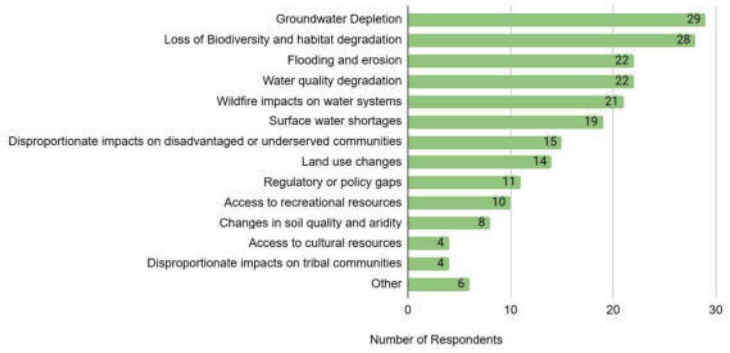


Taken together, the survey results reveal a landscape in which some sectors—particularly municipal agencies, select nonprofits, and parts of the water sector—are advancing formal resilience planning, while others rely heavily on "other" frameworks or lack plans altogether.

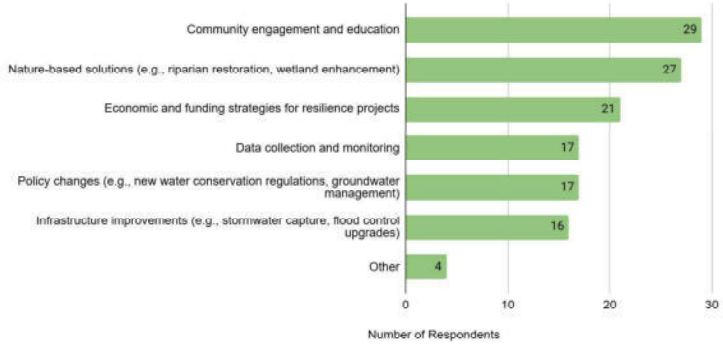
Q25: What are the most urgent climate hazards affecting water resources in the Ventura River Watershed as identified by your organization? Select up to three.



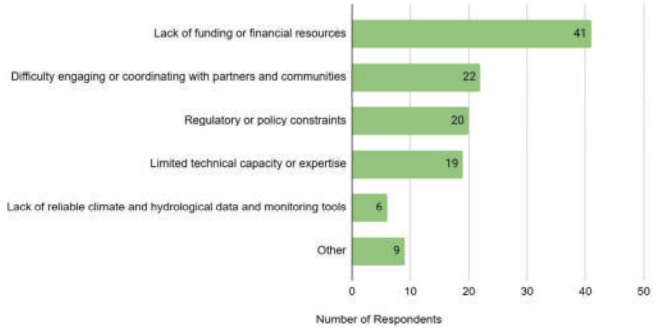
Q26: Most urgent challenges facing the Ventura River Watershed in terms of water and climate resilience as identified by your organization? Select up to five.



Q27: What approaches or strategies does your organization prioritize to support climate adaptation and resilience in the Ventura River Watershed, considering your organization's objectives, goals, and capacity? Select up to three.



Q28: What approaches or strategies does your organization prioritize to support climate adaptation and resilience in the Ventura River Watershed, considering your organization's objectives, goals, and capacity? Select up to three.



Social Network Analysis (SNA)

Q17: *Which groups does your organization collaborate with in the Ventura River Watershed?
Please select from the groups listed. If a group is not listed, please select "Other" and include the name.

Survey Outputs:

- Survey provided an initial list of 74 organizations from across sectors and scales
- 51 Survey Respondents named an additional 63 organizations
  = 114 network organizations
- Respondents could choose the ways that they collaborate with each organization

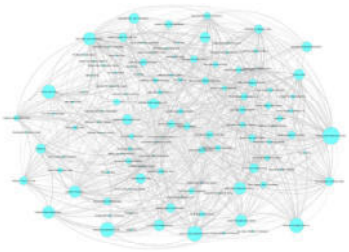


Image of VRWRP Network - all relationships

Social Network Analysis (SNA)

Q18: *How do you collaborate?
Please select all that apply.

Routine collaboration on watershed-related projects or programs

"CollabNet"

Knowledge, data, or expertise on watershed-related issues

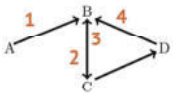
"InfoNet"

Funding, materials, work share, or work trade for watershed-related projects or programs

"FundNet"

SNA Terminology: Degree

Degree:
How many total connections does an organization have?
High degree organizations are the **"hubs" for diffusing information**, but they do not always reach diverse portions of the network and the quantity of ties may indicate lack of strength.
Ex: B has a degree of 4

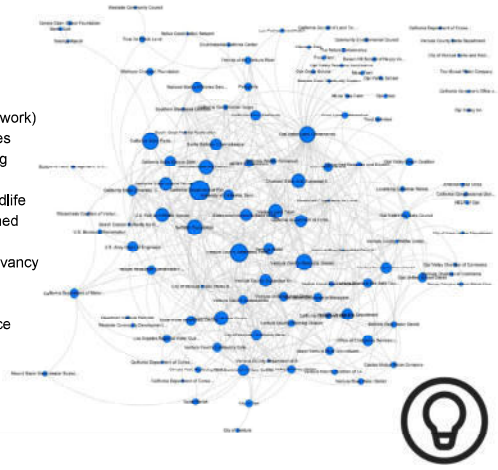


Out-degree:
In general, organizations with high out-degree can **spark the flow of information** across a network, but may not be the most efficient at spreading it.
Ex: B has an out-degree of 1

In-degree:
In general, organizations with high in-degree are **the leaders**, looked to by others for advice, expertise, or information.
Ex: B has an in-degree of 3

Selected Degree Results

- 1,104 total information ties
- 6 organizations have zero information ties
- 6 organizations (5% of the network) hold 21% of the information ties
- Top In-Degree (14-20 incoming ties):
  1. CA Dept of Fish and Wildlife
  2. Ventura County Watershed Protection
  3. Ojai Valley Land Conservancy
  4. Surfrider Foundation
  5. California State Parks
  6. Ventura County Resource Conservation District

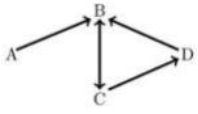


SNA Terminology: Betweenness

Betweenness:
The number of times an organization lies between two organizations that otherwise would not be connected.

This bridging or brokering position is considered a **measure of influence**, and highlights quality of ties over quantity. However, many high betweenness scores within a network can indicate that large numbers of organizations are peripheral or receive information from limited sources.

Ex: B is between A & C and A & D



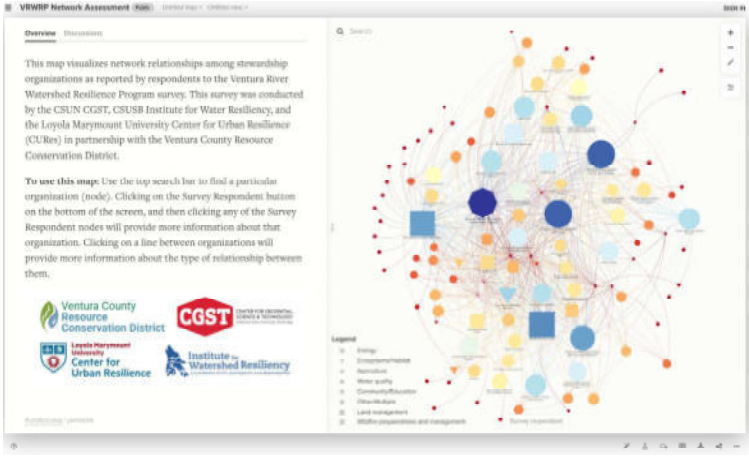
In-Degree (Leadership) vs. Betweenness (Influence)

Top Groups: In-Degree	Top Groups: Betweenness
Ventura County Resource Conservation District	Ojai Valley Land Conservancy
Ventura Land Trust	Ventura County Resource Conservation District
Ventura County Watershed Protection	Surfrider Foundation
Ojai Valley Land Conservancy	Farm Bureau of Ventura County
Casitas Municipal Water District	Ventura River Water District
Ventura Water	Casitas Municipal Water District
Surfrider Foundation	Ventura Water
Ventura River Water District	Ojai Valley Fire Safe Council
Ventura County Fire Department	Los Angeles Regional Water Quality Control Board (LARWQCB)
California State Coastal Conservancy	Ventura Land Trust
California Department of Fish and Wildlife	U.S. Fish and Wildlife Service
California State Parks	Ventura County Watershed Protection
City of Ojai	Concerned Resource and Environmental Workers (C.R.E.W.)
State Water Resources Control Board (SWRCB)	California Conservation Corps

Other Notable SNA Results

- Two groups ranked among the top in-degree and betweenness for all 3 relationship types:
  - Ojai Valley Land Conservancy
  - Ventura County Resource Conservation District
- Betweenness was highest in the information network, indicating that more organizations are playing a bridging role in information sharing
- 11 organizations held only one tie across all network types, including one responding organization: Westside Community Council

KUMU Network Mapping Tool



Case Studies: Ventura Watershed Strengths

Ojai Valley Land Conservancy

- **Mission:** Protect and restore natural landscapes in the Ojai Valley and lead response to climate change.
- Collaboration: ranked 1st in “betweenness” and 4th in “in-degree.”
- Partnering with the RCD on the Ventura River Watershed Riparian Resilience Program to remove Arundo. Recently obtained $7 million grant.
- Involved in trails, restoration, and have logged over 7,100 volunteer hours last year along with their 20 employees.

Surfrider Foundation

- **Mission:** protection and enjoyment of the world’s ocean and beaches for all people.
- Collaboration: ranked 3rd in "betweenness" and 7th in "in-degree."
- The Ventura County Chapter is part of five major coalitions.

Case Studies: Ventura Watershed Opportunities

Ventura Land Trust & Teranga Ranch Partnership

- VLT indicated that it struggles with community engagement.
- A potential solution could be a formal partnership with Teranga Ranch, an expert in community education.
- By leveraging Teranga Ranch's outreach skills, VLT can transform volunteer events into educational experiences, building a stronger community connection to restoration efforts and improving the long-term success of their projects. This would help VLT directly address its stated weakness and fulfill its mission of increasing stakeholder communication.

Westside Community Council Partnerships

- The Westside Community Council lacks, but desires partnerships needed to address community challenges effectively. They express a strong willingness to engage with partners.
- One potential partner could be CAUSE- would empower the community to advocate for environmental justice issues. CAUSE uses many avenues for advocacy.
- Another partnership is with the City of Ventura- would enable the council to assist implementing tangible projects to promote watershed health in an urban environment.

Engagement Workshop December 4 (9am-12pm)

- Goals/objectives
- Demonstration of developed survey, network & mapping tools
- Potential applications to inform coalition & partnership work/collaborations
- Facilitate engaged discussion to identify network gaps & to formulate recommendation.





Questions?



danielle.bram@csun.edu
ben.chou@csun.edu
jennifer.alford@csusb.edu
michele.romolini@lmu.edu

EAGLE ROCK ANALYTICS

Climate Hazard Results

Ventura River Watershed Council

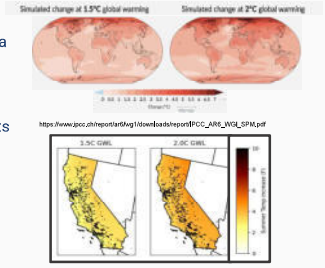
Summary of the Analysis

Goal: Derive climate-informed insights from quantitative metrics using the most advanced climate model output available for California.

- **Details:**
  - Model output from the Coupled Model Intercomparison Project Phase 6 (CMIP6)
  - Dynamically or statistically downscaled to 3 km resolution
  - 137 different futures to synthesize
  - Global Warming Level approach (details to follow)
- **Final Selected Climate Hazards**
  - Extreme Heat
  - Drought
  - Precipitation
  - Wildfire
  - Marine Stratus

Global Warming Levels (GWL): What is it?

- Global Warming Level (GWL) approach: Group climate simulations by **how much global warming has occurred** instead of by a specific year or timeframe.
- Global warming is calculated relative to pre-industrial conditions (1850-1900)
- GWLs align with familiar international targets for climate change mitigation (e.g. 1.5 °C and 2.0 °C)
- *"What will climate impacts in California look like when the world reaches 2.0 °C of warming?"*



GWL: Why?

Major benefits to GWL approach

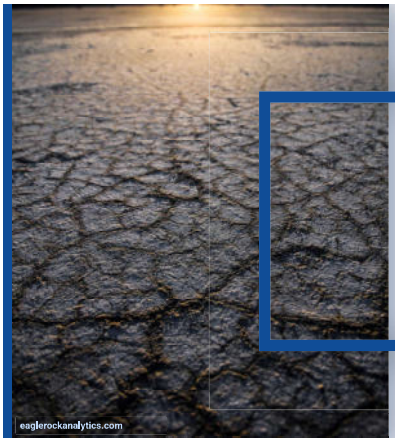
- Removes uncertainty from models that warm unrealistically quickly
- Allows the use of simulations from multiple Shared Scoio-economic Pathways (SSP) scenarios for additional statistical robustness
- Enables more flexible adaptive planning
- Aligns with IPCC, national, state climate planning processes

GWL gives a **clearer picture of how climate impacts could evolve** with continued greenhouse gas emissions

	Global Warming Level	Best estimate year
Historical baseline	0.8 °C	2002
Near Term Planning	1.5 °C	2031 (SSP 3–7.0)
Mid-Century Planning	2.0 °C	2047 (SSP 3–7.0)
Long Term Planning	3.0 °C	2075 (SSP 3–7.0)

Ventura River Watershed Results

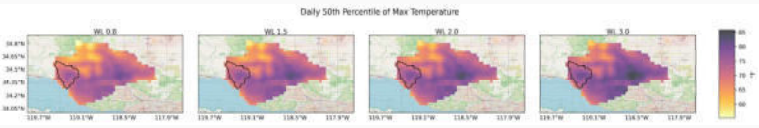
- **A wetter hotter future filled with more extremes**:
  - Substantial *increase* in *daytime* and *nighttime temperatures* during JJA and SON
  - *Wintertime caution advisories* for high *heat*
  - *Similar frequency* of *droughts* but more *severe*
  - *Extreme single-day precipitation events* will increase in intensity while multi-day events will decrease in intensity
  - An *increase* in *dryer conditions* coinciding with *high winds*
  - A *reduction* in the *marine stratus* which means a loss of the critical modulation of heat waves and drought



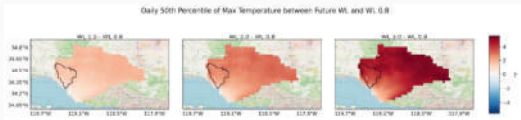
Extreme Heat

EAGLE ROCK ANALYTICS

Extreme Heat: Max Temperature

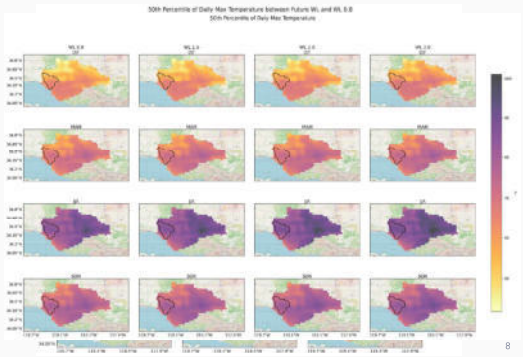


- Metric: 50th/95th Percentile of Max Temperature
- *High confidence* that extreme daily max temperatures will increase by 4°F under 3.0°C of warming



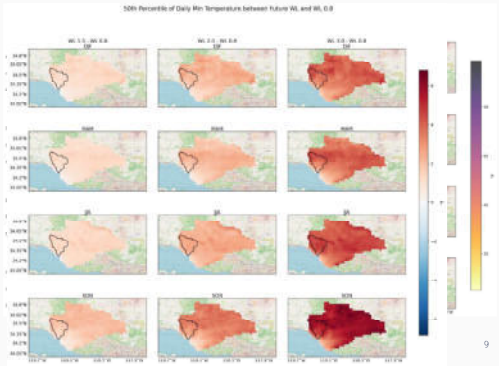
Extreme Heat: Max Temperature

- Metric: Average Daily Max Temperature by season
- *High Confidence* the largest change in daily max temperature will occur during Fall



Extreme Heat: Min Temperature

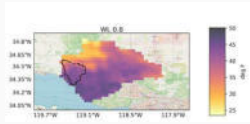
- Metric: Average daily minimum temperature by season
- *High confidence* minimum temperature will increase the most during Fall



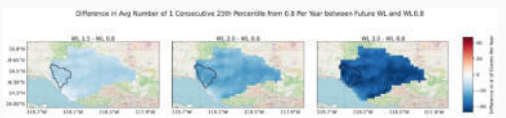
Extreme Heat: Min Temperature

- Metric: 25th Percentile of minimum temperature
- *High confidence* there will be at least 40 less days per year with temperatures below ~40°F

Ventura River Watershed should expect nighttime temperatures to be significantly warmer, especially during SON



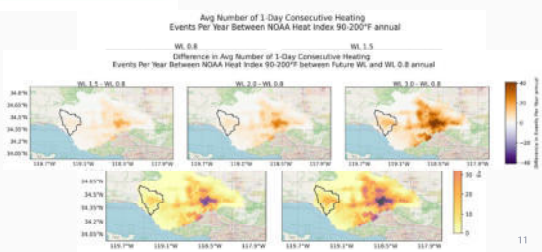




Extreme Heat: Heat Index

Classification	Heat Index	Effect on the body
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity
Extreme Caution	90°F - 103°F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	103°F - 124°F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	125°F or higher	Heat stroke highly likely

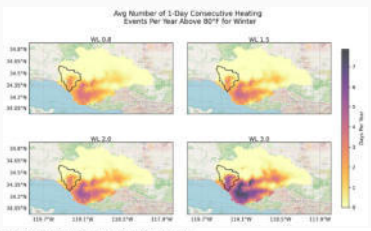
- Metric: Frequency in Extreme Caution or above
- *High confidence* the frequency of days where heat could severely impact the body will increase by 20 events per year

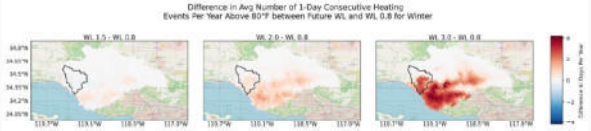


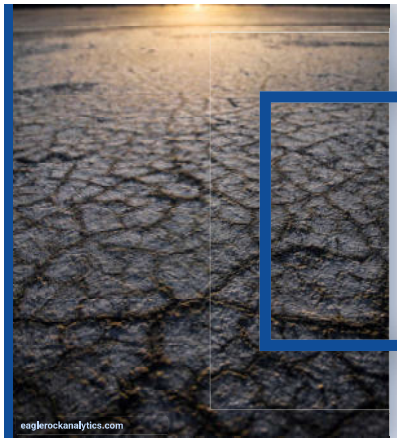
Extreme Heat: Heat Index

- Metric: Frequency of 'Caution' Advisory in winter
- *High confidence* that there will be more than 5 events per year in winter when a 'caution advisory' will be issued

Ventura River Watershed should expect 'caution advisories' in winter which typically don't occur now.







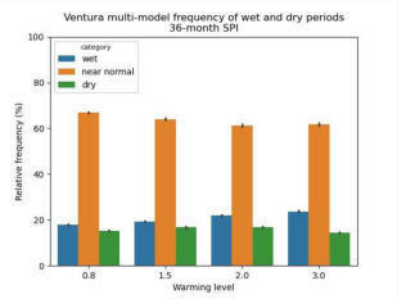
Drought

EAGLE ROCK ANALYTICS

Drought

- Metric: 36-month Standard Precipitation Index
- *High Confidence* that the frequency of droughts will remain relatively constant

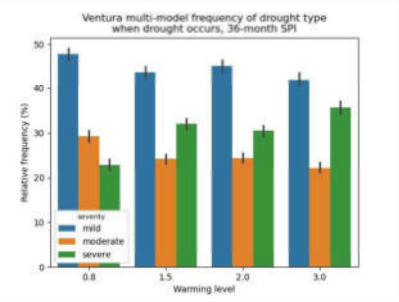
SPI	SPI < -2	-2 < SPI < -1.5	-1.5 < SPI < -1.0	-1.0 < SPI < 1.0	1.0 < SPI < 1.5	1.5 < SPI < 2.0	SPI > 2.0
Interpretation	Severely Dry	Moderately Dry	Mildly Dry	Near Normal	Mildly Wet	Moderately Wet	Severely Wet

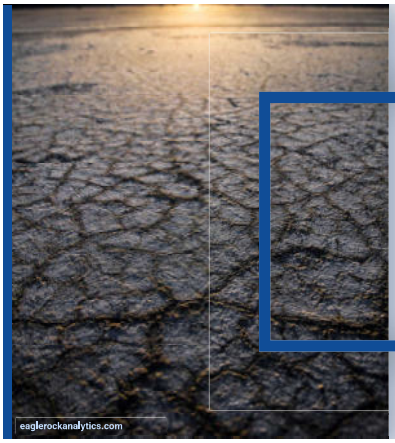


Drought

- Metric: 36-month Standard Precipitation Index
- *High Confidence* the frequency of *severe droughts* will *increase*

Ventura River Watershed should expect the same frequency of droughts but they will be more severe (D3/D4 - Extreme/Exceptional Droughts - National Drought Monitor)

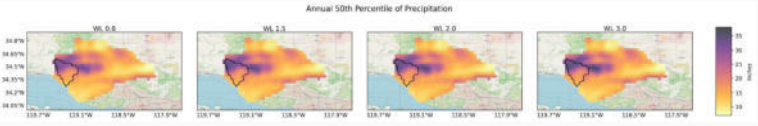




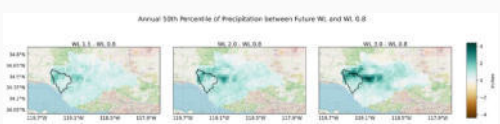
Precipitation

EAGLE ROCK ANALYTICS

Total Precipitation (Annual)

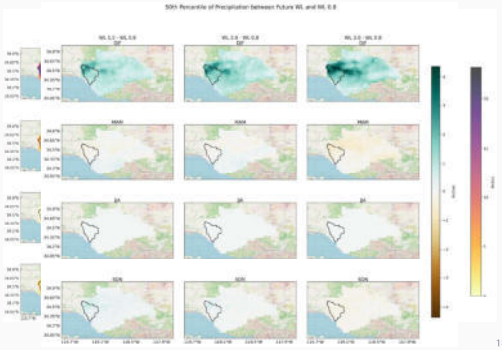


- Metric: Annual Precipitation
- *High confidence* that the watershed will see an increase in total precipitation

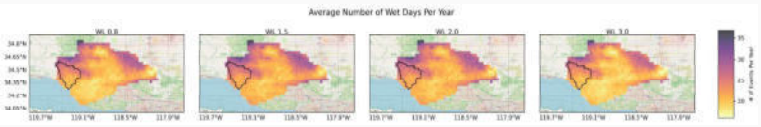


Total Precipitation (Seasonal)

- Metric: Seasonal Precipitation Totals
- *High confidence* that the increase in annual precipitation comes from winter with a decrease in shoulder seasons



Wet Days



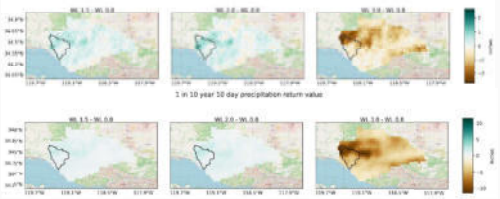
- Metric: # of wet days
- *High confidence* that the number of days with precipitation will go unchanged



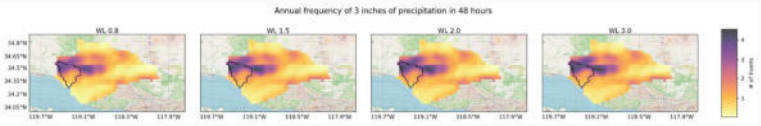
Extreme Precipitation (Annual)



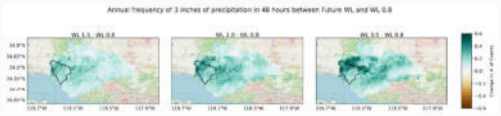
- Metric: Extreme Precipitation Intensity
- *High confidence* that 1 day events will get more intense but the intensity of multi-day rainfall will decrease



Extreme Precipitation (Annual)



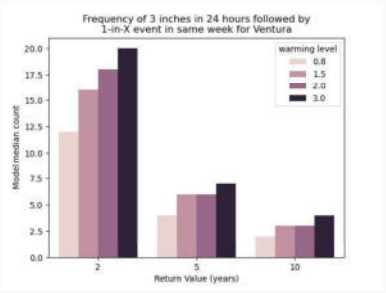
- Metric: Frequency of 3 inches of rain in 48 hours
- *High confidence* no change in the frequency of extreme rain over 48 hours (multi-day events)

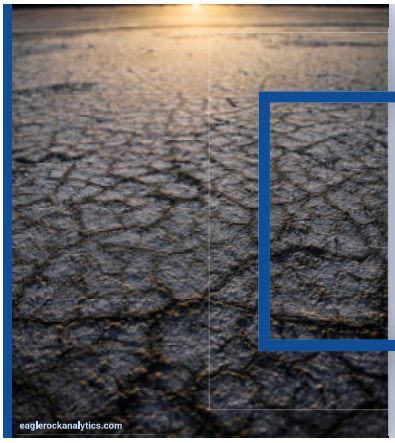


Extreme Precipitation (Compound Events)

- Metric: 3 inches of rain in 24 hours followed by a 1 in X event in the same week
- *High Confidence* Preconditioned compounded events will increase in frequency in the future

Ventura River Watershed should expect the same number of days of precipitation but more intense precipitation will fall exacerbating the impact of preconditioned compound events





Wildfire

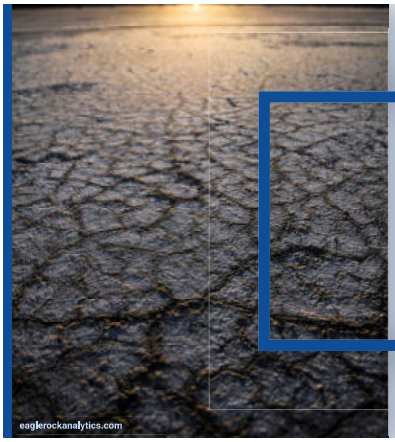
EAGLE ROCK ANALYTICS

Wildfire



- Metric: 6 month dry period + Winds Above 15 mph
- *Moderate confidence* that the number of high fire potential days per year will increase by 10+

Ventura River Watershed should expect 10-20 more events per year where Red Flag Warnings could be issued



Marine Stratus

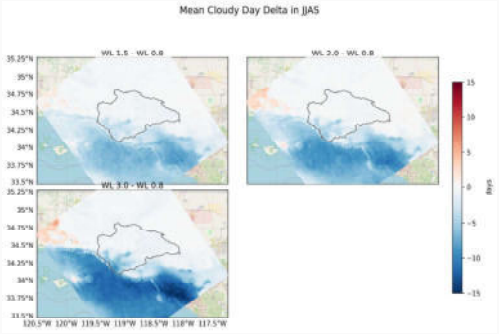
EAGLE ROCK ANALYTICS

Marine Stratus Proxy

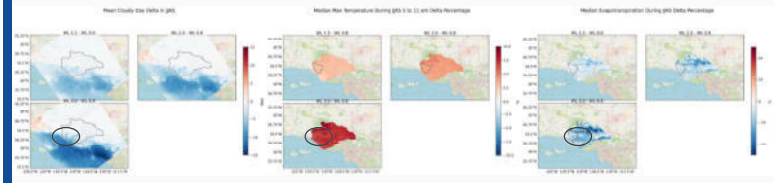
- Marine Stratus is complex. To develop an easy to interpret metric we needed to create a proxy for marine stratus.
- Based on peer-reviewed literature we selected the change in low clouds cloud fraction along the coastline.
  - Low clouds were defined as anything under 2000 meters
  - Limited the analysis to June, July, August and September
- Marine stratus moderates heat waves and droughts.
- To confirm the proxy and larger scientifically known relationships were correct we examined the joint distributions and change signals of marine stratus with temperature and evapotranspiration.

Marine Stratus

- Metric: Cloudy Days
- *High confidence* in a reduction of days with marine stratus



Marine Stratus

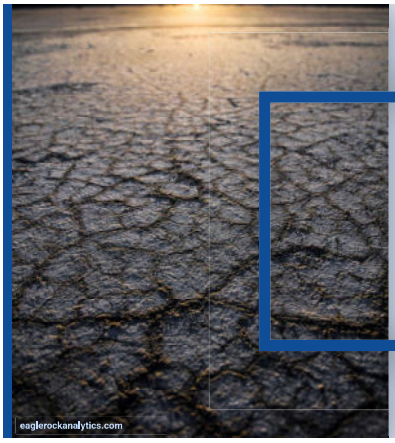


- Metric: Delta Signals
- *High confidence* that there will be fewer days of marine stratus aligned with hotter temperatures and a decrease in evapotranspiration.

Ventura River Watershed should expect a decrease in marine stratus impact the modulation of heat waves and droughts over the region.

Ventura River Watershed Results

- **A wetter hotter future filled with more extremes**:
  - Substantial *increase* in *daytime* and *nighttime temperatures* during JJA and SON
  - *Wintertime caution advisories* for high *heat*
  - *Similar frequency* of *droughts* but more *severe*
  - *Extreme single-day precipitation events* will increase in intensity while multi-day events will decrease in intensity
  - An *increase* in *dryer conditions* coinciding with *high winds*
  - A *reduction* in the *marine stratus* which means a loss of the critical modulation of heat waves and drought



Questions

EAGLE ROCK ANALYTICS

Ventura River Watershed Council Meeting

Thursday, December 4, 2025

8:30 am – 12:00 pm

555 Mahoney Ave.
Oak View, CA 93022

Meeting Agenda

Ventura County Resource Conservation District

Please note, this is an in person meeting

Item No.	Timeframe	Topic	Desired Outcome/Description
1	8:30 - 8:45	**Sign in and Coffee**	
2	8:45 - 9:00	**Introductions and Overview** *VCRCD, WRP Team, CSU Team*	Outline purpose and objectives of the meeting.
3	9:00 – 9:15	**Underserved Community Engagement** *Central Coast United for a Sustainable Economy (CAUSE)*	Focus group and survey highlights, how to better support our frontline communities into the future
4	9:15 - 9:45	**Network Assessment Results & Demos** *CSU Team*	Introduction to utilizing tools to visualize and strengthen watershed resiliency network.
5	9:45 - 10:45	**Breakout Groups** *CSU Team*	Breakout groups will discuss use of the web map, dashboard, and KUMU map to strengthen partner engagement.
6	10:45 - 11:00	**Break**	
7	11:00 - 11:55	**Group Discussion**	Share breakout group discussions, identify recommendations for improving network engagement, and discuss the future of the Council.
8	11:55 - 12:00	**Wrap Up** *VCRCD*	

Regional Network Assessment

Danielle Bram
Director

Ben Chou
Project Manager

Nora Carmody
GIS Analyst

Center for Geospatial Science & Technology
California State University, Northridge

Jennifer Alford, PhD
Director, Institute for Watershed Resiliency

California State University, San Bernardino

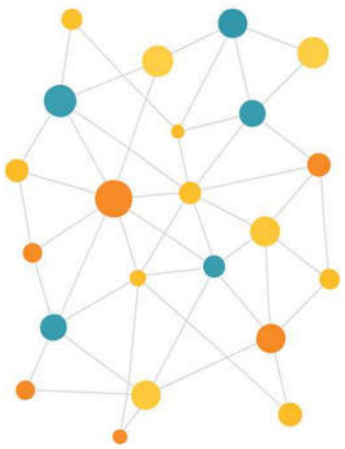
Michele Romolini, PhD
Managing Director, Center for Urban Resilience

Loyola Marymount University

Mapping Connections for Watershed Resilience
December 4, 2025

Goals/Objectives

- **Identify and Assess Existing Regional Network**
  - Assess level of current activity of groups working in the watershed
  - Evaluate participant engagement and contribution, inclusivity, and health of the networks
  - Identify spatial and organizational gaps in engaging historically excluded communities



Workshop Goals/Objectives

- Demonstrate survey, network, and mapping tools
- Interact with tools & provide feedback in breakout groups
- Discuss how tools can be used to inform coalition & partnership work/collaborations
- Identify network gaps & develop recommendations for improving network engagement/resilience

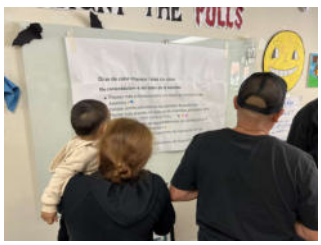




Underserved Community Engagement

- Survey and two focus groups led by CAUSE
- Focused on community climate concerns and priorities





4

Network Assessment Results & Demos

- **Community Partner Survey** (Summer 2025)
  - Organization Information
  - Existing Networks and Collaboration
  - Water & Climate Resilience

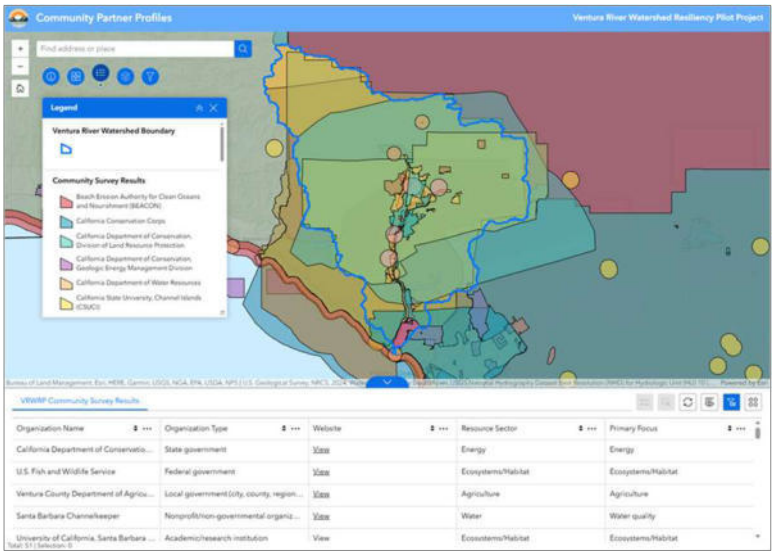


- **Focused Outreach** (Fall/Winter 2024)
  - Key Partner Meetings



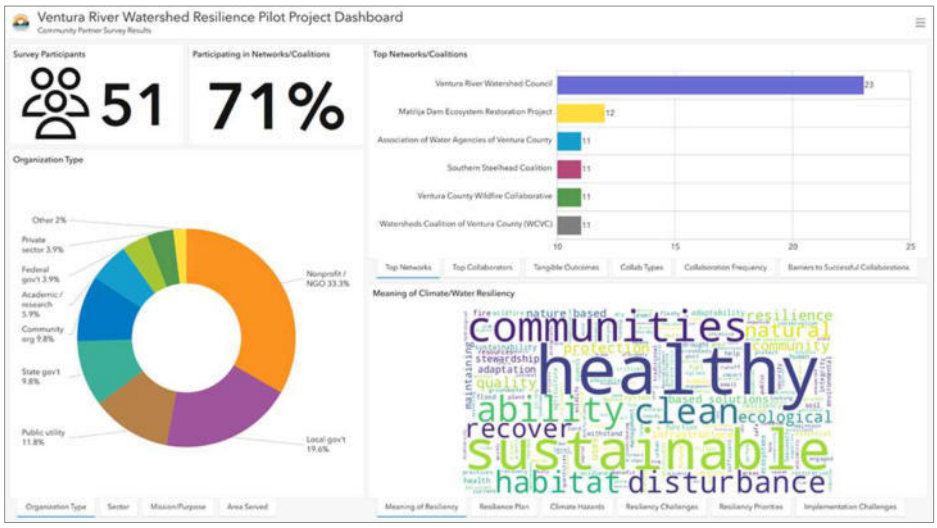
5

Community Partner Profiles Web Map
t.ly/vrwrp-webapp



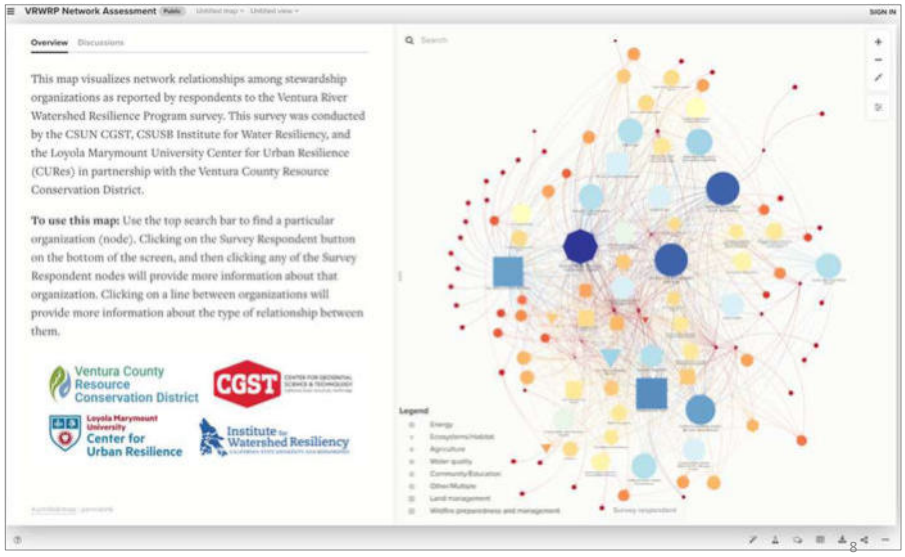
6

Survey Results Dashboard
t.ly/vrwrp-dashboard



7

KUMU Network Mapping Tool
t.ly/vrwrp-kumu



8

Case Studies: Ventura Watershed Strengths

Ojai Valley Land Conservancy

- **Mission:** Protect and restore natural landscapes in the Ojai Valley and lead response to climate change.
- Collaboration: ranked 1st in “betweenness” and 4th in “in-degree.”
- Partnering with the RCD on the Ventura River Watershed Riparian Resilience Program to remove Arundo. Recently obtained $7 million grant.
- Involved in trails, restoration, and have logged over 7,100 volunteer hours last year along with their 20 employees.

Surfrider Foundation

- **Mission:** protection and enjoyment of the world’s ocean and beaches for all people.
- Collaboration: ranked 3rd in "betweenness" and 7th in "in-degree."
- The Ventura County Chapter is part of five major coalitions.

9

Case Studies: Ventura Watershed Opportunities

Ventura Land Trust & Teranga Ranch Partnership

- VLT indicated that it struggles with community engagement.
- A potential solution could be a formal partnership with Teranga Ranch, an expert in community education.
- By leveraging Teranga Ranch's outreach skills, VLT can transform volunteer events into educational experiences, building a stronger community connection to restoration efforts and improving the long-term success of their projects. This would help VLT directly address its stated weakness and fulfill its mission of increasing stakeholder communication.

Westside Community Council Partnerships

- The Westside Community Council lacks, but desires partnerships needed to address community challenges effectively. They express a strong willingness to engage with partners.
- One potential partner could be CAUSE- would empower the community to advocate for environmental justice issues. CAUSE uses many avenues for advocacy.
- Another partnership is with the City of Ventura- would enable the council to assist implementing tangible projects to promote watershed health in an urban environment.

10



Breakout Groups





11

Group Discussion
Breakout Group Reports



12

Network Engagement Recommendations

Equity & Access

- How could we use these tools to make the network more inclusive and accessible to smaller or under-resourced groups?



13

Network Engagement Recommendations

Collaboration Opportunities

- How can we increase collaboration among weakly connected organizations to improve overall network resilience?



14

Ventura River Watershed Council Meeting

Thursday, March 19, 2026

9:00 am – 11:00 am

Virtual Only

Meeting Agenda

Ventura County Resource Conservation District

Please note, this is ZOOM meeting

Zoom Link:

https://us02web.zoom.us/j/89511629279?pwd=Z0lTT3VyWFd4Zlo5RWtnREsvZjhNZz09

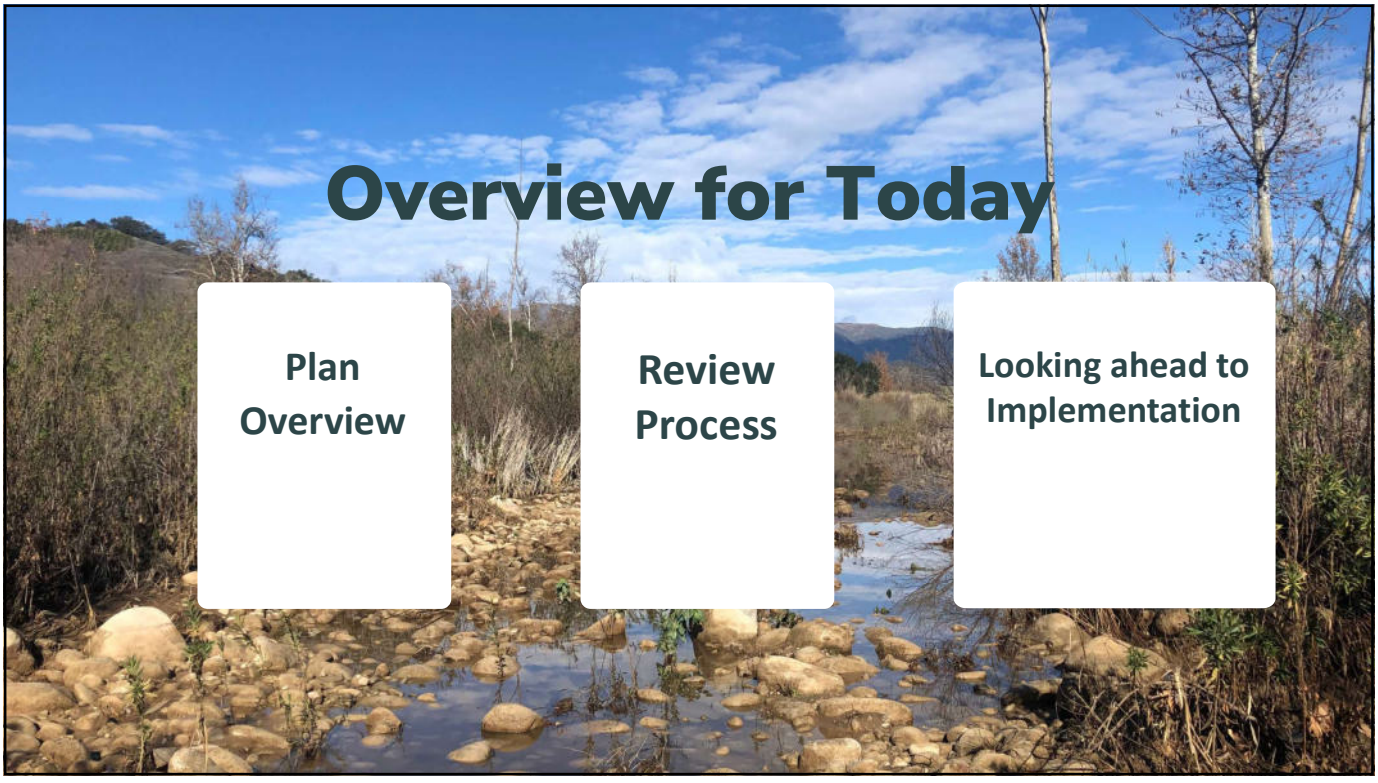
Item No.	Timeframe	Topic	Desired Outcome/Description
1	9:00 - 9:05	**Introductions and Agenda Overview** *Lauren Zaragoza*	
2	9:05 - 9:10	**General Announcements** *Open Floor*	Opportunity for partner updates, upcoming events, etc.
3	9:10 – 9:45	**Ventura River Watershed Resilience Program Overview** *WRP Project Team, Lynn Rodriguez & Lara Shellenbarger* **Technical Oversight and Key Findings and Strategies** *Anna Yip*	A recap on what the plan is, how it was developed, notable milestones An overview of key vulnerabilities, strategies, implementation actions and performance indicators
4	9:45 - 10:00	**Acknowledgements and Reflections** *WRP Project Team, Jamie Whiteford, Advisory Group*	Opportunity for project team to acknowledge gratitude and for project team and Advisory Group to offer reflections
5	10:00 - 10:05	**Break**	

6	10:05 -10:15	**Review Process** *WRP Project Team, Lauren Zaragoza*	How to access the plan on the VCRCD website, open for review, how to make comments, project submittal to DWR, questions
7	10:15 - 10:40	**Looking Ahead to Implementation** *Mike Antos*	How do we support and plan for implementation, funding discussions
8	10:40 - 11:00	**Wrap Up & Open Floor** *VCRCD, Consultants, General Audience*	Questions and clarifications
9		**Upcoming Meetings**	Leadership Committee Meeting May 15th, General Meeting June 4th 9:00-11:00 am

Ventura River Watershed Resilience Pilot Project

Watershed Council Meeting
March 19, 2026





Purpose of Watershed Resilience Pilot

- Build stronger **community-based networks**
- Assess local **climate vulnerability and risks**
- Develop **adaptation strategies**
- Strengthen **vulnerable communities**
- **Build on previous regional planning efforts** (i.e. VR Watershed Management Plan and IRWM Plan)



La1

Recap on Engagement

Key Engagement Overview

Watershed Council Meetings & Workshop

- Presentations at key milestones
- Workshop on strengthening network connections

Advisory Group Meetings & Office Hours

- Climate hazard metrics; historical water budget approach; quantitative vulnerability assessment approach; qualitative vulnerability assessment; implementation roadmaps

Three Forums

- Vulnerability assessment and vision; adaptation strategies; Tribal resilience and implementation roadmaps

Partner Meetings and Interviews

- Focused discussion on points of interest

Survey and Focus Groups with Overburdened Communities

Enhanced engagement with BVBMI

August 2024 – January 2025

Phase 1: Network Formation, Early Coordination, and Scoping

- **August 2024** – Watershed Council: VRWRP introduction
- **Fall 2024** – Key partner interviews
- **October 2024** – Watershed Council: Approval of role of Council as WRP Network
- **December 2024** – Watershed Council: Updates on VRWRP scope and timeline, and website launch
- **January 2025** – AG formation

March – June 2025

Phase 2: Vision, Watershed Assets, and Challenges

- **March 2025** – AG Meeting #1: VRWRP introduction and overview
- **April 2025** – Forum #1: Vision, goals, and watershed assets
- **June 2025** – Watershed Council: Review and approve vision statement

May – December 2025

Phase 3: Network Assessment, Vulnerability and Technical Analysis

- **May 2025** – AG Meeting #2: Identify climate hazard metrics and thresholds
- **May-June 2025** – Community focus groups (West Ventura & Casitas Springs)
- **July 2025** - Forum #2: Identify and prioritize watershed assets and discuss climate hazard impacts
- **July 2025** – AG Meeting #3: Review historical water budget and problem statements
- **September 2025** – AG Meeting #4: Review initial qualitative vulnerability assessment results
- **October-November 2025** – Regional network assessment survey
- **November 2025 – November 2025** - "AG meeting #5: Review of quantitative vulnerability assessment approach

October 2025 - March 2026

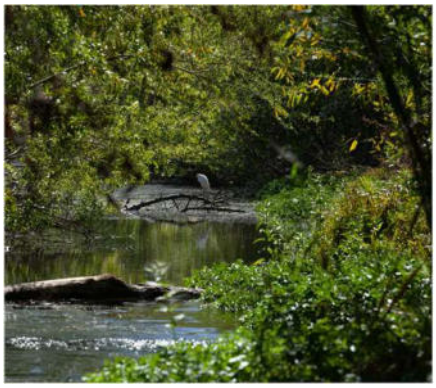
Phase 4: Adaptation and Implementation Strategies

- **October 2025** – Joint Watershed Council & AG Special Session: review key vulnerabilities and develop draft adaptation strategies and actions
- **December 2025** – AG Meeting #6: Tribal perspectives and Indigenous Knowledge Systems presentation; review draft adaptation strategies
- **February 2026** – Forum #3: Tribal resilience and implementation roadmaps
- **March 2026** – AG Meeting #7: Review compiled VRWRP
- **March 2026** – Watershed Council: VRWRP final presentation
- **December 2025** – Watershed Council: Regional network assessment results

Watershed Resilience Plan Overview

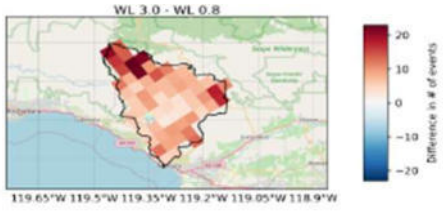
A **holistic plan to sustainably manage** water resources at a watershed scale in the face of climate change

- Identify **climate change vulnerabilities**
- Prioritize **adaptation strategies and projects**
- Integrate and prioritize **equity and inclusiveness**
- Enhance **partnerships across the Watershed**
- Improve regional **competitiveness for funding**



What's New in this Plan?

- Builds on existing Watershed Management Plan
- Climate-informed vulnerability assessment (quantitative + qualitative)
- Integrated watershed-scale strategy
- Frontline community input embedded
- Tribal perspectives and cultural resources integrated
- Network-based implementation approach
- Identified priority actions and pathways



Watershed Resilience Plan Organization



- Executive Summary
- **Chapter 1**: Introduction
- **Chapter 2**: Watershed Network
- **Chapter 3**: State of the Watershed
- **Chapter 4**: Future Climate Conditions
- **Chapter 5**: Climate Vulnerabilities
- **Chapter 6**: Adaptation Strategies, Actions, and Implementation Roadmaps
- **Chapter 7:** Resilience Indicators

Ventura River Watershed
Water Resilience for a Changing Climate

Adaptation Goals

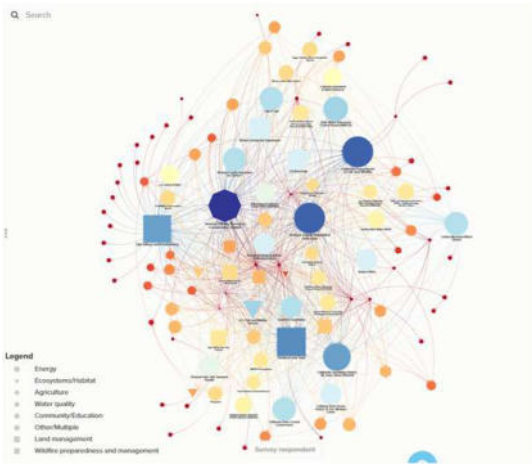
Adaptation Strategies are organized around eight goals:

- Ecosystem health strengthened watershed-wide
- Water supply reliability and infrastructure resilience improved
- Communities and ecosystems protected from flooding, erosion, and sea level rise
- Flood and erosion risks from extreme precipitation reduced
- Recreational access protected and enhanced
- Climate-resilient agriculture and local economy supported
- Watershed governance, funding, and monitoring strengthened
- Tribal leadership and Indigenous knowledge integrated



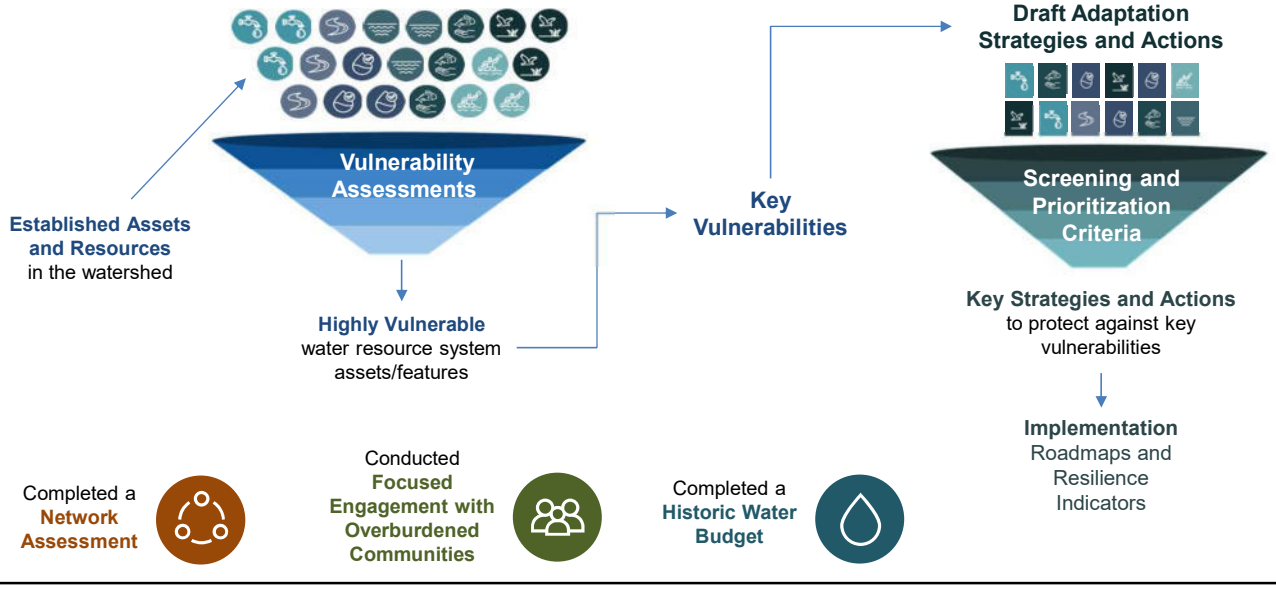
Program Recommendations

- Strengthen multi-agency coordination
- Strengthen Watershed Council as the central coordination forum
- Maintain and evolve Network tools
- Expand inclusive participation & strategic partnerships
- Coordinate funding strategies & pursue large-scale resilience investments
- Establish an annual progress reporting process
- Follow a clear near-term timeline for plan adoption & early implementation
- Maintain the Watershed Resilience Plan as a dynamic resource



La1

Accomplishments Recap: Technical Work



La1

Accomplishments Recap: Technical Work

April Forum and Initial Interviews

Established Assets and Resources in the watershed

Vulnerability Assessments

April – Nov: Forum, AG Mtgs, Asset Manager Interviews

Highly Vulnerable water resource system assets/features

Key Vulnerabilities

Draft Adaptation Strategies and Actions

Screening and Prioritization Criteria

December AG Meeting

Key Strategies and Actions to protect against key vulnerabilities

February Forum

Implementation Roadmaps and Resilience Indicators

May AG Meeting

Completed a Network Assessment

Conducted Focused Engagement with Overburdened Communities

July AG Meeting

Completed a Historic Water Budget

Key Findings, Strategies, and Implementation

8 Adaptation Goals ⟶ 8 Implementation Roadmaps

Resilience Indicators to Track Progress



Goal 1: **Ecosystem Health is Strengthened Watershed-Wide**
- **Strategy 1.1:** Restore and Protect Native Forest, Woodland, and Upland Ecosystems
- **Strategy 1.2:** Improve Soil Health and Watershed Function Across the Watershed
- **Strategy 1.3:** Restore Riparian Corridors and Enhance Habitat Connectivity
- **Strategy 1.4:** Enhance Aquatic Ecosystems and Steelhead Resilience

Goal 2: **Water Supply is More Reliable and Water Infrastructure is More Climate-Resilient**
- **Strategy 2.1:** Improve Groundwater Basin Understanding and Monitoring
- **Strategy 2.2:** Implement Conjunctive Use and Demand Management
- **Strategy 2.3:** Evaluate and Protect Long-Term Water Supply Reliability

Goal 3: **Communities, Infrastructure, and Ecosystems are Protected from Erosion, Flooding, and Shoreline Change Driven by Sea Level Rise and Storm Surge**
- **Strategy 3.1:** Upgrade and Strategically Relocate Critical Infrastructure
- **Strategy 3.2:** Rely on Nature-Based Solutions to Protect Coastal Infrastructure

Goal 4: **Flood and Erosion Risks to Communities, Infrastructure, Water Quality, and Ecosystems from Extreme Precipitation are Minimized**
- **Strategy 4.1:** Modernize Flood, Stormwater, and Wastewater Management Infrastructure
- **Strategy 4.2:** Enhance Erosion Control, Sediment Management, and Floodplain Function
- **Strategy 4.3:** Manage Septic and Wastewater Risks to Water Quality

Goal 5. **Recreational Access for Community Enjoyment is Protected and Enhanced**
- **Strategy 5.1:** Build Climate-Adaptive, Multi-Functional Public Spaces
- **Strategy 5.2:** Enhance Recreation Management and Protect Sensitive Habitats

Goal 6. **Agricultural Practices Are Adapted to the Effects of Climate Change and Sustain a Thriving Local Economy and Ag-Based Livelihoods**
- **Strategy 6.1:** Promote Water-Resilient and Water Efficient Cropping and Irrigation Systems
- **Strategy 6.2:** Promote Regenerative Agriculture and Soil Health
- **Strategy 6.3:** Reduce Agricultural Water-Quality Impacts and Runoff

Goal 7. **Coordinated Watershed Resilience is Strengthened Through the Improvement of Governance, Funding, and Monitoring Tools**
- **Strategy 7.1:** Expand Coordinated Data and Monitoring Capabilities
- **Strategy 7.2:** Improve Interagency Coordination, Water System Preparedness, and Emergency Response
- **Strategy 7.3:** Strengthen Funding Pathways for Implementation

Goal 8. **Native Leadership and Indigenous Knowledge Strengthen Climate Resilience of Cultural Resources, Sacred Sites, Subsistence Areas, and Heritage Assets**
- **Strategy 8.1:** Strengthen Tribal-led Stewardship and Relationships by Building Tribal Capacity and Workforce Capacity
- **Strategy 8.2:** Protect Cultural Sites from Climate-Driven Hazards, such as Wildfire, Flooding, Erosion, and Coastal Hazards
- **Strategy 8.3:** Sustain Traditional Subsistence Resources Under Changing Climate Conditions

AY1

Acknowledgments and Reflections

- Barbareño/Ventureño Band of Mission Indians (BVBMI)
- Central Coast Alliance for Sustainable Economy (CAUSE)
- Chumash Elder and Educator
- City of Ventura
- County of Ventura Watershed Protection District
- Farm Bureau of Ventura County
- Meiners Oaks Water District
- MERITO Foundation
- Ojai Basin Groundwater Management Agency
- Ojai Valley Fire Safe Council
- Ojai Valley Land Conservancy
- Ojai Valley Sanitation District
- Santa Barbara Channelkeeper
- Surfrider Foundation
- Upper Ventura River Groundwater Agency
- Ventura County Board of Supervisors
- Ventura County Resource Conservation District
- Ventura Land Trust
- Ventura River Water District

Ventura River Watershed
Water Resilience for a Changing Climate

WRP Team

WRP Team

Project Managers
(consultants to RCD):
Lynn Rodriguez
Lara Shellenbarger

VENTURA COUNTY RESOURCE CONSERVATION DISTRICT

CAUSE
Central Coast Alliance United for a Sustainable Economy

rincon

The Barbareño/Ventureño Band of Mission Indians

Institute for Watershed Resiliency
California State University San Bernardino

Ventura River Watershed Council

EAGLE ROCK ANALYTICS

NATIVE COAST ACTION NETWORK

Loyola Marymount University
Center for Urban Resilience

CGST
Center for Geospatial Science & Technology
California State University Northridge

Stantec

How to Review and Submit Comments

You may use the feedback form to:

- Identify specific sections/chapters you are commenting on
- Share suggestions, concerns, or clarifications
- Flag errors or omissions (e.g., typos, terminology, figures)

https://vcrcd.org/venturawatershedresilience/



VRWRP Available Now!
2 weeks review – Closes April 1st

** Graphical edits to be posted next week (Executive Summary, Implementation Roadmaps)*

Next Steps for WRP

- Coordination of the watershed resilience network
- Strengthening of the Watershed Council
- WRP integration under Council governance
- Build coalitions: leaders and partners
- Build systems: support and coordination
- Leverage funding: implementation and support
- Track progress
- Communicate outcomes



PROP 4 – CLIMATE BOND

- November 2024, voters approved Proposition 4
- $10 billion bond measure focused on increasing the state's resilience to the impacts of climate change.
- Governor has proposed a multiyear spending plan to implement the bond
- Appropriations totaling **$2.7 billion** in **2025-26**.
- Governor proposes shifting some prior appropriations from the General Fund and Greenhouse Gas Reduction Fund (GGRF) to instead be supported by Proposition 4.

PROP 4 – CLIMATE BOND

Purpose	Bond Total	2025-26	2026-27	2027-28	2028-29	Pending
Safe Drinking Water, Drought, Flood, and Water	$3,800	$1,074	$972	$819	$925	$10
Wildfire and Forest Resilience	$1,500	$325	$376	$214	$496	$89
Coastal Resilience	$1,200	$173	$129	$190	$708	–
Biodiversity and Nature-Based Climate Solutions	$1,200	$286	$136	$165	$512	$101
Clean Energy	$850	$275	$229	$3.0	$21	$323
Park Creation and Outdoor Access	$700	$286	$117	$42	$23	$231
Extreme Heat Mitigation	$450	$102	$172	$152	$24	–
Climate Smart Agriculture	$300	$134	$84	$15	$7	$60
Totals	**$10,000**	**$2,655**	**$2,215**	**$1,600**	**$2,716**	**$814**

Figure 1 Governor's Proposition 4 Proposal: Multiyear Spending Plan (In Millions)

The Governor's proposal allocates about 27% of the total bond funds ($2.7 billion) in the 2025-26 fiscal year, with varying percentages across categories. Some allocations, totaling $814 million, remain pending and await further legislative input or program development.

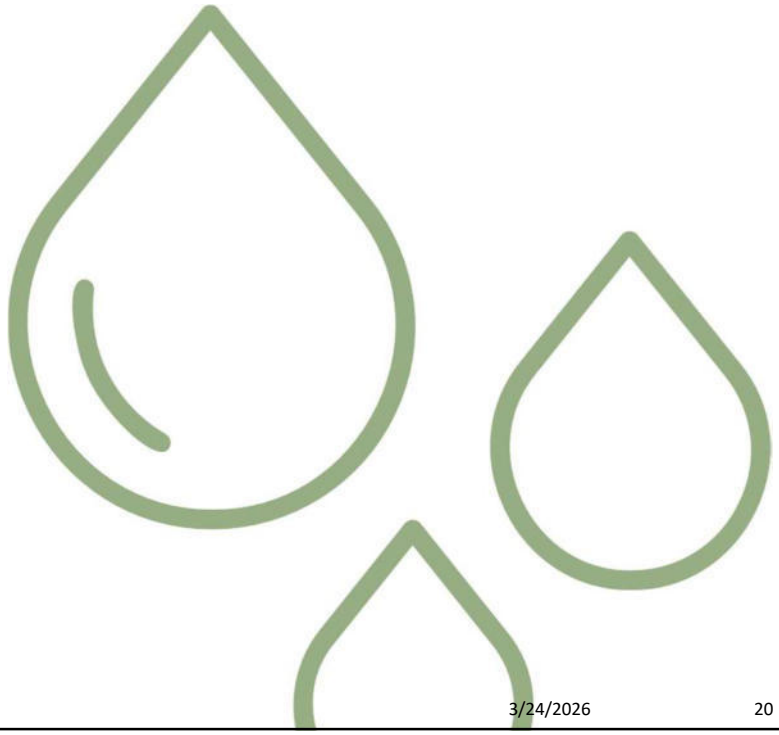
Upcoming Meetings

- **Leadership Committee Meeting – *Tentative Date May 14th, 10:30am – 12pm.***
  - Review Watershed Coordinator Workplan, Consider Adoption/ Approval of the WRP, and Charter Revision Discussion
- **June 4th Watershed Council Meeting – Resumes normal schedule** (first Thursday of every other month, 9:00 – 11am.)
  - Vote on adoption of WRP
  - Vote on Amendments to Charter
  - Implementation Roadmap Next Steps, Funding Solicitations?

Ventura River Watershed
Water Resilience for a Changing Climate

Ventura River Watershed
Water Resilience for a Changing Climate

THANK YOU!!



Ventura River Watershed Resilience Pilot Project ~ Advisory Group
Meeting #1
March 17, 2025 at 2:00 p.m. - 4:00 pm
Zoom Link:
https://us06web.zoom.us/j/81050130182?pwd=7S7EEa8lLFmxEUj62GXNTQZf6ZUt3b.1

Call in: +1669 444-9171 8
Meeting ID: 810 5013 0182
Passcode: 788863

AGENDA

Agenda Item	Time Frame
1. Welcome and Introductions a. Introduce Advisory Group Chair - Vivon Crawford, Ojai Valley Land Conservancy b. Introduce consultant team	**2:00 – 2:10 pm**
2. **Recap Decisions from January 30th Leadership Committee Meeting** a. Review schedule	**2:10 – 2:15 pm**
3. **Network Assessment Survey – review approach, process, questions and proposed launch including beta testing** – Michele Romolini, Loyola Marymount University; Danielle Bram, Cal State Northridge; Jennifer Alford, Cal State San Bernardino a. Discuss and provide input on draft questions b. Solicit beta testers	**2:15 – 2:50 pm**
4. **Networks and How They Work** – Mike Antos, Stantec	**2:50 – 3:05 pm**
5. **Advisory Group Roles and Protocols** - Lynn and Lara a. Action Item: Review and approve draft *Advisory Group Roles and Protocols* guiding document b. Advisory Group materials access – WRP website	**3:05 – 3:35 pm**
6. **Information Gathering for Water Budget Analysis** – Jamil Ibrahim and Blair Greimann, Stantec	**3:35 – 3:45 pm**
7. **Preview Vision and Goals Workshop in April** - Lara	**3:45 - 4:00 pm**
8. **Next Meeting Date**: May 19th at 2:00 p.m.	

Ventura River Watershed Resilience Pilot Project
Advisory Group Meeting #1
March 17, 2025
Virtual Meeting

Facilitators: Vivon Sedgwick, Lynn Rodriguez, Lara Shellenbarger

Attendees:

Advisory Group Members and Others:

- Bruce Kuebler, Ventura Water District
- Bryan Bondy, Upper Ventura River Groundwater Agency
- Christopher Danch, Ojai Valley Fire Safe Council
- Kalli O'Connor, Ojai Valley Fire Safe Council
- Justin Martinez, Meiners Oaks Water District
- Christy Cooper, Meiners Oaks Water District (partial attendance)
- Jamie Whiteford, Ventura County Resource Conservation District (VCRCD)
- Heidi Ortloff, VCRCD, Ventura River Watershed Council
- Lauren Zaragoza, VCRCD
- Jodi Switzer, Farm Bureau of Ventura County
- Laura Pavliscak, Ventura Land Trust
- Nate Irwin, Santa Barbara Channelkeeper
- Rocio Lozano-Knowlton, Merito Foundation
- Sarah Mulder, City of Ventura, Ventura Water
- Scott Meckstroth, Ojai Valley Sanitation District
- Jennifer Tribo, City of Ventura

WRP Team & Consultants

- Lynn Rodriguez – Project Manager
- Lara Shellenbarger – Associate Project Manager
- Ben Chou, CGST, CSU Northridge
- Danielle Bram, CGST, CSU Northridge
- Jennifer Alford, CSUSB Institute for Watershed Resiliency

- Lara Shellenbarger, Watershed Resilience Project
- Michele Romolini, Loyola Marymount University Center for Urban Resilience
- Mike Antos, Stantec
- Jamil Ibrahim, Stantec

Summary of Key Outcomes Related to WRP:

- Advisory group roles and responsibilities finalized with unanimous approval.
- Network assessment survey planned with advisory group feedback incorporated.
- Strategic importance of networks in watershed resilience emphasized.
- Plans for development of Ventura River Watershed-wide Water Budget initiated.
- Vision and Goals Workshop planning underway to enhance broad community involvement.

Meeting Agenda and Summary:

1. Welcome and Introductions:
    - Lynn Rodriguez welcomed attendees and introduced Vivon Sedgwick as Advisory Group Chair.
    - Attendees introduced themselves via chat and verbally during the meeting.
2. Network Assessment Survey and Tools – Lynn Rodriguez & CSU Team:
    - Lynn Rodriguez discussed Task 3 Network Assessment Survey. The survey aims to identify and assess existing watershed/environmental stewardship networks, assess network relationships and identify gaps. The survey will be conducted through a web-based survey and be distributed starting in April.
    - CSU team (Danielle Bram, Ben Chou, Jennifer Alford, Michele Romolini) presented their approach, methodology, and prior experience with similar assessments.
    - Next steps: Advisory Group members will be asked to provide feedback (via email) on the survey questions, beta-test the survey, and assist in distributing and encouraging partners to respond to optimize survey effectiveness.
3. Networks for Watershed Resilience – Mike Antos, Stantec:
    - Presentation on the value of people networks as a resilience strategy.

- Discussion on the characteristics and levels of networks (cooperating, coordinating, collaborating).
- Highlighted the importance of distributed leadership and collaborative relationships for watershed resilience.
- Connection to broader regional initiatives like Flood MAR and IRWM.

4. Network Overview and Advisory Group Roles – Lara Shellenbarger:
   - Overview of Watershed Council designated as the WRP "network" and the formation of an Advisory Group at the January 30th Leadership Committee meeting.
   - Overview of the Advisory Group's roles and responsibilities, membership, and facilitated discussion on the proposed Code of Conduct.
   - The group voted to approve the draft document outlining advisory group protocols and responsibilities. The motion was unanimously approved by advisory group members (1st – Vivon Sedgwick, 2nd – Bruce Kuebler).
   - The group discussed preferred methods for sharing documents. Different methods will be utilized as needed including email, public website, and SharePoint. Documents requiring Advisory Group edits and feedback may be sent via a link to a shared document on SharePoint, with edits visible by all.
5. Ventura River Water Budget Analysis – Jamil, Stantec:
   - Introduction to the upcoming water budget analysis focused on consolidating existing hydrologic data and models.
   - Discussion of objectives to document baseline conditions for assessing climate vulnerabilities and ensuring the Water Budget follows DWR's Water Budget Guidelines and standardization.
   - Participants encouraged providing relevant contacts and additional data sources to avoid duplication and enhance the analysis. An email will be sent to Advisory Group members by the end of the week.
   - Further discussion on the Water Budget will occur over the next two Advisory Group meetings (May 19 & July 21)
6. Vision and Goals Workshop Planning – Lara Shellenbarger:
   - Discussion of logistics and goals for the upcoming Vision and Goals Workshop.

- April 30, 2025, (time to be determined) identified as the preferred date, pending confirmation of location (potentially Oak View Resource Center, Camp Arnaz, or Kent Hall).
- Group members committed to supporting workshop planning, outreach, and participation. Vivon (OVLC) volunteered to meet with the project team in April to help with details.

Next Steps:

1. Advisory group members to provide final edits on advisory group protocols document to Lara Shellenbarger by end of this week.
2. Lara Shellenbarger/Lynn Rodriguez to send email request for water budget information and key contacts by end of this week once in receipt of specific request from Jamil Ibrahim at Stantec.
3. Advisory group members to respond to water budget information request email promptly.
4. Lara Shellenbarger/Lynn Rodriguez to distribute link to website section hosting advisory group documents.
5. Lara Shellenbarger/Lynn Rodriguez to finalize date, time and location for Vision and Goals Workshop, tentatively scheduled for April 30, 2025.
6. Vivon Sedgwick to assist with planning the Vision and Goals Workshop.
7. Christopher Danch to provide contact information for Kent Hall as a potential workshop location.
8. Advisory group members to assist in advertising and participate in the Vision and Goals Workshop.

Ventura River Watershed Resilience Pilot Project

Advisory Group Meeting #1
March 17, 2025



Agenda

1. **Welcome and Introductions**
   1. Introduce Advisory Group Chair - **Vivon Crawford, Ojai Valley Land Conservancy**
   2. Introduce consultant team
2. **Recap Decisions from January 30th Leadership Committee Meeting**
   1. Review schedule
3. **Network Assessment Survey – review approach, process, questions and proposed launch including beta testing** – Michele Romolini, Loyola Marymount University; Danielle Bram, Cal State Northridge; Jennifer Alford, Cal State San Bernardino
   1. Discuss and provide input on draft questions
   2. Solicit beta testers
4. **Networks and How They Work** – Mike Antos, Stantec
5. **Advisory Group Roles and Protocols** - Lara
   1. **Action Item:** Review and approve draft *Advisory Group Roles and Protocols* guiding document
   2. Advisory Group materials access – WRP website
6. **Information Gathering for Water Budget Analysis** – Jamil Ibrahim and Blair Greimann, Stantec
7. **Preview Vision and Goals Workshop** – Lara
8. **Next Meeting Date: May 19th at 2:00 pm**

Recap Jan 30th Leadership Committee Outcomes

DWR Requirements for Watershed Network Decision-Making

✅ Have **written policies and procedures**
✅ Establish an **equitable and inclusive** decision-making structure
✅ Ensure that all **stakeholders have a voice**, including **historically underrepresented communities**

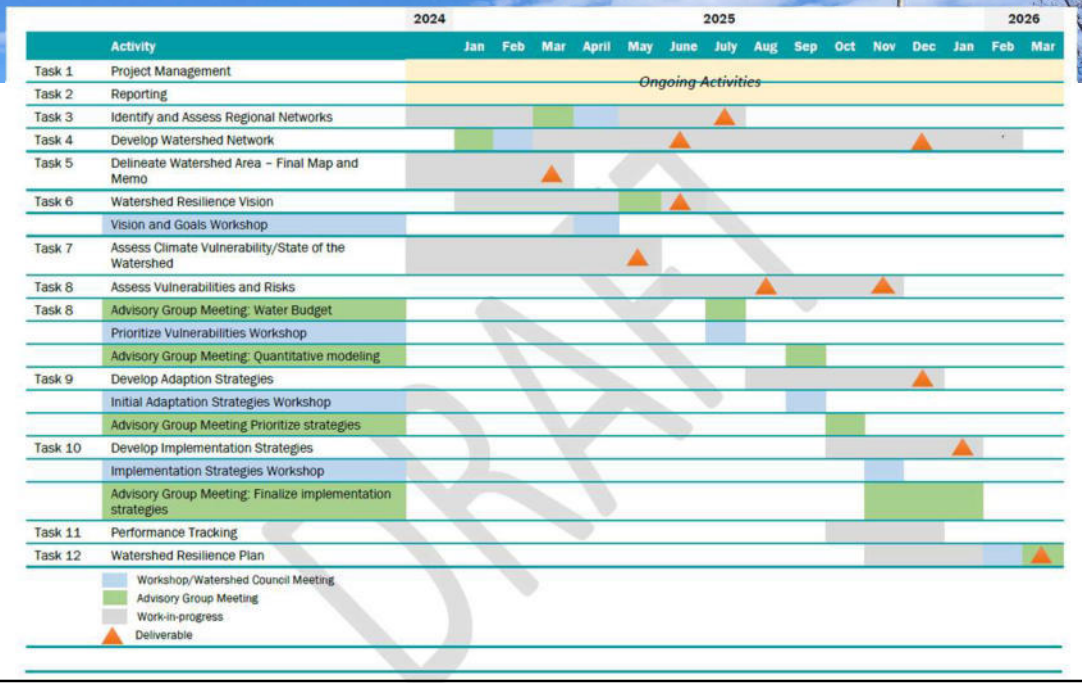
The **Ventura River Watershed Council will serve as the Watershed Network** (agreed upon at the October 3rd, 2024 Watershed Council meeting)

The **Leadership Committee formed an Advisory Group** to serve as the core advisory body for the WRP (agreed upon at the January 30th, 2025 Leadership Committee meeting).

Advisory Group Meeting Schedule

- Membership mirrors Leadership Committee membership plus additional members for equity and representation
- Meet bimonthly on the 3rd Monday of the month at 2:00 pm
- March, May, July, September, November, January *(subject to change as tasks progress)*
- All virtual
- *Additional meeting proposed in April for workshop preparation (discussed under item 7)*

Tentative Schedule



Network Assessment Survey

Task 3: Identify and Assess Regional Networks

Identify and assess existing regional networks, evaluating **participant engagement and contribution, inclusivity, and health of the networks**. Include regional water management groups, groundwater sustainability agencies, regional climate collaboratives, regional flood management groups, environmental groups, regional forest and fire capacity program groups, and other relevant water and resource management groups. Identify and engage **vulnerable communities**, **California Tribes**, and watershed participants not previously included in water-related decision-making and **assess their capacity and interest in contributing to this process**.

Network Assessment Survey Overview

- Purpose of the Survey
  - Support work for Task 3 Identify and Assess Regional Networks and Task 4 Watershed Network Development
  - Identify and evaluate organizations working on water-climate resiliency in the Ventura River Watershed
  - Expand existing datasets to better understand: 1) Organization goals and expertise, 2) Projects, locations, and timelines, 3) Partnerships and collaboration networks, 4) Financial limitations and support needs
  - Inform the development of a STEW-MAP network assessment
- Who will be surveyed?
  - All organizations involved in water-climate resilience within the watershed and project area of interest (the Watershed Council email list will serve as a starting place)
- How it will be conducted?
  - Web-based survey
  - Distributed in April - May

Watershed Network Assessment

Danielle Bram
Director, CGST
California State University, Northridge

Ben Chou
Project Manager, CGST
California State University, Northridge

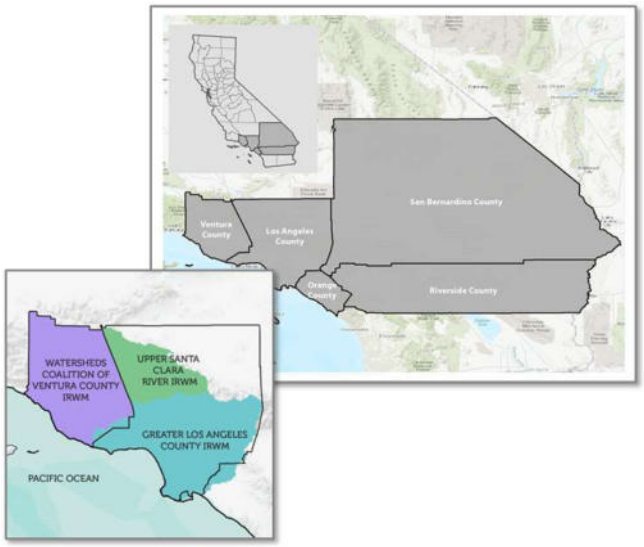
Jennifer Alford, PhD
Director, Institute for Watershed Resiliency
California State University, San Bernardino

Michele Romolini, PhD
Managing Director, Center for Urban Resilience
Loyola Marymount University

Disadvantaged Community Involvement Program

Main Goals

- Generate and increase community involvement
- Increase understanding of water resource needs
- Identify & prioritize technical assistance projects based on issues of greatest concern



Institutional Needs Assessments

Survey Questions

- Needs and strengths of the community they serve
- Barriers to equitable access to the benefits of water, wastewater, and stormwater infrastructure
- Governance and decision-making processes and engagement strategies
- Future challenges and opportunities


COMMUNITY - Issues and Challenges

[PROMPT] Q18: What do you see as barriers to access the benefits of drinking water, wastewater, or stormwater infrastructure in your community?

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(PROBE) Q19: Is safe, affordable water for drinking, washing, and cooking accessible to all members of your community?

-Please Select-

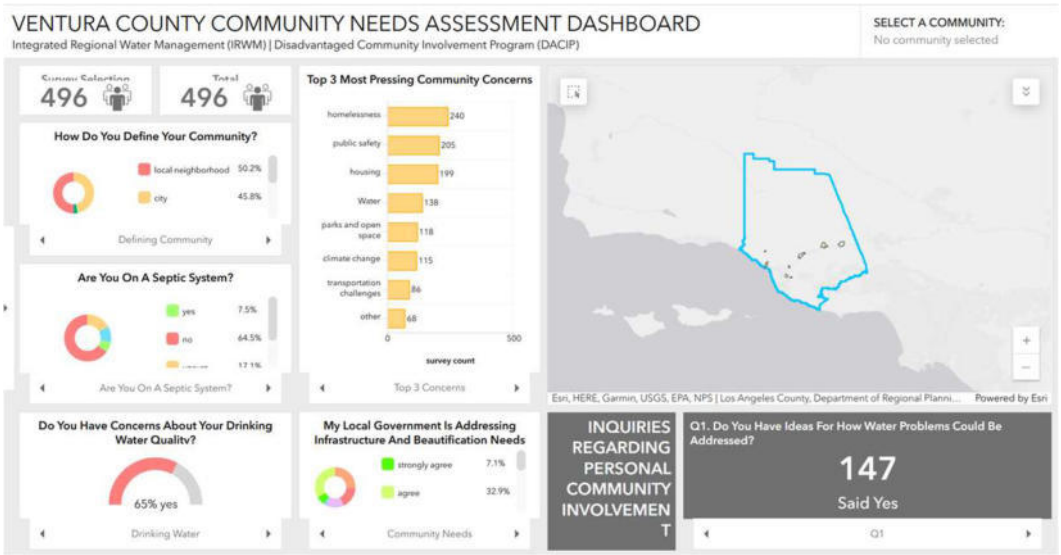
Please explain.

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Q20 (1): What types of drinking water and wastewater (sanitation) infrastructure/regulations impact your community?

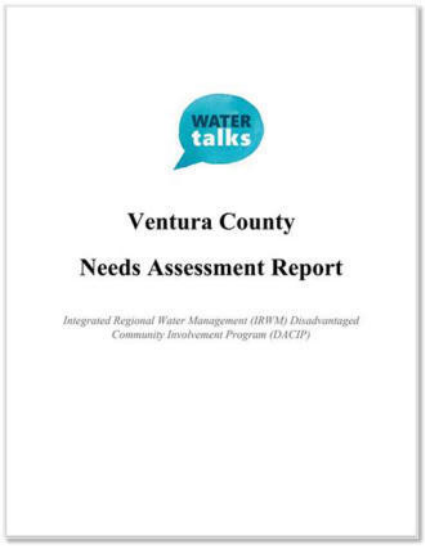
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Survey Results Dashboard



Challenges

- **Infrastructure & Regulations**
  - Aging infrastructure
  - Changing regulatory requirements
  - Increasing development pressures
- **Community Engagement**
  - Limited participation by working populations
  - Lack of affordable/stable internet
  - Language barriers
- **Climate Change**
- **Tribal Engagement**



LA River STEW-MAP

Main Goals

- To find, survey, and map groups in the LA River Watershed working on environmental stewardship
- Understand groups' organizational activities, geographic footprint, and network relationships
- Produce online resources for a variety of end users

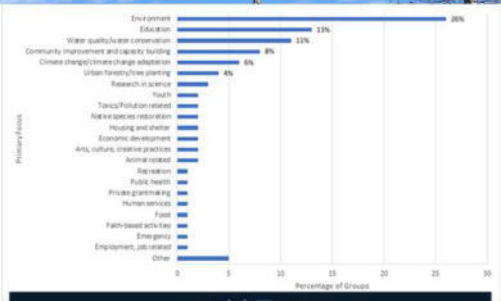


STEWARDSHIP: the act of conserving, managing, monitoring, transforming, advocating for, and/or educating the public about their local environments

LA River STEW-MAP – Key Findings

Organization Characteristics

- 535 organizations inventoried; 107 responded to survey
- Gov't agencies identified as a funder for 2/3 of organizations
- Education is a focus of stewardship organizations
- Stewardship groups support local environments AND communities

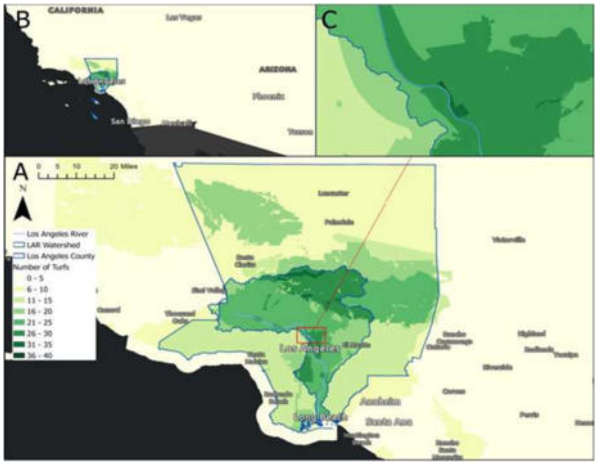




LA River STEW-MAP – Key Findings

Stewardship Geography

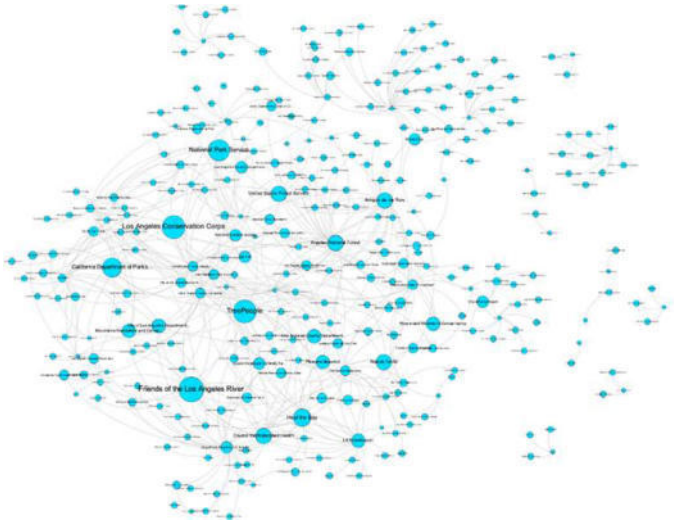
- Highest stewardship concentration was found in downtown LA around the LA River
- Other areas of high stewardship concentration were the northeastern area of the watershed, within the Angeles National Forest



LA River STEW-MAP – Key Findings

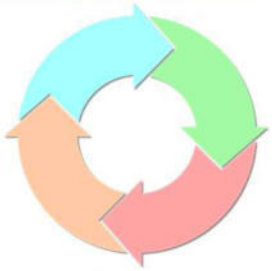
Network Relationships

- Groups identified over 1200 collaborative, knowledge, or funding relationships
- The “hubs” of activity in the stewardship network were mostly 501(c)3 nonprofit groups, and government agencies from the local to the federal level



VRWRP Survey – Next Steps

- **Survey Topics**
  - Organization Information
  - Existing Networks and Collaboration
  - Water & Climate Resilience
- **Advisory Group Feedback**
- **Advisory Group Testing**
- **Survey Launch**





Networks and How They Work

Thinking About Networks

Mike Antos, PhD, ENV SP
Principal Watershed Social Scientist



People Networks are a Resilience Strategy

- Familiarity
- Trust

- "Knowing who to call…"



People Networks ARE a Climate Adaptation

World Environment Day
June 5, 2024

Facilitating the establishment of a Flood-MAR Network in California

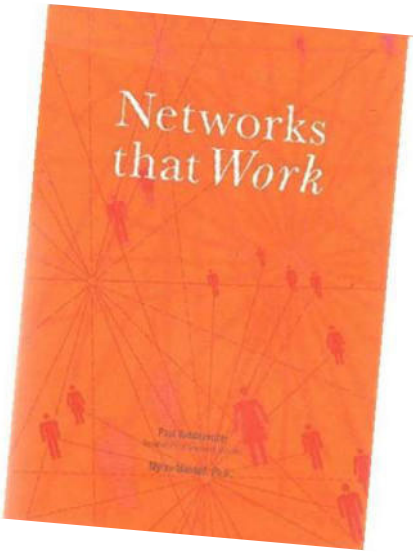
Acknowledgements to California Department of Water Resources, Jenny Marr, Orit Kalman, multiple Stantec colleagues including Marisa Perez-Reyes, and many Flood-MAR Network members.

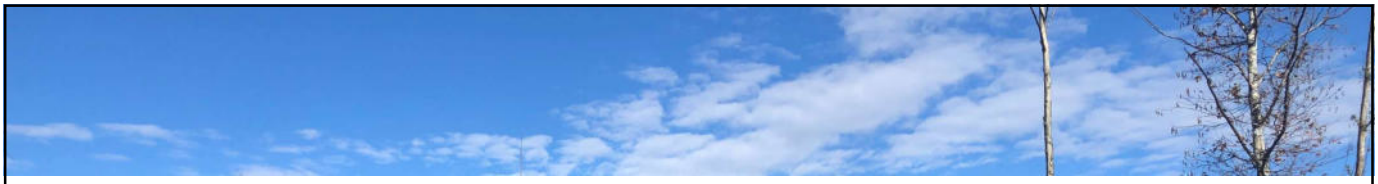
What is a Network?

"Many different organizations working in concert around a common defined purpose as equal partners"

Not the same as an "organization", which are members of networks.

Paul Vandeventer
Myrna Mandell





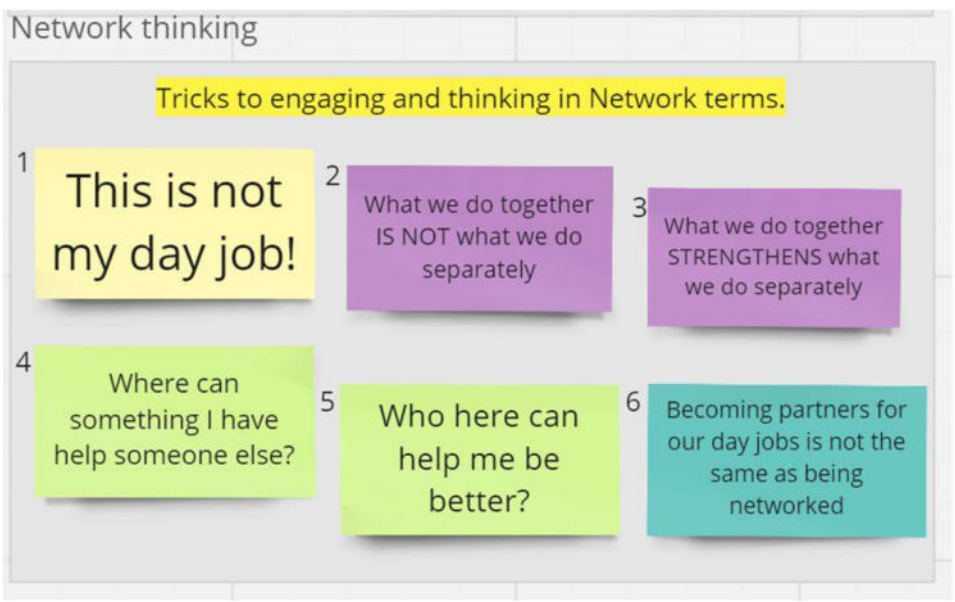
Why Network?

- Scale and focus
- Productive working relationships
- Lasting effectiveness and change

How Network?

- Investment in new relationships
- Agreement for distributed leadership
- Members accept the risk of participation

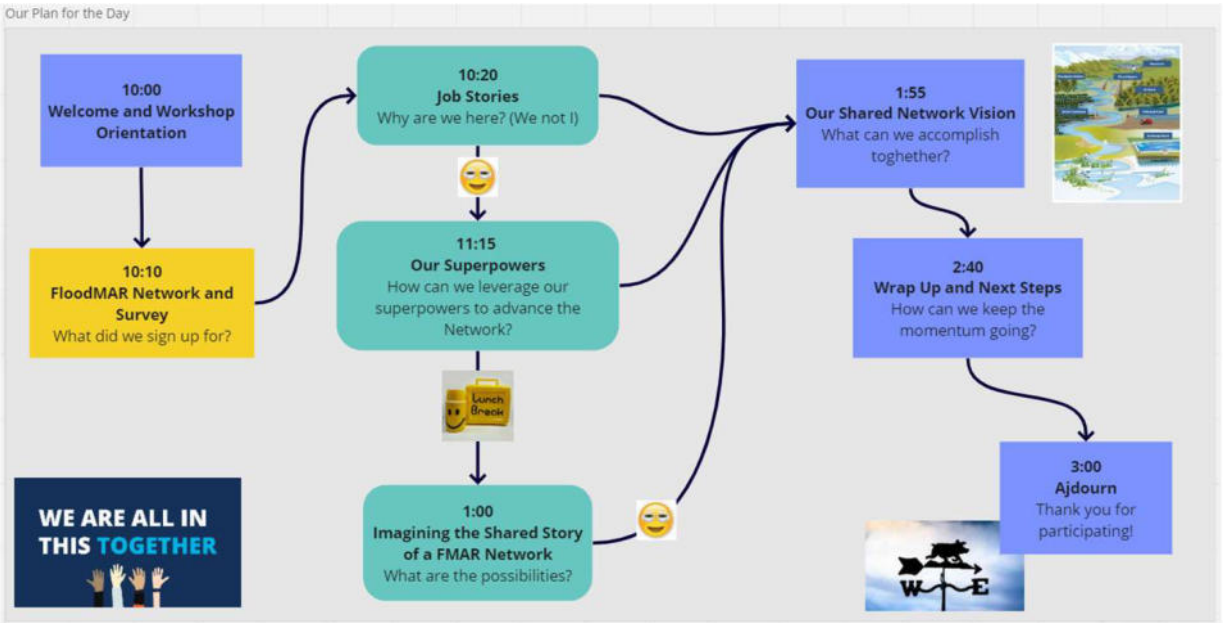
Give / Get

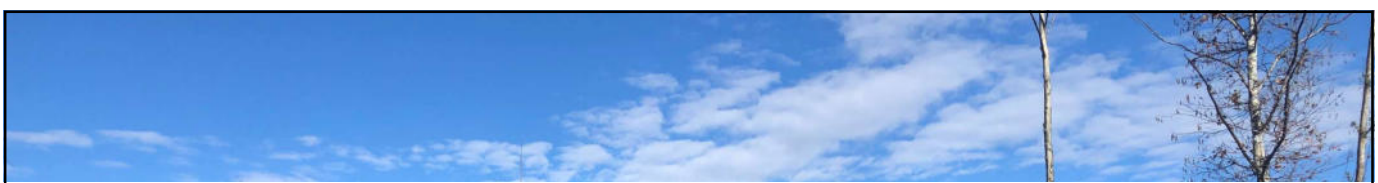




As a [role], I want to [action], so I can [achieve an outcome]

People Networks





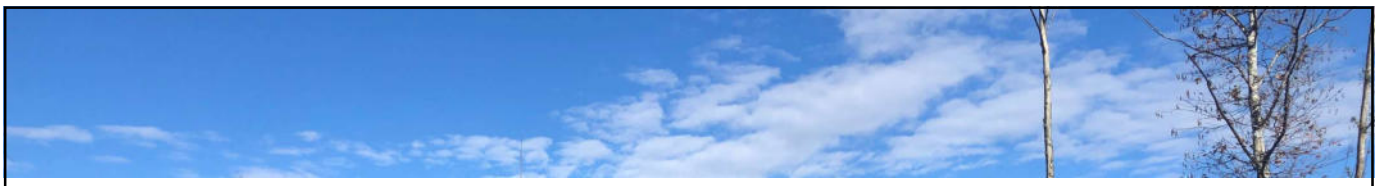
Network Complexity = Risk

Increasing Complexity

Cooperating Network

Coordinating Networks

Collaborating Networks



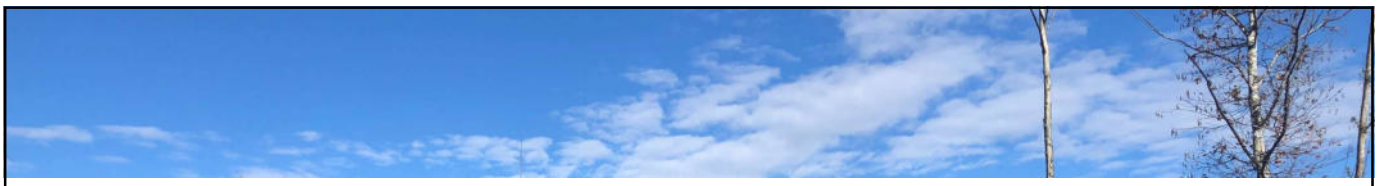
Cooperating Network

- Lower risk, lower impact
  - –Create conditions for better relationships
  - –Space to explore new levels of trust
  - –Model and explain best practices
  - –Shared learning
  - –Facilitate problem-solving



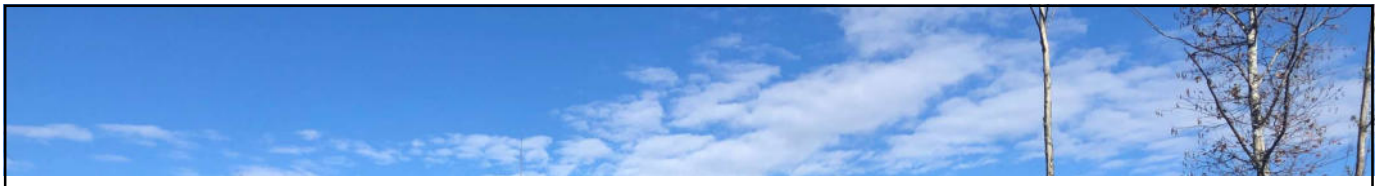
Coordinating Network

- Low to moderate risk to members
  - –Consensus identification and pursuit of priorities
  - –Negotiate commitments amongst members
  - –Change member boundaries based on new understanding of interdependence
  - –Pursue multi-party efforts with mutual reliance

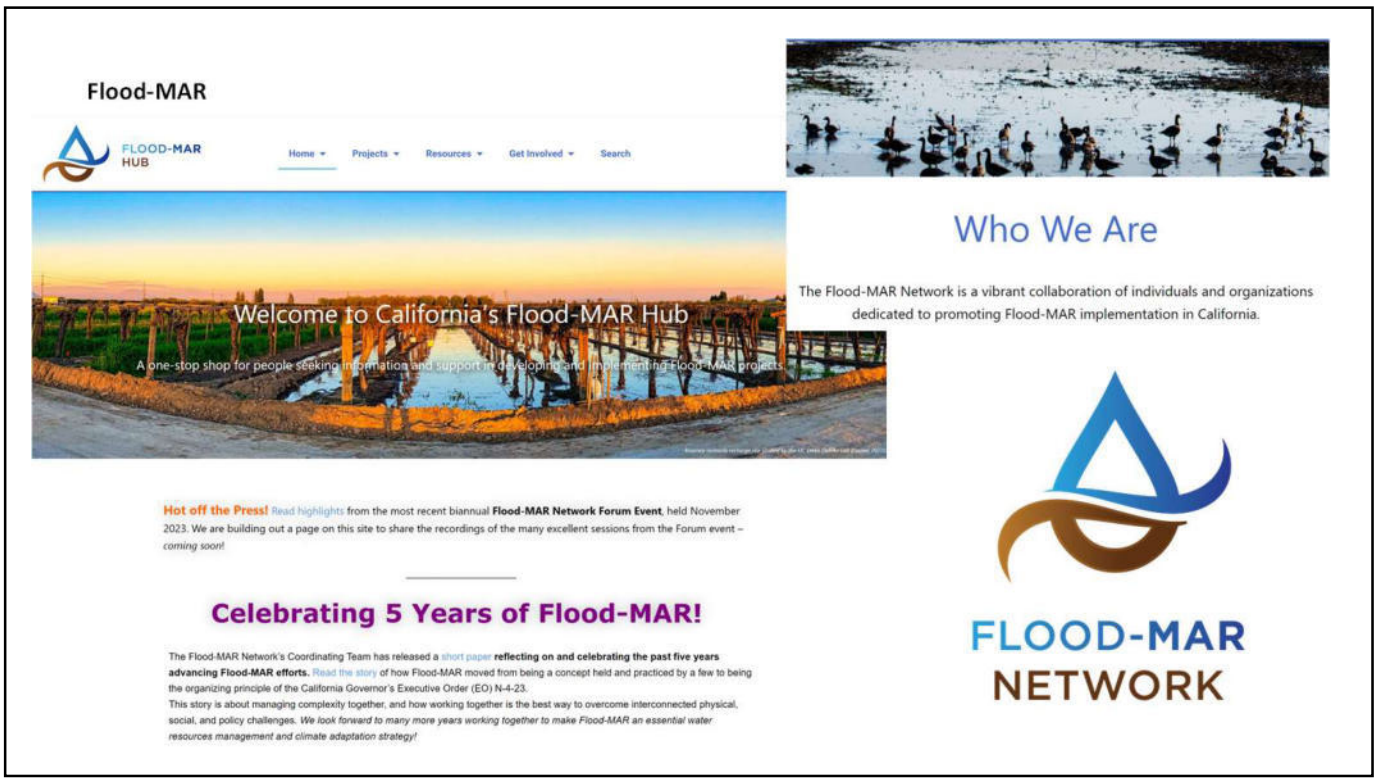


Collaborating Network

- High stakes & risk, opportunity for high impact
  - –Shared pursuit of long-term or transformational change
  - –Processes for raising and overcoming conflict
  - –Representation to enforce commitments to one-another
  - –Shared authority despite unequal resource contributions (more from those who can…)
  - –Commitment by members to change based on outcomes



- Questions to ask when developing a network purpose statement:
  - –Why am I interested in being part of a network? (GET)
  - –What ”superpowers” do I bring with me that can be leveraged by a network? (GIVE)
  - –How does our individual work inform the definition of a collective purpose? (JOINT PROBLEM)
  - –What is our shared story? (CONNECTIONS)
  - –What can we accomplish as a network? (VISION OF OPPORTUNITY)







Thank you!

Mike Antos, PhD, ENV SP

Principal Watershed Social Scientist

Advisory Group Roles and Protocols

Purpose and Responsibilities

- **Advisors to the WRP consultants and the Watershed Council:** Provide guidance, technical and local knowledge.
- **Consensus-Based Recommendations:** Advisory Group provides guidance; the Watershed Council retains final decision-making authority (following the Watershed Council Charter for guidance)
- **Collaborative Guidance:** Enhance shared knowledge, promote transparent communication, trust-building, and cooperative action.
- **Equity and Inclusivity:** Reflect diverse watershed interests and ensure perspectives especially from underrepresented and vulnerable communities, are included.
- **Charter Review:** Provide recommendations on to the Leadership Council, especially on inclusivity, equity, and strengthening the network

Advisory Group Roles and Protocols

Developing Our Advisory Group Code of Conduct

- Purpose:
  - Establish shared expectations collaboratively.
  - Ensure all members feel ownership and accountability.
- Examples:
  - *Treat others respectfully.*
  - *Encourage inclusive and respectful dialogue*
  - *Listen actively.*
  - *Participate actively.*
  - *Declare conflicts transparently*



Advisory Group Roles and Protocols

Action Item: Review and approve draft *Advisory Group Roles and Protocols* guiding document

Option 1: Approve with edits and feedback provided today. We will incorporate changes, circulate a final version, and unless significant additional changes are requested it will be considered approved.

Option 2: Edits and feedback provided today are incorporated into a final draft that is brought back to the AG at the May 19 meeting for approval.

Information Gathering for Water Budget Analysis

Task 8 - Assess Vulnerabilities and Risks

- **Task 8.1 Prepare Updated Historical Water Budget**
  Engage with the Technical Workgroup to define existing models and their purpose, inputs, and outputs. Work with Ventura RCD to develop and share information requests, as needed.

Known Hydrologic Data Sources and Analyses

- Groundwater-Surface Water Model for the Ventura River Watershed (GSFLOW) – State Water Board
- Upper Ventura River Groundwater Basin Groundwater Model (MODFLOW) – Upper Ventura River Groundwater Agency
- Ojai Valley Groundwater Basin Groundwater model (MODFLOW) – Ojai Basin Groundwater Management Agency
- Ventura Surface Water Hydrology Model (VSWHM; HSPF) – Ventura County Watershed Protection District
- Ventura Water Allocation Model (VWAM; WEAP) – State Water Board

Information Gathering for Water Budget Analysis (cont'd)

Kickoff – Information Requests

- Point(s) of Contact for information/inquiries on hydrologic data sources and analyses
- Information on and points of contact for additional/applicable data or analyses for Ventura River Watershed water budget components
- Email request to Advisory Committee members for responses on above items forthcoming

Next steps

- Compilation and review of hydrologic analyses performed in watershed.
- Coordination with Project Managers for potential future meetings with hydrologic analysis POCs to discuss:
  - Data availability and sharing
  - Modeling assumptions/considerations
  - Limitations/challenges and/or recommendations
  - Other considerations

Watershed Resilience Vision and Goals Workshop

Purpose - Work with the watershed network to develop problem statements and establish the watershed resilience vision and goals to guide the development of the Watershed Resilience Plan

Watershed Resilience Vision and Goals Workshop

Location options – Oak View Resource Center (available) - other options include Camp Arnaz, Camp Comfort
Dates options – April 24, 30, or May 1



- 2-3 hours starting at 2 or 4 pm
- Welcome & history of watershed
- **Activities:** defining the watershed's water systems, understanding the climate hazards, and crafting a draft vision statement
- Need AG help advertising the workshop

Request volunteer Advisory Group members to assist with planning.
(we will try to keep it to one virtual meeting in April)



Highlight of Work Completed

(read on your own)

- Secured agreement that the **Ventura River Watershed Council will serve as the Watershed Network**
- Convened **four Watershed Council meetings** (August, October, December, February) to support network development
- Submitted NAHC request for **updated Tribal contacts and initiated coordination** with Tribal members, including BVBMI Tribal Council, sent initial engagement letters, and separate questionnaire, participated in Watershed Resilience Program Tribal webinar hosted by DWR
- Met with **20+ watershed partner entities** to gain insights on climate risks and watershed resilience priorities
- Compiled **comprehensive list of interested parties/partners** for network assessment and foundational inventory of relevant studies and plans
- Finalized contracts and onboarded **Rincon and CSU** consultants
- Formed technical **Advisory Group** to support Watershed Council and WRP development
- Assessment of network decision-making structure ongoing - potential revisions to the Council charter
- Continual updates to project website
- Held **monthly and quarterly meetings with DWR** and engaged with **four WRP pilot watersheds** (Russian River, Calaveras River, American River, Pajaro River)

Tentative Schedule of Work Ahead March-May 2025

- **Conduct 2 network meetings (April 3 and TBD Workshop)**
- **Prepare for and facilitate Vision and Goals Workshop**
- **Conduct Advisory Group Meeting – March 17th**
- **Onboard CAUSE to work with underserved communities**
- **Continue formal Tribal engagement phase – including option for bringing Tribal members on as paid advisors if so desired**
- **Activate engagement with underserved communities**

Ventura River Watershed Resilience Pilot Project ~ Advisory Group
Meeting #2
March 19, 2025 at 2:00 pm - 4:00 pm

Zoom Link:
https://us06web.zoom.us/j/82763430675?pwd=d4Qnkal2WJQAizWKaMhvmKkIliM5Vn.1

Meeting ID: 827 6343 0675 ~ Passcode: 747433
Call-In: *+1 (669) 900-6833 (same Meeting ID and Passcode)*

MEETING PURPOSE & OBJECTIVES:

Purpose:

- Update AG about the workshop, the survey, and upcoming community engagement
- Seek advice about near-term efforts in the technical evaluation
    - Water Budget
    - Climate Change Levels
    - Climate Impact Metrics

Objectives:

1. The AG will feel up to date with progress across the multiple elements of the Project
2. The technical team will explain the role of Climate Change Levels, and Climate Impact Metrics, and receive advice from the AG that will support next steps by the technical team.

AGENDA

Agenda Item	Time Frame
1. **Welcome and Introductions** - Lynn	10 minutes
2. **Recap AG Meeting on March 17** - Lynn and Lara a. Meeting Protocols posted on website	5 minutes
3. **Vision Forum Review and Reflections** – Lynn and Lara/All	15 minutes
4. **Update on Network Assessment Survey** – Ben Chou, CSU	10 minutes

5. **Update on Planned Engagement with Frontline Community Members** – Cameron Yee, CAUSE	10 minutes
6. **Technical Update & Questions for the AG – Water Budget**- Facilitated by Mike Antos, Stantec **a.** Water budget data information gathering **b.** Upcoming AG member reviews and timeframes	15 minutes
7. **Technical Update & Questions for the AG - Climate Scenario Levels and Metrics** - Eagle Rock Analytics – Colie Roman	45 minutes
8. **Wrap Up – What's Next** – Lynn and Lara	10 minutes
Adjourn - Next Meeting Date: July 21, 2025	

For more information visit: https://vcrcd.org/venturawatershedresilience/

Ventura River Watershed Resilience Pilot Project
Advisory Group Meeting #2
May 19, 2025
Virtual Meeting

Facilitators: Mike Antos, Lynn Rodriguez, Lara Shellenbarger

Attendees:

Advisory Group Members and Others:

- Bruce Kuebler, Ventura Water District
- Bryan Bondy, Upper Ventura River Groundwater Agency
- Cameron Yee, CAUSE
- Carlie Dominguez, Native Coast Action Network
- Christopher Danch, Ojai Valley Fire Safe Council
- Christy Cooper, Meiners Oaks Water District (partial attendance)
- Jamie Whiteford, Ventura County Resource Conservation District (VCRCD)
- Heidi Ortloff, VCRCD, Ventura River Watershed Council
- Lauren Zaragoza, VCRCD
- Jodi Switzer, Farm Bureau of Ventura County
- Julie Tumamait-Stenslie
- Laura Pavliscak, Ventura Land Trust
- Nate Irwin, Santa Barbara Channelkeeper
- Peter Shellenbarger, City of Ventura
- Sarah Mulder, City of Ventura, Ventura Water
- Scott Meckstroth, Ojai Valley Sanitation District
- Jennifer Tribo, City of Ventura
- Vivon Sedgwick, Ojai Valley Land Conservancy (Chair)

WRP Team & Consultants

- Lynn Rodriguez, WRP Project Manager
- Lara Shellenbarger, WRP Associate Project Manager
- Anna Yip, Rincon

- Ben Chou, CGST, CSU Northridge
- Cameron Yee, CAUSE (also advisory group member)
- Colie Roman, Eagle Rock Analytics
- Mike Antos, Stantec
- Jamil Ibrahim, Stantec

Summary of Key Outcomes Related to WRP:

- The second Advisory Group (AG) meeting provided an update on multiple project elements, including recent public engagement at the first Forum, the partner network survey, and planned frontline community involvement.
- An update was provided on technical work on the watershed water budget. and climate hazard metrics.
- An overview of climate hazard metrics was discussed and AG members offered valuable feedback on climate impact thresholds, infrastructure concerns, and community well-being issues such as mental health and climate grief.
- A date was set for the second WRP Forum – July 30th in-person at Camp Arnaz

Meeting Agenda and Summary:

1. Welcome and Introductions:
    - Lynn introduced the meeting purpose: updating the group on engagement activities and seeking input on technical work related to climate metrics and the water budget.
    - Attendees introduced themselves via chat and verbally during the meeting.
2. Recap of AG Meeting on March 17
3. Vision Forum Recap – Lynn Rodriguez and Lara Shellenbarger
    - Lynn and Lara summarized the April 30 Vision Forum, held at Camp Arnaz. There were around 35 participants, and at least 6 Advisory Group members attended. The forum featured three interactive mapping and discussion activities related to how the water sectors of the Ventura River Watershed experience climate hazards. They noted the positive feedback from attendees. One activity was around the draft Vision Statement and the

feedback received from the forum and how it will be incorporated into a revised draft and shared with the Advisory Group soon.
    - Workshop Reflections – Open Discussion – AG members shared reflections on the forum, including the value of in-person interaction, new community connections, and opportunities to better incorporate cultural heritage into resilience planning.
    - Forum #2 – it was proposed to hold the next forum on Wednesday, July 30th at Camp Arnaz.
4. Network Assessment Survey Update – Ben Chou (CSU Northridge)
    - Ben provided a progress update on the Watershed Network Assessment Survey (supporting Task 3). Approximately 20% of contacted groups completed the survey, with 12 more in progress. The survey results will help address the strength and composition of the watershed network and identify opportunities for deeper collaboration and equity-centered engagement.
5. Frontline Community Engagement Update – Cameron Yee (CAUSE)
    - Cameron discussed CAUSE's planned focus groups and survey work targeting Spanish-speaking adults and English-speaking youth on the Westside of Ventura. This effort will incorporate climate priorities and lived experiences of frontline communities in the Watershed Resilience Plan. This work is expected to take place over the summer.
6. Water Budget Technical Update – Jamil Ibrahim (Stantec), Facilitated by Mike Antos
    - Jamil shared that the team is using the State Water Board's integrated groundwater-surface water model for the historical water budget analysis (1993–2019 period). Group discussion included questions about groundwater use representation, model limitations, and inclusion of recent hydrologic extremes in the data period. There was discussion on the purpose of establishing an updated historical Water Budget for the WRP – it will serve as an agreed upon baseline. More discussion on the Water Budget and updates will be shared at the July 21st AG meeting.
7. Climate Scenario Levels and Metrics – Colie Roman (Eagle Rock Analytics), Facilitated by Mike Antos
    - Colie introduced a draft framework for evaluating climate hazards using scenario-based global warming levels (1.5°C, 2.0°C, 3.0°C).

- Colie asked for feedback from the AG on what baseline to use (0.8°C - 2002, 1.0°C - 2010, 1.2°C -2020) (slide 25)
- She outlined proposed metrics and thresholds for each hazard:
- Drought: Standardized Precipitation Index (SPI < -1) was recommended.
- Wildfire: Fosberg Fire Index (FFI) was proposed to identify high fire-risk days. An AG member highlighted the importance of understanding local ignition patterns starting in the lower watershed, stressing the need for locally-informed management zones.
- Extreme Heat: Heat Index. It was suggested that 80°F and 95°F be used as relevant thresholds, particularly due to their significance for outdoor worker protections under Cal/OSHA.
- Extreme Precipitation and Flooding: Rainfall intensity thresholds such as 5 inches over 2 days were suggested, and using storm return intervals (e.g. 10-year and 100-year storm) relevant to infrastructure and water quality design standards and permitting.
- Water Quality Impacts: One participant emphasized the need to consider nutrient loading, sedimentation, and algae bloom dynamics in future analyses, particularly following high-intensity storm events. It was suggested that we should consider using the Ventura River Nutrient Transport Model with new climate data inputs as part of this analysis.
- Marine Stratus: Low cloud fraction was proposed as a proxy metric.
- Sea Level Rise: Scenarios of 25 cm, 50 cm, and 75 cm sea level rise were suggested with impacts on groundwater, shoreline position, and flooding risk.
- Additional input highlighted the importance of identifying infrastructure vulnerabilities such as levees, and incorporating both technical and community-informed thresholds. Participants also raised questions about how these metrics would translate into impacts on water systems and social well-being.
- Carlie Domingues called attention to climate grief and mental health as significant but often overlooked aspects of climate vulnerability. She shared insights from Indigenous research on the mental health effects of losing

access to traditional resources such as salmon. The group recognized this as an important layer of resilience planning to be further explored.

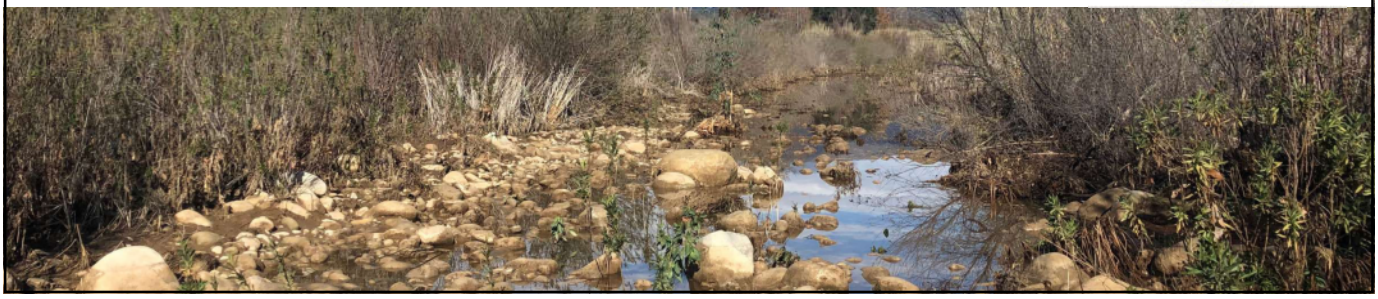
8. Wrap Up – What's Next – Lynn Rodriguez, Lara Shellenbarger, and Anna Yip
    - The facilitation team summarized next steps and invited Advisory Group members to provide feedback on the climate metrics presentation by May 30. Anna noted that a draft "State of the Watershed" chapter would soon be shared for review. Advisory Group members were thanked for their time, engagement, and forthcoming review contributions. Reminders were given for the upcoming:
    - Advisory Group Meeting: **July 21, 2025**
    - In-Person Forum #2: **Tentatively July 30, 2025**

Action Items:

1. Lynn & Lara – Share slide decks and post-meeting materials on project website.
2. Lynn & Lara – Finalize Vision Statement draft with community feedback and share with AG.
3. Advisory Group Members – Submit feedback on climate metrics and the preferred baseline by May 30. (slides 25 & 41)
4. Rincon Team – Circulate draft chapter on watershed hazards and systems for review.
5. Lynn & Lara – Confirm July forum date and coordinate AG review of facilitation materials in advance.

Ventura River Watershed Resilience Pilot Project

Advisory Group Meeting #2
May 19, 2025



Agenda

1. **Welcome and Introductions**
2. **Recap AG Meeting** #1 – March 17th
3. **Vision Forum Review and Reflections**
4. **Update on Network Assessment Survey**
5. **Planned Engagement with Frontline Communities**
6. **Technical Update and Questions for AG – Water Budget –**
7. **Technical Update and Questions for the AG – Climate Scena**
8. **Next Meeting Date: July 21st 2:00 pm**

Recap Last Advisory Group Meeting

March 17, 2025 Key Outcomes:

- Finalized Advisory Group roles and responsibilities with unanimous approval.
- Discussed the importance of networks for watershed resilience, focusing on collaboration and distributed leadership.
- Introduced the Network Assessment Survey to identify and assess existing watershed stewardship networks. Survey is now underway!
- Initiated planning for the watershed-wide Water Budget, consolidating existing hydrologic data to document baseline conditions.
- Started logistics planning for the Vision and Goals Workshop (April 30, 2025), with a focus on broad community engagement.

Recap Vision Forum

- Forum # 1 held on Wednesday, April 30th at Camp Arnaz
- More than 35 people attended representing diverse watershed interests as well consultant team
- Substantial amount of feedback received through 3 interactive activities
- Results of activities being processed and will inform development of the WRP vision and the chapter devoted to Watershed Problems and Challenges

- Forum # 2 – proposed date July 30th





Vision Statement Update

Draft Vision Statement Activity – Key Themes Heard in Feedback Received

- **Incorporating Community and Cultural Values:** Emphasis on maintaining community connection to the river, the importance of local water sources, and preserving cultural values. We will explore revising the first sentence to better reflect these aspects.
- **Emphasizing Ecosystem Resilience and Stewardship:** Strong desire to prioritize natural functions, ecosystem resilience, and the biosphere. We can consider strengthening the language around this - framing ecosystem resilience as the primary pathway to climate adaptation and resilience.
- **Addressing Length and Clarity:** Several participants noted the statement might be too long or feel like a "word soup." We should be mindful of conciseness as we integrate new elements and look for opportunities to streamline the language.

Next Steps:

- The Vision Statement will be revised based on the feedback and further engagement activities, including CAUSE's work with low-income/frontline communities this summer.
- The final draft will be presented to the Advisory Group and Council in the fall.
- The revised draft may be shared with AG members for additional input before finalization.

Network Assessment Survey

Task 3: Identify and Assess Regional Networks

Identify and assess existing regional networks, evaluating **participant engagement and contribution, inclusivity, and health of the networks**. Include regional water management groups, groundwater sustainability agencies, regional climate collaboratives, regional flood management groups, environmental groups, regional forest and fire capacity program groups, and other relevant water and resource management groups. Identify and engage **vulnerable communities**, **California Tribes**, and watershed participants not previously included in water-related decision-making and **assess their capacity and interest in contributing to this process**.

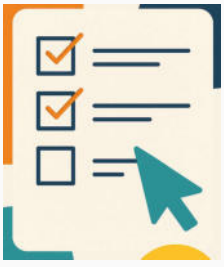
Watershed Network Assessment Survey

Ben Chou
Project Manager
Center for Geospatial Science & Technology (CGST)
California State University, Northridge

VRWRP Advisory Group Meeting
May 19, 2025

Community Partner Survey

- **Survey Topics**
  - Organization Information
  - Existing Networks and Collaboration
  - Water & Climate Resilience



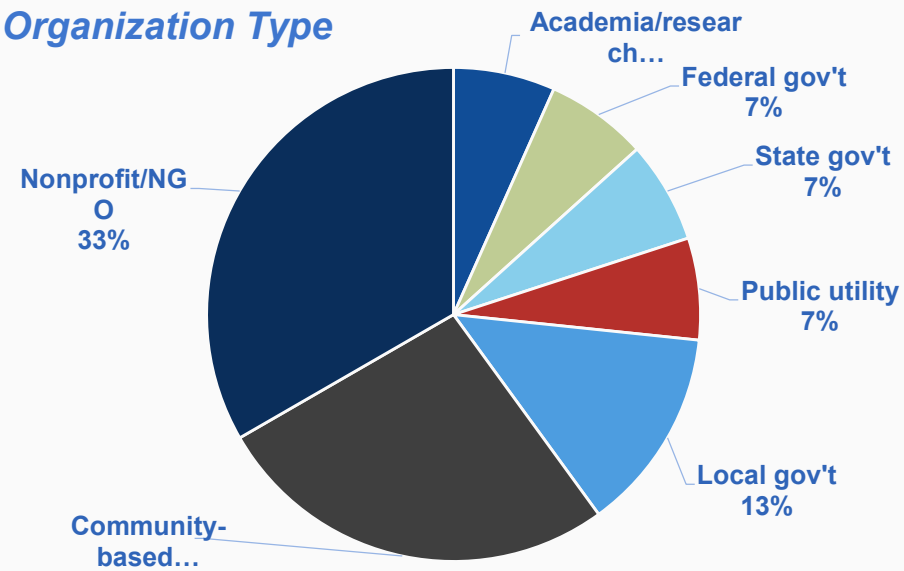
- **Survey Launch – May 9**
  - **Deadline – May 23**



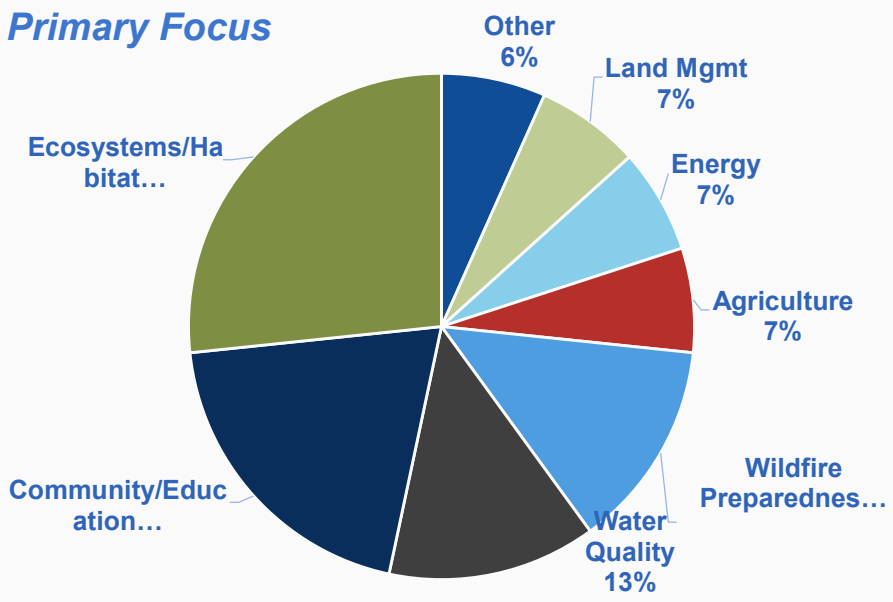
Survey Response Summary



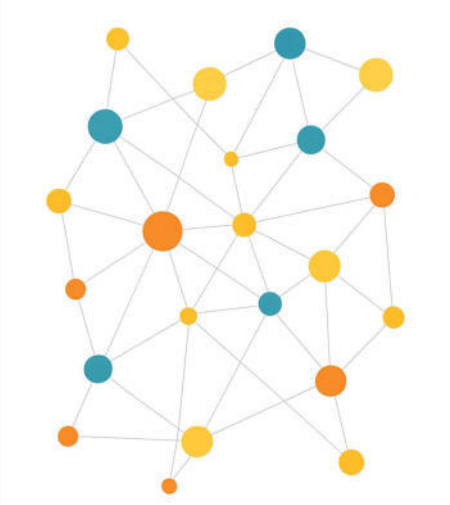
Survey Response Summary



Survey Response Summary



Next Steps



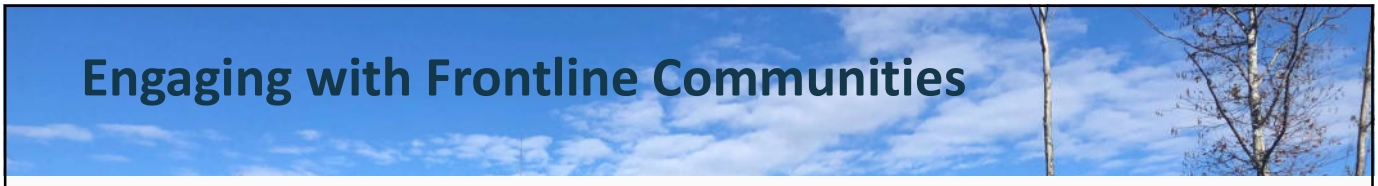
- **Data Cleanup**
- **Data Analysis**
  - Spatial
  - Network
  - Climate/Water Resilience
- **Preliminary Draft Results**
  - July 21 AG Meeting

Reminder

Please fill out the survey.

Survey Questions or Issues?

ben.chou@csun.edu



CAUSE – Cameron Yee

Engaging with Frontline Communities

CAUSE tasks focus on getting input from the Ventura Westside community

- Survey development and implementation to identify community-perceived climate hazards, inform prioritized vulnerabilities, and gather initial suggestions for potential adaptation strategies.
- Conduct two focus groups, one with Spanish-speaking adults and one with English-speaking Latinx youth on the Westside of Ventura. Possible focus is on the Initial Adaptation Strategies.



Water Budget Update

Preview of July AG Meeting

Grant Task:
Prepare Updated Watershed Water Budget

Purpose
- Support vulnerability assessments
- Prepared using methods, as indicated in DWR's Handbook for Water Budget Development.
- Provide info about the historical water supply and uses within the watershed

Methods
- Use available model data to generate water budget
- Primary window of work
  June – August 2025

Progress:
- Completed desktop review of available models
- Initiated engagement with Points of Contact (POCs) to obtain data, discuss assumptions, and receive guidance

In-Progress Activities

Engagement with State Water Resources Board on California Water Action Plan/ Instream Flows activities for Ventura River and review of data
- Hydrologic analysis – Groundwater-Surface Water Model for the Ventura River Watershed (VRW GW-SW Model)
  - GSFLOW model
  - Simulation Period 1993-2019
- Water allocation modeling – Ventura Water Allocation Model (VWAM) (*under development*)
  - WEAP model
  - Estimates monthly water use for every water right in watershed.



In-Progress Activities

Next Steps

- Coordinate with DWR on water budget analysis completed for future scenarios project, California Water Plan Update 2023N
  - New statewide model with relatively coarse (HUC-8 scale) data
  - Currently undergoing calibration
  - POC: Paul Shipman
- Coordinate with local agencies and districts with recent water budgeting or modeling for review and comparison to State Water Board data analysis
  - Advisory Group – Thank you for info!
  - Not started

More in July!

Historical Water Budget check-in at mid-point of task

- Share results of preliminary historical water budget based on State Water Board's VRW GW-SW Model) for simulation period 1993-2019
- Solicit feedback

Discuss major uncertainties

Discuss representation of recent hydrologic variability

- 2020-2022 – Drought conditions (2020-2021 record dry year
- 2023 – high flows/flood condition

EAGLE ROCK ANALYTICS

Global Warming Level and Climate Hazard Metric Overview

May 19, 2025

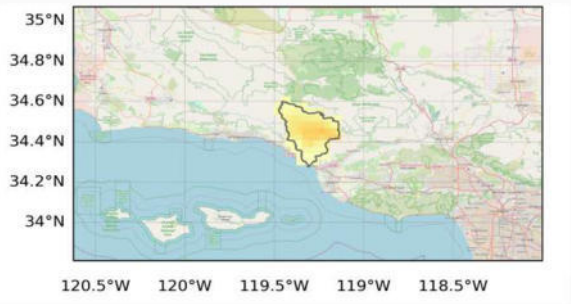


Global Warming Levels

EAGLE ROCK ANALYTICS

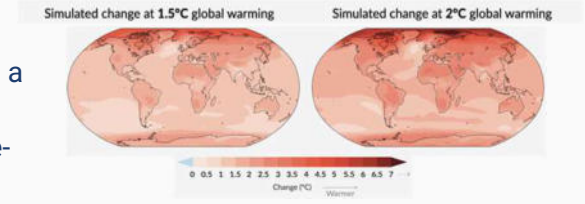
Overview of Methods & Data

- Climate data from 15 climate models and 137 climate simulations
- LOCA2 statistical & WRF dynamical downscaling to 3km resolution
- Extract over the Ventura study area (right)

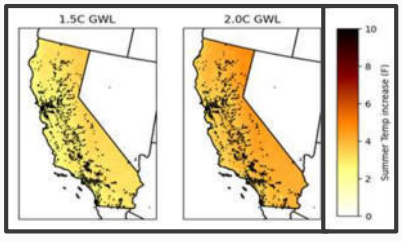


Global Warming Levels (GWL): What is it?

- Global Warming Level (GWL) approach: Group climate simulations by **how much global warming has occurred** instead of by a specific year or timeframe.
- Global warming is calculated relative to pre-industrial conditions (1850-1900)
- GWLs align with familiar international targets for climate change mitigation (e.g. 1.5 °C and 2.0 °C)
- *"What will climate impacts in California look like when the world reaches 2.0 °C of warming?"*



https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf



GWL: Why?

Major benefits to GWL approach

- Removes uncertainty from models that warm unrealistically quickly
- Allows the use of simulations from multiple Shared Socio-economic Pathways (SSP) scenarios for additional statistical robustness
- Aligns with IPCC, national, state climate planning processes

GWL gives a **clearer picture of how climate impacts could evolve** with continued greenhouse gas emissions

	Global Warming Level	Best estimate year
Historical baseline	0.8 °C	2002
Recent historical	1.0 °C	2010
"Present day"	1.2 °C	2020
Next 10 years	1.5 °C	2031 (SSP 3-7.0)
Mid-Century	2.0 °C	2047 (SSP 3-7.0)
Next 50 years	3.0 °C	2075 (SSP 3-7.0)

What is your baseline?

- Options:
  - 0.8, 1.0 or 1.2 as baseline

What is your planning horizon?

- ***Recommendation:***
  - 1.5 for near-term planning
  - 2.0 for mid-century planning
  - 3.0 for long-term planning



Proposed Metrics for Climate Hazards

EAGLE ROCK ANALYTICS

Selected Climate Hazards

- Drought**
- Wildfire**
- Extreme Heat*
- Extreme Precipitation/Flooding*
- Marine Stratus**
- Sea Level Rise

*Studied in the 2019 Ventura County Climate Report
**Discussed in the 2019 Ventura County Climate Report

Questions to think about

- How would you use these metrics to make informed planning decisions?
- Is there something missing?
- Are there critical thresholds for these climate hazards that directly impact your operations?

Drought

What:

- Extended periods of drier than normal conditions.

Threats:

- Impacts both society and ecosystems spanning timescales ranging from weeks to years.

Why:

- Because water supplies are local and the amount of rainfall received annually is highly variable, supplies must be managed with caution.

Drought

- **Recommended Metric:** SPI (24/36 months)
- **Metric Description:**
  - The Standardized Precipitation Index, based on deviations of precipitation from the long-term mean, is representative of long-term drought conditions more relevant to hydrological drought.
  - First developed by T. B. McKee, N.J. Doesken, and J. Kleist in 1993 (McKee et al. 1993).
- **Thresholds**

SPI	SPI < -2	-2 < SPI < -1.5	-1.5 < SPI < -1.0	-1.0 < SPI < 1.0	1.0 < SPI < 1.5	1.5 < SPI < 2.0	SPI > 2.0
Interpretation	Extremely Dry	Severely Dry	Moderately Dry	Near Normal	Moderately Wet	Very Wet	Extremely Wet

Wildfire

What:

- Destructive fires that can start in wildland and spread quickly into urban areas.

Threats:

- Causes widespread destruction impacting various sectors; threatens local water quality and supply by damaging assets, interrupting power supply and using up water supplies.

Why:

- Identifying high wildfire risk regions is critical for proactive management and adaptation planning.

Wildfire

- **Recommended Metric:** Average number of high fire risk (Fosberg Fire Index) days.
- **Metric Description:**
  - Calculate Fosberg Fire Index
    - This index assesses the impacts of small-scale/short-term weather variations on fire potential and is highly sensitive to changes in fine fuel moisture
  - Count the number of days where the fire risk is high (threshold).
  - Compare the frequency across GWLs.
  - Easy to interpret metric providing the count of high fire risk days and can relate to current frequency of high fire risk days to provide context.
- **Thresholds**
  - Threshold from SPC

Fosberg Index	< 50	50-70	70-90	90-100
Interpretation	Okay	High	Very High	Extreme

Extreme Temperature & Heat

What:

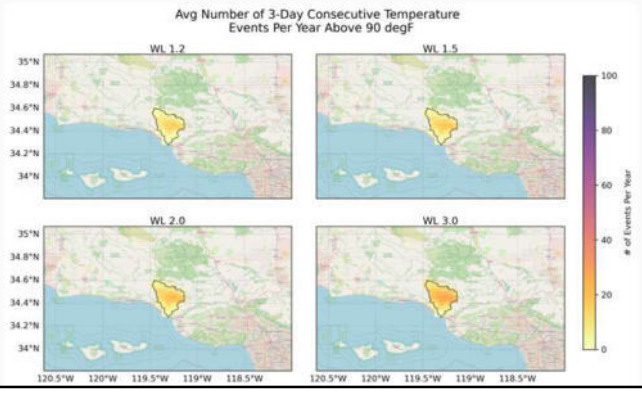
- High temperatures (day and/or night) and/or humidity for extended periods of time.

Threats:

- Impacts human health, heat-sensitive industries (e.g., agriculture), and infrastructure especially when observed over long durations. Higher temperatures can threaten the biological diversity and viability of the watershed's ecosystems.

Why:

- Increases in the duration and intensity of temperature will enhance needs for cooling, increase energy demands, and severely impact human health/productivity; disproportionately impacting disadvantaged communities.



Extreme Temperature & Heat

- **Recommended Metric:** Extreme Temperature Events (Intensity and Frequency) & Heat Index (Intensity and Frequency)
- **Metric Description:**
  - Calculate the intensity and/or the number of days above a threshold for a specific duration.
  - Calculate the Heat Index
    - Commonly known index that describes the heat stress (temperature and humidity).
    - Show changes in intensity and frequency above threshold.
  - Both are easy to interpret metrics
- **Thresholds**
  - *Are there specific temperature thresholds and/or event durations that are critical to known assets or planning strategies?*
  - Other suggested thresholds:
    - 90 degrees after 3 days (FEMA)
    - National Definitions for Heat Index

Classification	Heat Index	Effect on the body
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity
Extreme Caution	90°F - 103°F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	103°F - 124°F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	125°F or higher	Heat stroke highly likely

Extreme Precipitation/Flooding

What:

- Intense periods of heavy rain (or no rain) extending multiple days.

Threats:

- Impacts water supplies, can result in compounding events (such as mudslides), and impact water quality.

Why:

- The sequencing of storms and length of dry periods between precipitation events is important to water resource and flood management.

Extreme Precipitation/Flooding

- **Recommended Metric:** Precipitation events over/under critical thresholds (intensity/frequency)
- **Metric Description:**
  - Calculate the frequency of precipitation above (below) a threshold.
  - Compare precipitation intensity from baseline to near-term and mid-century.
  - Break into season, percentiles.
  - Event durations (dry and wet)
- **Thresholds**
  - *Are there specific thresholds (intensity and duration) we should consider that are known stressors?*
  - Alternatively, we can develop thresholds based on baseline GWL.

Marine Stratus

What:

- Low altitude marine stratus clouds - commonly called coastal fog.

Threats:

- Influences irrigation demand for crops, moderates coastal heat waves and greatly impacts the local ecosystems.

Why:

- Confirming suggested declines in marine stratus is critical to guiding planning and mitigation of impacts related to changes in evaporative demand (increases), which could increase drought stress, and changes in coastal heat waves due to changes in moderation of temperatures.

Marine Stratus

- **Recommended Metric:** Change in low-cloud fraction along coastline (using a proxy for marine stratus)
- **Metric Description:**
  - Calculate time-delta changes in low-cloud fraction across GWLs
  - Require a bit of analysis

Sea Level Rise

What:

- Coastal flooding due to future sea level rise, coastal storms, and long-term topographic change.

Threats:

- Sea level rise threatens the Ventura River Watershed's coastal areas with increased tidal flooding, saltwater intrusion, and habitat loss, particularly near the estuary and low-lying infrastructure.

Why:

- Modeling sea level rise is critical to identify vulnerable assets, inform land use decisions, and prioritize adaptive infrastructure investments before impacts become irreversible.

Sea Level Rise

- **Recommended Metrics:** Flooding, groundwater, and shoreline position
- **Metric Description:**
  - Flooding
    - Evaluated on a sunny day and 100-year storm:
      - 25cm SLR (~2050; intermediate - intermediate/high scenario)
      - 50cm SLR (~2060; intermediate/high - high scenario)
      - 75cm SLR (~2070; intermediate/high - high scenario)
  - Groundwater Hazard
    - 25cm, 50cm, and 75cm SLR
  - Shoreline Position
    - 25cm, 50cm, and 75cm SLR

25cm SLR during 100-year storm



Source: CoSMoS Tool -- https://ourcoastourfuture.org/hazard-map/

Metrics for Climate Hazards

Climate Hazard	Metric	Addresses	Depends On	Thresholds
Drought	SPI (24/36 months)	Long-term drought conditions more relevant to hydrological drought	Precipitation	> 0 = Wet Conditions < 0 = Dry Conditions
Extreme Precipitation and Flooding	Precipitation events over threshold (Intensity and Frequency)	Larger scale inundation events	Precipitation	***Need to Establish***
Wildfire	Average number of high fire risk (Fosberg Fire Index) days (i.e. over critical threshold)	The Fosberg Fire Index assess the impacts of small-scale/short term weather variations on fire potential	Temperature, Humidity, Wind speed	SPC Fosberg Fire Index threshold
Extreme Temperature & Heat	Extreme Temperature Events (intensity and frequency)	Exposure to heat across a range of durations looking at a wide range of heat stressors on assets	Temperature	Frequency of 10 degrees above regional average for a duration of 24 hours or ## of weeks; ***Need to Establish***
	NWS Heat Index	Exposure to apparent temperature (temperature feels like to the human body)	Temperature, Relative Humidity	Nationally Established
Marine Stratus	Change in low-cloud fraction along coastline	Proxy for marine stratus which regulates temperature and evapotranspiration demand in the future.	Low cloud fraction	N/A
Sea Level Rise	Flooding	Coastal flooding due to future sea level rise, coastal storms, and long-term topographic change	Total water level	25cm SLR (~2050); sunny day & 1% storm 50cm SLR (~2060); sunny day & 1% storm 75cm SLR (~2070); sunny day & 1% storm
	Groundwater	How easily groundwater can move through connected subsurface openings.	Hydraulic conductivity	25cm SLR; 50cm SLR; 75cm SLR
	Shoreline Position	Shore profile changes over time	Land-water boundary at the Mean High Water line	25cm SLR; 50cm SLR; 75cm SLR

Wrap Up and Next Steps



Backup

EAGLE ROCK ANALYTICS

Marine Stratus

- **Climate Hazard Motivation:** Using low-cloud cloud fraction along the coastline provides a proxy for marine stratus. Marine stratus regulates temperature and evaporative demand in the region. Evapotranspiration can be moderated by the presence or absence of marine stratus and provides water resources for ecological function in coastal ecosystems. Marine stratus lowers atmospheric evaporative demand, which can reduce drought stress for some species by 22–40% along the coast (Fischer et al. 2009) as well as influences irrigation demand for crops (Baguskas et al. 2018). Marine stratus has also been demonstrated to moderate coastal heat waves in southern California (Gershunov et al. 2011; Clemesha et al. 2016).
- **2019 Ventura Plan Metrics:** No metrics were formally presented. The uncertainty associated with marine stratus and onshore/offshore flow makes it difficult to synthesize. Understanding critical drivers/processes will be needed.
- **Recommended Metric:** Change in low-cloud fraction along coastline
- **Metric Description:**
  - Calculate time-delta changes in low-cloud fraction across GWLs
  - Will require a bit of iterative analysis

Extreme Heat

- **Climate Hazard Motivation:** Extreme heat can severely impact many sectors. The duration of heat including both day and nighttime temperatures contributes to heat risk. Little to no overnight relief effects anyone without effective cooling/hydration and can impact health systems, heat-sensitive industries, and infrastructure (e.g. there is no natural break in the heat and that is a stressor) Higher temperatures can theathene the biological diversity and viability of the watershed's ecosystems. Increases in the duration and intensity of temperature will enhance needs for cooling, increase energy demands, and severely impact human health/productivity; disproportionately impacting disadvantage communities.
- **2019 Ventura Plan Metrics:** Presented changes in maximum and minimum temperature by season, changes in the frequency of temperature above and below a threshold. Appears no duration.

- **Recommended Metric:** Extreme Heat Events (Intensity and Frequency) & Heat Index (Intensity and Frequency)
- **Metric Description:**
  - Calculate the intensity and/or the number of days above a threshold for a specific duration.
  - Calculate the Heat Index
    - Commonly known index that describes the heat stress (temperature and humidity).
    - Show changes in intensity and frequency above threshold.
  - Both are easy to interpret metrics
- **Thresholds**
  - *Are there specific temperature thresholds and/or event durations that are critical to known assets or planning strategies?*
  - Other suggested thresholds:
    - 90 degrees after 3 days (FEMA)
    - National Definitions for Heat Index



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Extreme Precipitation/Flooding

- **Climate Hazard Motivation:** Extreme precipitation can impact water supplies, result in compounding events (such as mudslides), and impact water quality. High intensity precipitation events can trigger flash floods and the sequencing of storms and length of dry periods between precipitation events is important to water resource and flood management.
- **2019 Ventura Plan Metrics:** Changes in average annual/seasonal precipitation (mid-century - baseline) broken into percentiles. Changes in the contribution of the top 5% of wettest days to total annual precip. Changes in the average annual number of dry days.

- **Recommended Metric:** Precipitation events over threshold (intensity/frequency)
- **Metric Description:**
  - Calculate the frequency of precipitation above a threshold.
  - Compare precipitation intensity from baseline to near-term and mid-century.
  - Break into season, percentiles.
- **Thresholds**
  - *Are there specific thresholds (intensity and duration) we should consider that are known stressors?*
  - Alternatively, we can develop thresholds based on baseline GWL.

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Wildfire

- **Climate Hazard Motivation:** Wildfires spread widespread destruction impacting various sectors. Dry, hot, windy conditions are conductive to wildfires, human activity tends to be the main driver of ignitions. Wildfires can threaten local water quality and supply by damaging assets, interrupting power supply and using up water supplies. There is a strong need to identify high wildfire risk regions for proactive management and adaptation planning.
- **2019 Ventura Plan Metrics:** No metrics were formally presented. Wildfire size, intensity and frequency identified as future needs.

- **Recommended Metric:** Average number of high fire risk (Fosberg Fire Index) days.
- **Metric Description:**
  - Calculate Fosberg Fire Index
    - This index assess the impacts of small-scale/short term weather variations on fire potential and is highly sensitive to changes in fine fuel moisture
  - Count the number of days where the fire risk is high.
  - Compare the frequency across GWLs.
  - Easy to interpret metric providing the count of high fire risk days and can relate to current frequency of high fire risk days to provide context.
- **Thresholds**
  - Use common thresholds

Drought

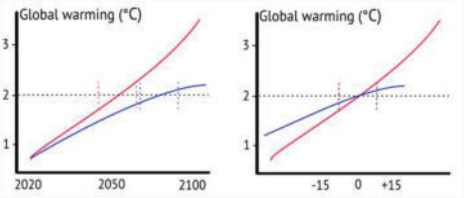
- **Climate Hazard Motivation:** Droughts, an extended imbalance between supply and demand of water, impact both society and ecosystems spanning timescales ranging from weeks to years. Cycles of floods and droughts are common. The Ventura River watershed is 100% dependent upon local water sources. Groundwater comprises almost half of the total water produced. The Lake Casitas reservoir is the watershed's main source of surface water and was designed to maintain supplies during a multiyear dry period. Because water supplies are 100% local and the amount of rainfall received annually is highly variable, supplies must be managed with caution.
- **2019 Ventura Plan Metrics:** No drought metrics were provided. "The specific types of drought, their magnitude and duration, and the hydroclimatic patterns that end drought in Ventura County will require additional research that integrates modeling approaches to evaluate water availability changes on both the supply and demand sides as well as examines the dynamical circulation mechanisms. Based upon the analysis provided in this document, clear evidence for increases in drought severity is provided, but evidence for occasional wet years is also demonstrated.Because precipitation remains variable, some years will be less drought prone than others due to more frequent and possibly stronger storms"

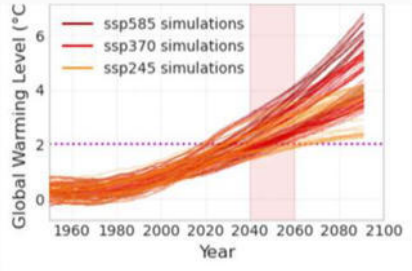
- **Recommended Metric:** SPI (24/36 months)
- **Metric Description:**
  - The Standardized Precipitation Index, based on deviations of precipitation from the long-term mean, is representative of long-term drought conditions more relevant to hydrological drought.
  - First developed by T. B. McKee, N.J. Doesken, and J. Kleist in 1993 (McKee et al. 1993).
- **Thresholds**

SPI	Interpretation
SPI < -2	Extremely Dry
-2 < SPI < -1.5	Severly Dry
-1.5 < SPI < -1.0	Moderately Dry
-1.0 < SPI < 1.0	Near Normal
1.0 < SPI < 1.5	Moderately Wet
1.5 < SPI < 2.0	Very Wet
SPI > 2.0	Extremely Wet

GWL: The How To

- **How the GWL method works**
  - Pull data from each simulation around the time it crosses a global warming threshold
  - Data from all simulations is aligned and aggregated





Ventura River Watershed Resilience Pilot Project ~ Advisory Group
Meeting #3
July 21, 2025 at 2:00 pm - 4:00 pm

Zoom Link: https://stantec.zoom.us/j/97540986670

Dial In:	669-444-9171 (San Jose)
Find your local number:	https://stantec.zoom.us/u/abAH19Korl
Meeting ID:	975 4098 6670

MEETING PURPOSE & OBJECTIVES:

Purpose:

- Update AG about the Vision Statements, the CAUSE Survey, the work by the CSU technical team
- Review and discuss purpose and status of the Water Budget task
- Focused discussions about the Problem Statements

Objectives:

1. The AG will feel up to date with progress across the multiple elements of the Project
2. The Technical Team will brief about the role of the Problem Statements and receive advice to support next steps.

AGENDA

Agenda Item	Time Frame
1. **Welcome, Introductions, Agenda Review** – Lynn & Lara	10 minutes
2. **Updates** – CSU, CAUSE, Lynn	20 minutes
3. **"Historical" Water Budget** – Lara, DWR, Stantec	25 minutes
4. **Problem Statements Summary** - Rincon	10 minutes
5. **Problem Statements Exercise** – All in facilitated breakout rooms	50 minutes
6. **Wrap Up – What's Next** – Lynn and Lara	5 minutes

Adjourn - Next Meeting Date: 2pm September 15, 2025

Ventura River Watershed Resilience Pilot Project

Advisory Group Meeting #3
July 21, 2025



Agenda

- **Welcome and Introductions**
- **Updates from Project Team**
- **"Historical" Water Budget**
- **Problem Statements**
- **Wrap Up**
  - **Upcoming Forum! July 30, Camp Arnaz**
  - **Next Meeting Date: September 15**

Revised Vision Statement & Goals

We envision a resilient, thriving, and equitable Ventura River Watershed—where water, communities, ecosystems, and cultural practices are interconnected and sustained for future generations.

Through proactive collaborative planning, inclusive engagement, and science-informed strategies we will strive to restore natural functions, protect local water resources and enhance water security, and strengthen our collective capacity to adapt to increasing climate challenges. Our efforts will support sustainable watershed management that benefits both ecological health and community well-being.

*(This vision is supported by guiding principles and **goals** that will shape our collective actions.)*

- Restore and Protect Ecosystem Health
- Safeguard and Sustain Local Water Resources
- Advance Climate Resilience through Action and Innovation
- Promote Equity and Cultural Connection
- Foster Stewardship and Education
- Support Collaborative, Informed Decision Making

Engaging with Frontline Communities

VRWRP Outreach Survey

- 8 open ended questions
- 2 initial questions focused on perceived positives and negatives in the community
- 6 follow up questions focused specifically on the climate and water challenges in the Ventura River Watershed.

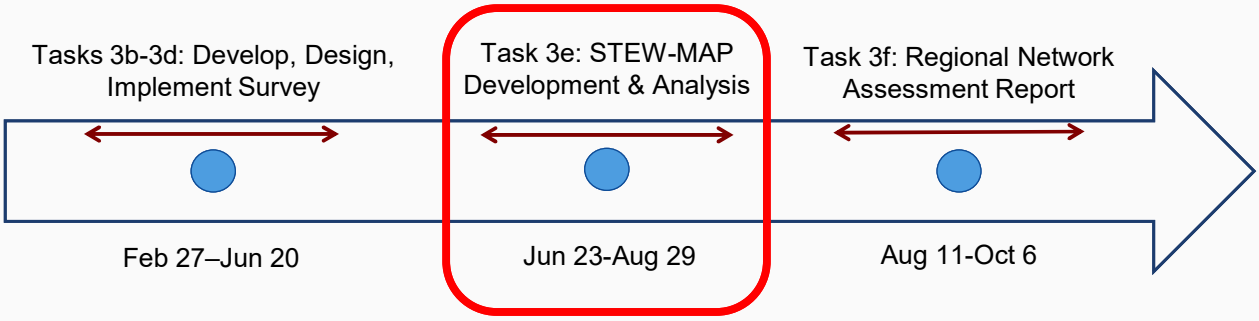
CAUSE Outreach Team

- 5 CAUSE Youth Fellows trained in conducting community outreach
- Focused on high volume places like the Red Barn Market and door to door outreach



Ventura River Watershed Resilience Pilot

Network Assessment Progress
July 21, 2025



CSUN CALIFORNIA STATE UNIVERSITY NORTHRIDGE

Institute for Watershed Resiliency CALIFORNIA STATE UNIVERSITY, SAN BERNARDINO

Loyola Marymount University Center for Urban Resilience

Ventura River Watershed Resilience Pilot

Network Data Processing

Network Actors

51 Responding Groups

+

105 New Partners Listed

=

156 Network Participants

#Ties	Type of Tie
418	Routine collaboration on watershed-related projects or program
478	Knowledge, data, or expertise on watershed-related issues
327	Funding, materials, work share, or work trade for watershed-related projects or programs
1,223	**TOTAL # Network Ties**

Network Ties

CSUN CALIFORNIA STATE UNIVERSITY NORTHRIDGE

Institute for Watershed Resiliency CALIFORNIA STATE UNIVERSITY, SAN BERNARDINO

Loyola Marymount University Center for Urban Resilience

Water Budget – DWR/Stantec

Purpose (text paraphrased from DWR Water Budget Handbook)

- A water budget serves a critical element of water management planning by:
  - Providing an understanding of historical conditions, and
  - Illustrating how future changes to supply, demand, hydrology, population, land use, and climatic conditions will affect a geographic area.
- Water budgets may be useful for a variety of purposes:
  - Water supply planning,
  - Preparing feasibility studies,
  - Facilitating integrated water resources management, Estimating and quantifying water resources,
  - Identifying data gaps, and/or
  - Forecasting optimum water management actions.

Water Budget – Stantec

Interpretation of Ventura GSFLOW Model Data

- Similar fundamental assumptions and limitations
- Requires translating model inputs and outputs into water budget components
- Opportunity to improve and investigate watershed-wide information



Water Budget – Stantec

Method

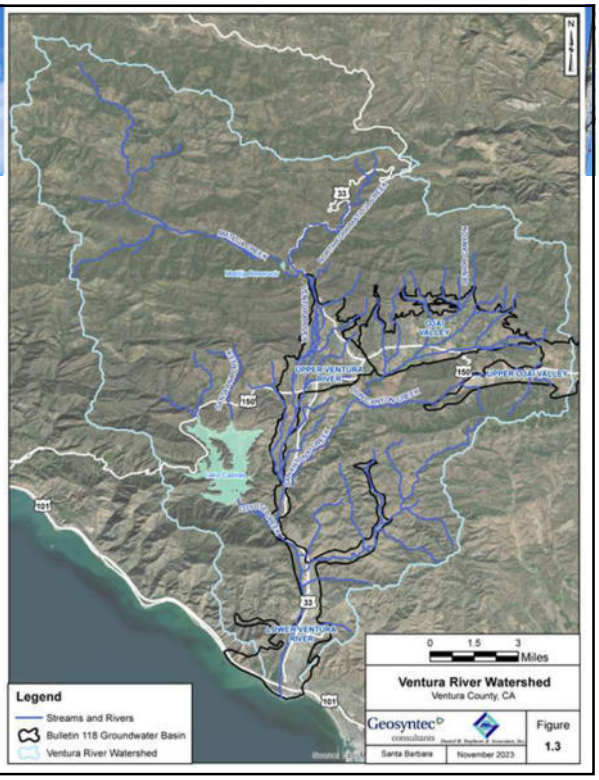
- Using DWR water budget methodologies and relationships among different water budget components
- 4 (interrelated) water budgets:
  - Land System
  - Surface Water
  - Groundwater
  - Total (Watershed)

Flow Type	Origin/ Destination	Component
Inflow	Into Zone	Precipitation on Land System
Inflow	Between Systems	Surface Water Delivery
Inflow	Between Systems	Groundwater Extraction
Inflow	Between Systems	Stored Water Extraction
	Within System	Applied Water Reuse/Recycled Water
	Within System	Applied Water
Inflow		*Total Inflow*
Outflow	Out of Zone	Evapotranspiration
Outflow	Between Systems	Runoff
Outflow	Between Systems	Return Flow
Outflow	Between Systems	Recharge of Applied Water
Outflow	Between Systems	Recharge of Precipitation
Outflow	Between Systems	Managed Aquifer Recharge
Outflow	Out of Zone	Recycled Water Export
Outflow		*Total Outflow*
Storage Change		Change in Land System Storage
Land System Mass Balance Error		

Water Budget – Stantec

Major Watershed Features

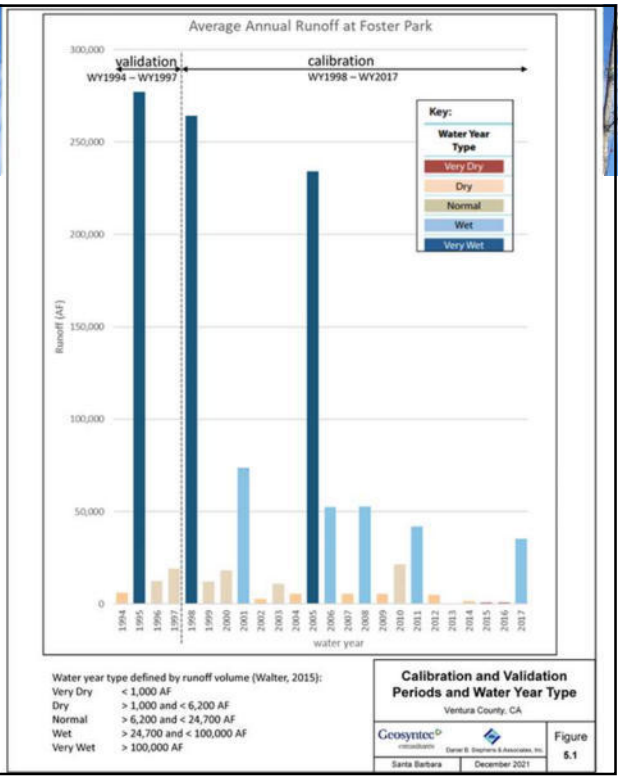
- 2 reservoirs
- 4 groundwater basins
- No imported water
- Minimal stream/groundwater inflow from outside basin
- Minimal exports from watershed
- Outlet to ocean



Water Budget – Stantec

Period of Simulation

- Water Years 1994-2017
  - 24 simulated years
  - 1 climate cycle = 30 years
- Year Types
  - 3 very wet years
  - 3 very dry years
  - Represents 2012-2017 drought



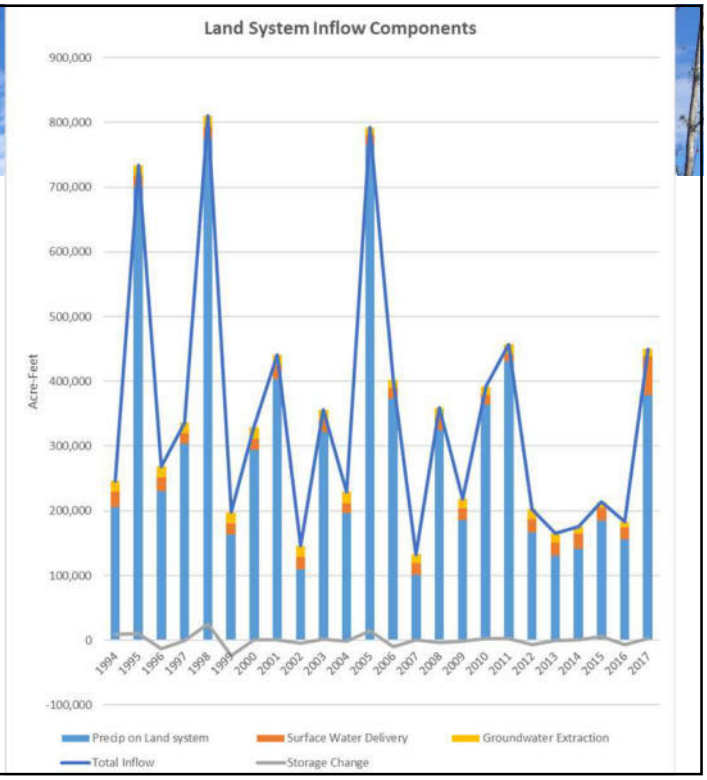
Water Budget – Stantec

Observations

- Significant hydrologic variability
- Relatively steady groundwater extraction
- Slight variations year to year in surface water delivery

Takeaways

- Limited storage
- Exposed to hydrologic variability



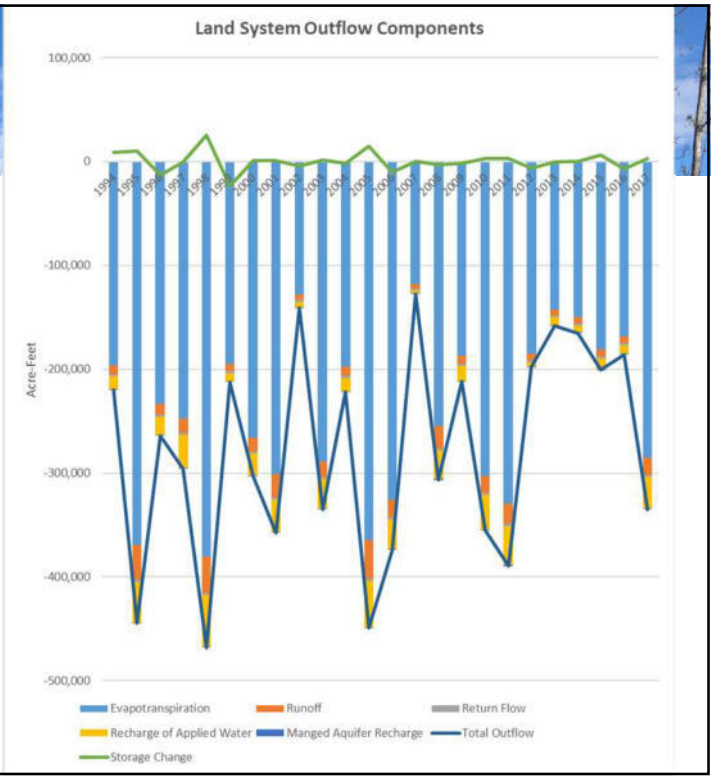
Water Budget – Stantec

Observations

- Major outflow is ET
- Runoff/recharge echo water year type

Takeaways

- Limited storage
- Recharge in a wet year is generally only usable in single, successive dry year



Water Budget – Stantec

Discussion

- Obtain information for water budget component refinements
  - Parse M&I and Agricultural surface water delivery quantities
  - Identify exported water types/quantities
  - Detail specific diversions and storage facilities
  - Other?
- Understand limitations of model
  - Understand uncertainty of components of the water
- Determine exactly how water budget will be used in additional analyses
  - Vulnerability assessments
  - Adaptation strategy proof-of-concept
  - Other?

Why Problem Statements?

Purpose

- Define the major climate-related challenges in the Watershed
- Synthesize science, local knowledge, and partner input to frame the most pressing issues

Role in the WRP

- Set the foundation for identifying goals, strategies, and implementation actions
- Ensure we're aligning on the "why" before jumping into the "how"

How Were They Developed?

Inputs Used

- Feedback from Forum #1
- Partner interviews
- Background research

Approach

- Problems are complex and interconnected; tried to tease out and provide focus for each statement
- Incorporated language from feedback where possible

How We'll Review Them Today

Today's Focus:

- Identify any gaps in the PSs
- Review a selection of draft PSs
- Requesting input on clarity, accuracy, framing, and missing content

Next Steps:

- Open opportunity to provide input on ALL PSs for another 1-2 weeks
- Feedback will be used to revise PSs
- PSs will guide strategy development

Problem Statement Activity

Instructions:

- You will be broken into two breakout rooms
- A facilitator (Mike or Anna) will guide you through some discussion around the draft Problem Statements
- Reconvene at 3:50pm

Coming Soon!

- Key events
  - July 30 Forum (next slide focus)
  - Watershed Council (August 7)
- Next AG Meeting – September 15, 2pm - 4pm

Upcoming Forum

Wednesday, July 30 from 1 – 4pm at Camp Arnaz in Oak View

Identifying community assets, vulnerable communities, and how they are impacted by climate change

Features two interactive activities to collect critical feedback for the WRP

Optional BYO networking lunch 12:30-1pm.

Have you registered?

https://tinyurl.com/29y3pexv





Ventura River Watershed Resilience Pilot Project ~ Advisory Group
Meeting #4
September 15, 2025 at 2:00 pm - 4:00 pm

Zoom Link: https://stantec.zoom.us/j/97540986670

Dial In:	669 900 6833 US (San Jose)
Find your local number:	https://stantec.zoom.us/u/abAH19Korl
Meeting ID:	975 4098 6670

MEETING PURPOSE & OBJECTIVES:

Purpose:

- Opportunity for AG to review and respond to initial draft results of the qualitative vulnerability assessment, which draws on input received during the Watershed Forums, early key partner interviews, and desktop research.
- Queue up/preview the next step in the process – asset manager interviews – where vulnerability scores will be refined, exposure scores will be discussed, and insights on priority risks will be gathered.
- Initiate discussion about the quantitative vulnerability assessment approach. Qualitative results will guide which risks are prioritized for further analysis.

AGENDA

Agenda Item	Time Frame
1. **Welcome, Introductions, Agenda Review**	10 minutes
2. **Updates**	10 minutes
3. Vulnerability Assessment Overview	25 minutes
4. **Vulnerability Assessment Exercise + Report Back**	70 minutes
5. **Wrap Up – What's Next**	5 minutes

Adjourn

Next Meeting Date: November 17th, 2:00 pm –4:00 pm

Ventura River Watershed Resilience Pilot Project
Advisory Group Meeting #4
September 15, 2025
Virtual Meeting

Facilitators: Mike Antos, Stantec

Attendees:

Advisory Group Members and Guests:

- Bruce Kuebler, Ventura Water District
- Bryan Bondy, Upper Ventura River Groundwater Agency
- Cameron Yee, CAUSE
- Carlie Dominguez, Native Coast Action Network
- Christopher Danch, Ojai Valley Fire Safe Council
- Francisco Pineda, DWR
- Jodi Switzer, Farm Bureau of Ventura County
- Jennifer Tribo, City of Ventura, Ventura Water
- Lauren Zaragoza, VCRCD
- Paul Jenkin, Surfrider Foundation
- Scott Meckstroth, Ojai Valley Sanitation District
- Sudeep Motupalli Roa, Ojai Velley Fire Safe Council
- Teresa Romero, Native Coast Action Network
- Vivon Sedgwick, Ojai Valley Land Conservancy (Chair)

WRP Team & Consultants:

- Jamie Whiteford, VCRCD (also advisory group member)
- Cameron Yee, CAUSE (also advisory group member)
- Lynn Rodriguez, WRP Project Manager
- Lara Shellenbarger, WRP Associate Project Manager
- Anna Yip, Rincon
- Mike Antos, Stantec
- Bridget Lowry, Stantec

Summary of Key Outcomes Related to WRP:

- **Assessment methodology**: Rincon Consultants presented the approach and draft results of the qualitative vulnerability assessment, clarifying how sensitivity and adaptive capacity scores were developed and how exposure analysis will be layered on.
- **AG Discussion on Draft Vulnerability Scores**: During breakout sessions, participants reviewed qualitative vulnerability scores of the highly vulnerable assets and helped refine the relative vulnerability and discuss the consequences. Feedback:
    - *Very vulnerable and very consequential*: Estuary Ecosystems; Villages, Sacred Sites & Ceremonial Places; Ventura Water & Casitas MWD Water Supply Systems.
    - *Relatively less vulnerable*: Flood Management Systems, with varying levels of consequence.
- **Drivers of vulnerability**: Drought emerged as the most significant driver across systems, followed by wildfire, extreme precipitation/flooding, and then sea level rise/storm surge and extreme heat.
- **Next steps**: Advisory Group input will be incorporated into revised vulnerability scoring, used to guide asset manager interviews, and carried forward to the October 23 Special Session focused on adaptation strategies.

Meeting Agenda and Summary:

1. Welcome and Introductions:
    - Chair Yvonne Sedwick welcomed participants.
    - Project managers, consultant team (Stantec and Rincon), and DWR representative introduced themselves and their roles.
2. Project Updates and Schedule
    - The Watershed Resilience Pilot Project is entering an intensive phase with six months remaining.
    - Upcoming meetings:
        i. Watershed Council Meeting: October 2 will include Eagle Rock presentation of downscaled CMIP6 climate projections and updates from CSU team on the network assessment survey findings, and report on results of community surveys conducted by CAUSE.

   ii. Joint AG/Watershed Council Special Session: October 23 (virtual) to review vulnerabilities and begin adaption strategy development.

3. Vulnerability Assessment Overview
   - Anna Yip (Rincon) presented the qualitative assessment framework, explaining how sensitivity and adaptive capacity scores were assigned using the DWR matrix as a guide. Exposure analysis will follow.
   - Draft results: 40 assets across six overlapping water systems (Water Supply, Groundwater, Ecosystems, Flood Management, Cultural Resources & Recreation, and Water Quality), with 510 vulnerability scores compiled.
   - Drought emerged as the most significant driver of vulnerability, followed by wildfire, extreme precipitation/flooding, and then sea level rise/storm surge and extreme heat.
4. Interactive Exercise
   - Breakout groups reviewed a subset of assets that were ranked highly vulnerable, discussed the consequence of severe climate impacts on the individual assets, and were asked to identify measurable thresholds that could support the upcoming quantitative analysis (time constraints limited discussion on measurable thresholds).
   - Discussions highlighted the importance of using local expertise to ground results.
5. Report Back and Key Takeaways:
   - Mike Antos (Stantec) facilitated. Discussions demonstrated consistent agreement that estuary ecosystems, cultural resources, and municipal water systems are among the watershed's most critical vulnerabilities.
   - Flood management assets were largely ranked as relatively less vulnerable, with varying levels of consequence.
   - Participants stressed the importance of capturing interdependencies across systems (e.g., wildfire impacts on water supply and recreation) and ensuring equity and cultural values are reflected in prioritization.
   - Broad support for building equity and cultural dimensions into risk evaluation.
   - ***Figure 1 below. A combined Miro board (online collaboration tool) from the three break out groups***
6. Wrap Up and Next Steps
   - Results of the exposure analysis using climate projections will be presented at the October 2 Watershed Council Meeting.

- Asset manager interviews will be conducted in late September-October to refine vulnerability and risk assessments.
- The October 23 Special Session will bring together the AG and Watershed Council and participants in the first two forums to identify and prioritize adaption strategies.
- Advisory Group Meetings: **Special Session October 23, 1- 4 pm (virtual), November 17, 2-4 pm.**

Action Items:

1. Rincon Team – Refine draft vulnerability assessment scoring based on AG input; prepare materials for asset manager interviews and schedule interviews.
2. Advisory Group Members: Participate in asset manager interviews as requested.
3. Advisory Group Members: Review meeting materials (includes the Oct 2 Eagle Rock Analytics, climate hazards presentation to be shared with AG by October 7th) and participate in the October 23 Special Session to advance adaption strategy development.

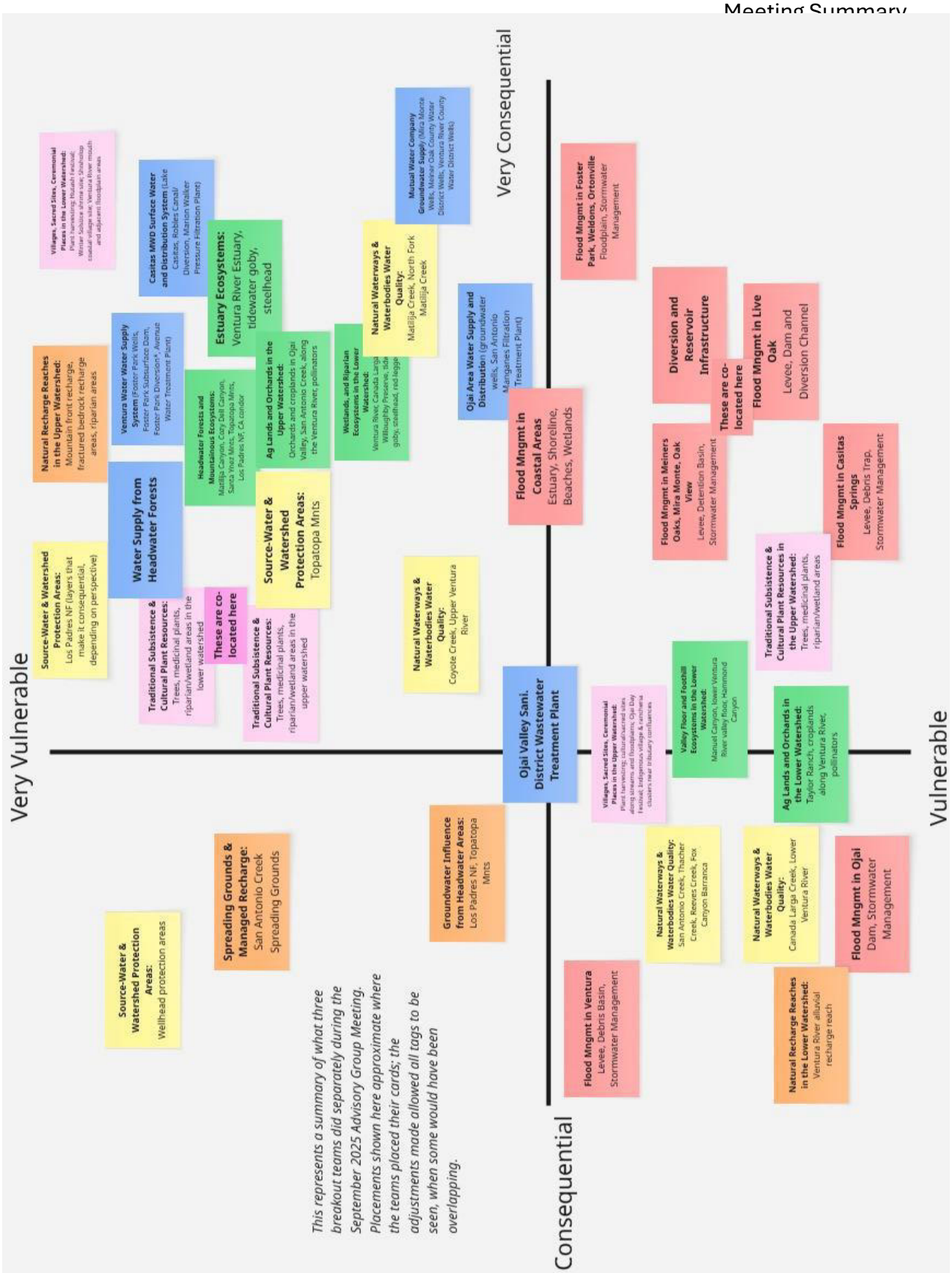


Figure 1 Combined Miro Board from Sept 15 AG meeting

Ventura River Watershed Resilience Pilot Project

Advisory Group Meeting #4
September 15, 2025



Agenda

Proposed Agenda

1. Welcome and Introductions
2. Updates from Project Team
3. Vulnerability Assessment Overview
4. Vulnerability Assessment Exercise + Report Back
5. Wrap Up

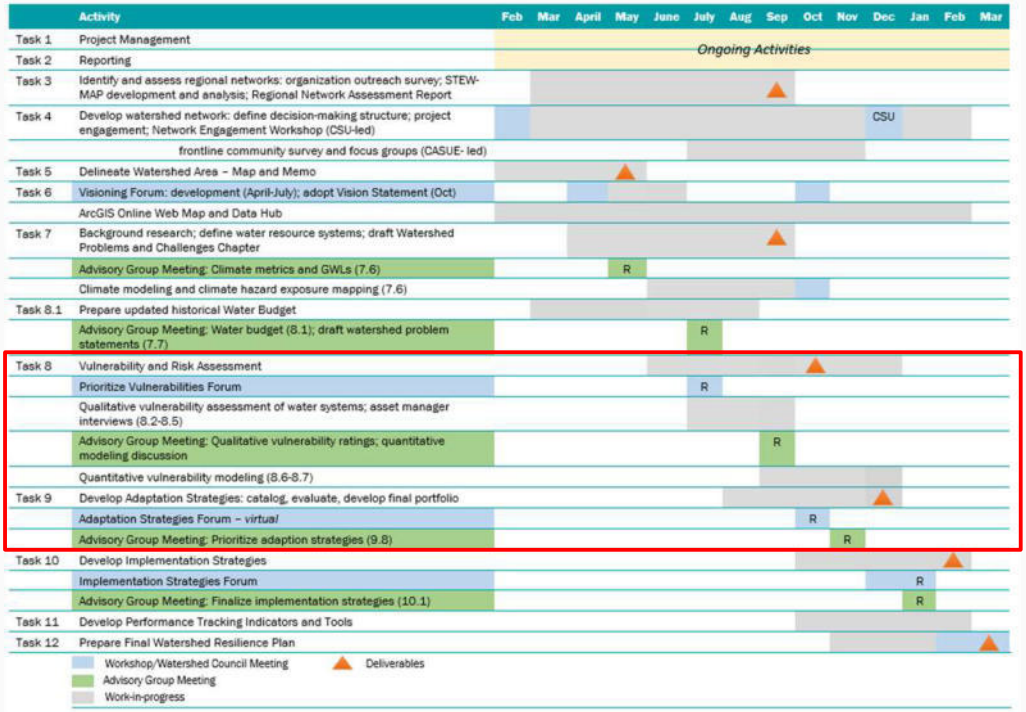
Meeting Purpose

- Opportunity for AG to preview the results of the qualitative vulnerability assessment, which was built off feedback received during the Watershed Forum, kay partner interviews, and desktop research.
- Discuss metrics that will be used to understand thresholds for the vulnerable assets/features and priority risks.

WRP Updates

- Schedule
- Next Steps

Looking Ahead



	Activity	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Task 1	Project Management	*Ongoing Activities*													
Task 2	Reporting														
Task 3	Identify and assess regional networks: organization outreach survey; STEW-MAP development and analysis; Regional Network Assessment Report								▲						
Task 4	Develop watershed network: define decision-making structure; project engagement; Network Engagement Workshop (CSU-led)											CSU			
	frontline community survey and focus groups (CASUE- led)														
Task 5	Delineate Watershed Area – Map and Memo				▲										
Task 6	Visioning Forum: development (April-July); adopt Vision Statement (Oct)														
	ArcGIS Online Web Map and Data Hub														
Task 7	Background research; define water resource systems; draft Watershed Problems and Challenges Chapter								▲						
	Advisory Group Meeting: Climate metrics and GWLs (7.6)				R										
	Climate modeling and climate hazard exposure mapping (7.6)														
Task 8.1	Prepare updated historical Water Budget														
	Advisory Group Meeting: Water budget (8.1); draft watershed problem statements (7.7)						R								
Task 8	Vulnerability and Risk Assessment									▲					
	Prioritize Vulnerabilities Forum						R								
	Qualitative vulnerability assessment of water systems; asset manager interviews (8.2-8.5)														
	Advisory Group Meeting: Qualitative vulnerability ratings; quantitative modeling discussion								R						
	Quantitative vulnerability modeling (8.6-8.7)														
Task 9	Develop Adaptation Strategies: catalog, evaluate, develop final portfolio											▲			
	Adaptation Strategies Forum – *virtual*									R					
	Advisory Group Meeting: Prioritize adaption strategies (9.8)										R				
Task 10	Develop Implementation Strategies													▲	
	Implementation Strategies Forum												R		
	Advisory Group Meeting: Finalize implementation strategies (10.1)												R		
Task 11	Develop Performance Tracking Indicators and Tools														
Task 12	Prepare Final Watershed Resilience Plan														▲

Workshop/Watershed Council Meeting ▲ Deliverables
Advisory Group Meeting
Work-in-progress

Upcoming Meetings

- **Watershed Council Meeting**
  - October 2nd at 9:00 AM (hybrid)
- **Special Session – Adaptation Strategies**
  - Watershed Council and Advisory Group
  - October 23rd at 1:00 PM (virtual)



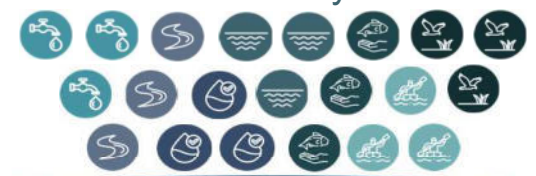
For more information about upcoming meetings visit: venturawatershed.org

Key Terms

- **Vulnerability Assessment:** Uses descriptive data, expert judgement, and interested party input to identify vulnerable systems. Inputs are sensitivity and adaptive capacity, and is screened by exposure.
- **Sensitivity:** Degree to which an asset is affected by climate hazards.
- **Adaptive Capacity:** Inherent ability of a system to adjust, cope, or recover from climate hazards.
- **Exposure:** Presence of assets in places that could be affected by climate hazards.
- **Priority Risks:** Vulnerable assets/features of highest concern identified through the vulnerability assessment.
- **Consequences:** Potential impacts or damages from climate hazards. Considers system function, financial implications, social implications, and governance impacts.

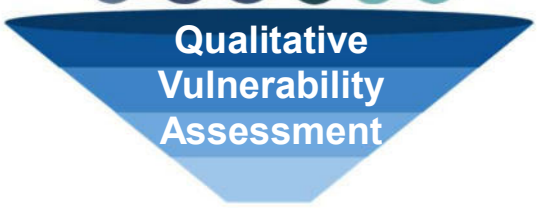
Process to Identify Vulnerable Resources

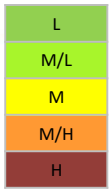
All water resource system assets and features

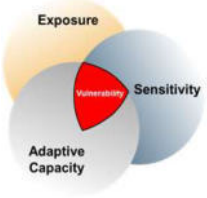


Forum #1
"Visioning"
(April 2025)

Qualitative Scoring







Forum #2
"Assets, Impacts, and Community Insights"
(July 2025)

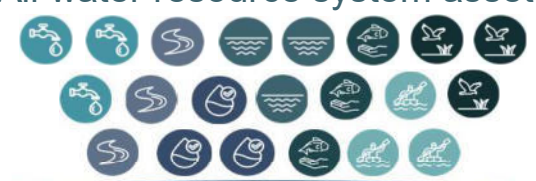
Most vulnerable
water resource system assets/features

Asset Manager Interviews
(Sept – Oct 2025)

Priority Risks
Vulnerable assets/features of highest concern

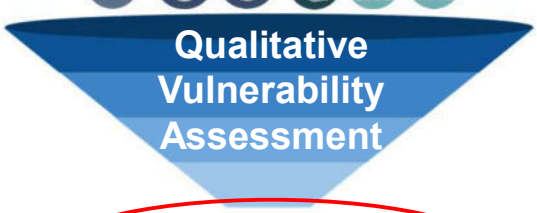
Process to Identify Vulnerable Resources

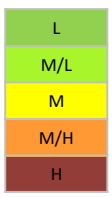
All water resource system assets and features

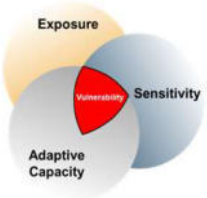


Forum #1
"Visioning"
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Qualitative Scoring







Forum #2
"Assets, Impacts, and Community Insights"
(July 2025)

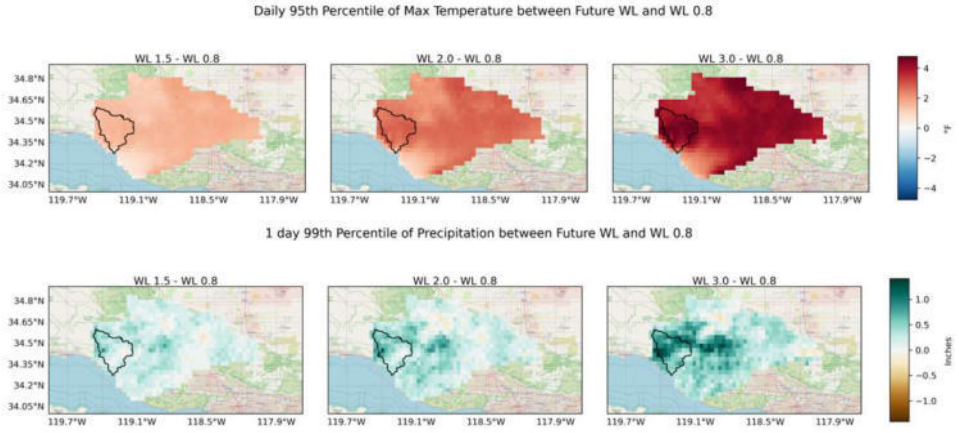
Most vulnerable
water resource system assets/features

Asset Manager Interviews
(Sept – Oct 2025)

Priority Risks
Vulnerable assets/features of highest concern

Vulnerability Assessment Overview

- On Deck:
  - Exposure of assets will be analyzed and accounted for in the Qualitative Vulnerability Assessment.
  - Eagle Rock Analytics will present on downscaled CMIP6 climate projection data findings during the Watershed Council meeting on 10/2.



Metrics for Climate Hazards Based on AG Input

Hazard	Metric	Thresholds	Strengths / Notes
Drought	SPI (24/36 months)	>0 = Wet; <0 = Dry	Standard, widely used; represents long-term hydrological drought
	SPEI	>0 = Wet; <0 = Dry	Includes temperature + precipitation
Extreme Precipitation & Flooding	Precipitation events over threshold (intensity & frequency)	1 in 10 events; 3" in 48 hrs; totals over 24 hrs, 48 hrs, 10 days vs. baseline GWL	Easy to interpret; flexible thresholds for different end-users
Wildfire	Avg. number of high fire risk (Fosberg Fire Index) days	Values >50 = wildfire risk	Easy to interpret; relates to current frequency
Extreme Heat	High temperature events (intensity & frequency)	Frequency of +10°F above regional average (1, 3, 10 consecutive days); OSHA thresholds (80°F, 95°F)	Flexible duration; applicable to assets and public health
	NWS Heat Index	NWS thresholds	Widely used; accounts for temp + humidity; relevant for public health
	Nighttime temperature (intensity & frequency)	Thresholds based on baseline percentiles	Captures heat duration, no overnight relief; stresses health, industry, infrastructure
Marine Stratus	Change in low-cloud fraction along coastline	N/A	Proxy for marine stratus; regulates evapotranspiration, moderates drought stress, influences irrigation & heat waves
Sea Level Rise	Flooding	Sunny-day & 100-year storm: 25 cm, 50 cm, 75 cm	Captures future flood exposure under different SLR scenarios
	Groundwater Hazard	25 cm, 50 cm, 75 cm SLR	Evaluates potential for groundwater rise and related impacts
	Shoreline Position	25 cm, 50 cm, 75 cm SLR	Tracks shoreline retreat and coastal change

Vulnerability Assessment Results

- Analyzed **40 assets/feature groupings** in the Ventura River Watershed
- Includes **85 asset components** across **4 different planning areas**
- Completed 3 scores per asset/feature per climate hazard for:
  Exposure (TBD) Sensitivity (✓) Adaptive Capacity (✓)
- **510 total vulnerability scores**
- **High Vulnerability (H):** 157 assets/features (30%)

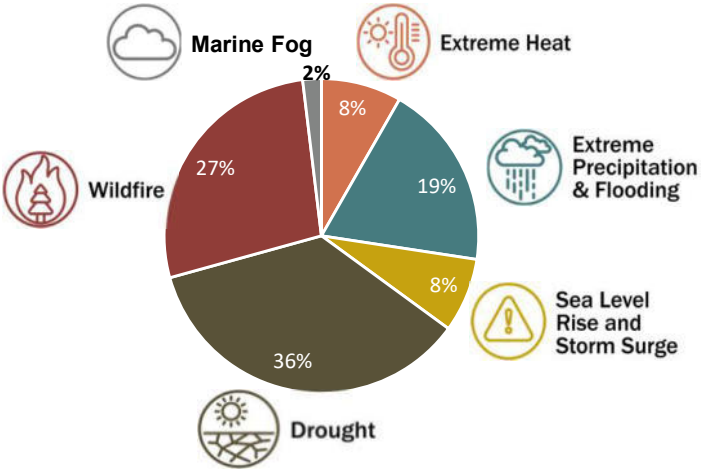
Low Risk
Special Case
Moderate Risk
High Risk



		Sensitivity				
		Low = 1	Moderate /Low = 2	Moderate = 3	Moderate /High = 4	High = 5
Adaptive Capacity	Low = 1	L	M/L	H	H	H
	Moderate /Low = 2	L	M	M/H	H	H
	Moderate = 3	L	L	M	M	H
	Moderate /High = 4	L	L	L	M	M
	High = 5	L	L	L	L	M

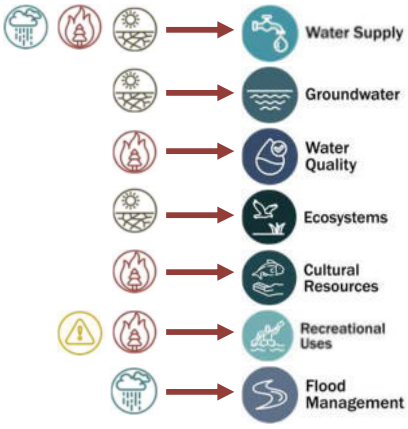
High Vulnerability Results

Percent of Assets Vulnerable Across Systems



Hazards Driving High Vulnerability

By Water Resource System



Low Vulnerability Results

ECOSYSTEMS	WATER SUPPLY	FLOOD MANAGEMENT	GROUNDWATER MANAGEMENT
Beaches and Coastal Dunes: Wildfire	**Ventura Water Reclamation Facility:** Extreme Heat	**San Antonio Creek Floodplains:** Drought	**Natural Recharge Reaches:** Extreme Precipitation and Flooding

Key Takeaways

Climate hazards are ***intensifying and uncertain***



Thomas Fire, 2017

Climate impacts will be ***more widespread and costly***



Flood, 2023

Water vulnerabilities are connected across the watershed



Solutions require Network collaboration

Next Step: Adaptation Strategies



Most vulnerable
water resource system
assets/features and climate hazards

Final WRP!

Implementation Strategies

Adaptation Strategies

Priority Risks

Quantitative Vulnerability Assessment

Next Step: Adaptation Strategies



Most vulnerable
water resource system
assets/features and climate hazards

Final WRP!

Implementation Strategies

Adaptation Strategies

Special Session on October 23

Priority Risks

Quantitative Vulnerability Assessment

Vulnerability Assessment Exercise

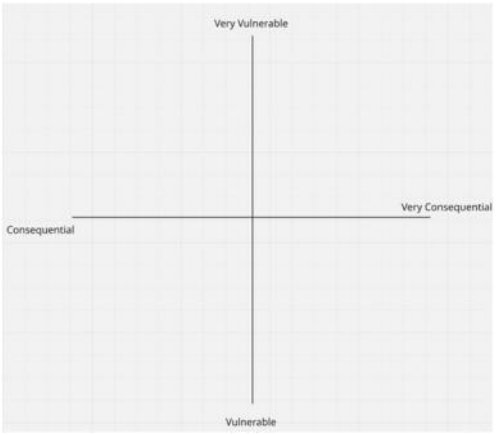
Breakout groups

Step 1: Review the list of assets that are qualitatively considered highly vulnerable.
Step 2: As a group, rank the assets based on two criteria:

- **Vulnerability** to climate hazards
- **Consequence** on watershed resiliency

Discuss the reasons behind your rankings.

- **Step 3:** As a group, identify any **quantitative measurable thresholds** you're aware of that could help support the quantitative assessment of the highest-ranking assets.
- **Step 4:** We will reconvene as a full group to hear **key takeaways** and **reflections** from each group's discussion.



Vulnerability Assessment Exercise Report Back

Announcements & What's Next

- Next AG Meeting – November 17, 2pm - 4pm

Ventura River Watershed Resilience Pilot Project ~ Advisory Group
Meeting #5
November 17, 2025 at 2:00 pm - 3:00 pm

Zoom Link: https://stantec.zoom.us/j/97540986670

Dial In:	669 900 6833 US (San Jose)
Find your local number:	https://stantec.zoom.us/u/abAH19Korl
Meeting ID:	975 4098 6670

MEETING PURPOSE & OBJECTIVES:

Purpose:

- To brief the AG on the quantitative vulnerability assessment approach and provide time for AG members to ask questions, discuss considerations, and offer insights to help refine implementation.
- Please note this meeting has been shortened to one hour (from 2:00 - 3:00 p.m.), and an additional AG meeting has been scheduled for December 15th, 2025, to prioritize adaptation strategies and briefly discuss the approach to develop implementation strategies.

AGENDA

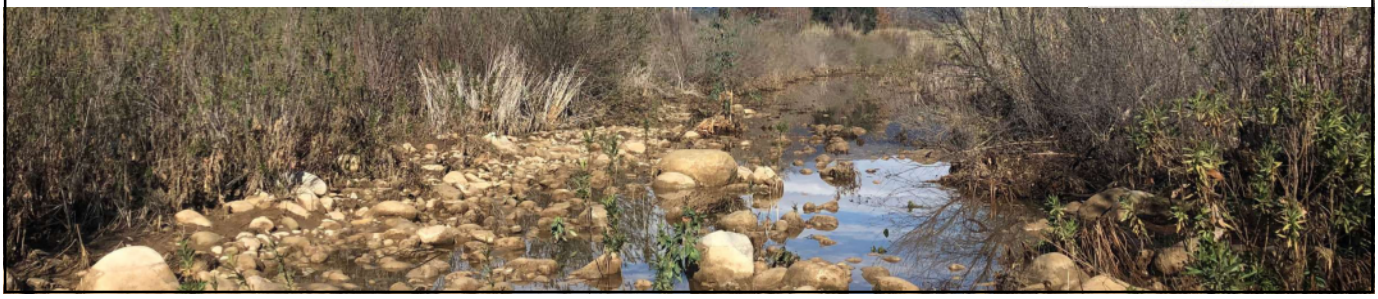
Agenda Item	Time Frame
1. Welcome, Introductions, Agenda Review	5 minutes
2. General Project Updates & Upcoming Meetings	10 minutes
3. Quantitative Assessment Plan	25 minutes
4. Questions & Discussion	15 minutes
5. Wrap Up	5 minutes

Adjourn

Next Meeting Date: December 15th, 2:00 pm –4:00 pm

Ventura River Watershed Resilience Pilot Project

Advisory Group Meeting
November 17, 2025



Agenda

- **General Project Updates**
- **Upcoming Meetings**
- **Quantitative Assessment Plan**

Upcoming Meetings

- **December 4 Watershed Council Meeting**
  - Interactive Workshop: Mapping Connections for Watershed Resilience.
  - Please RSVP!
- **December 15 Advisory Group Meeting**
  - Finalize Adaptation Strategies
  - Begin Discussing Implementation Strategies

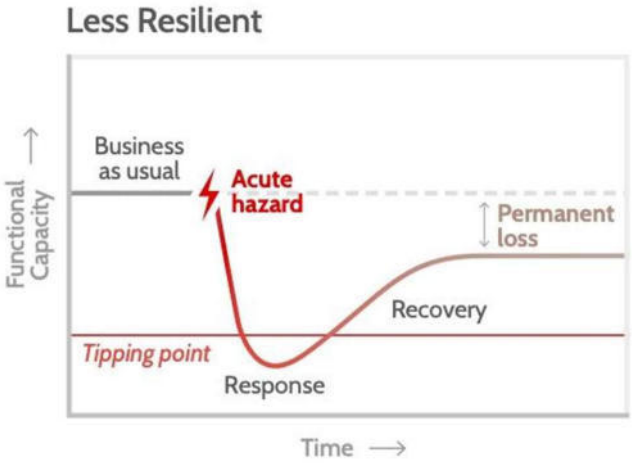
Save the date for final Forum – February 11 at Camp Arnaz!

Ventura River Watershed
Water Resilience for a Changing Climate

Quantitative Assessment

Purpose

Following completion of the qualitative assessment, a quantitative assessment should be performed for an area indicating high potential vulnerability.

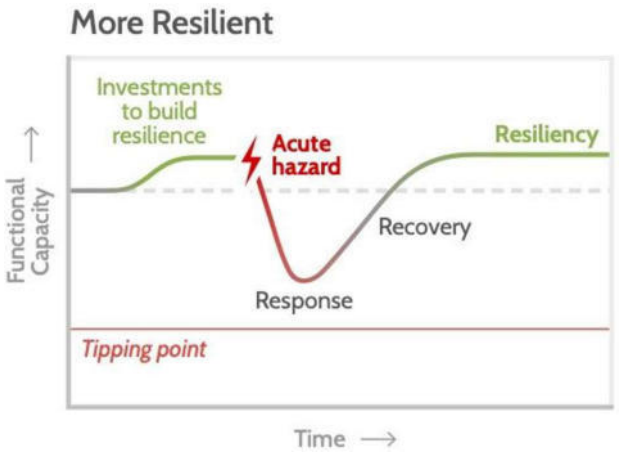


Quantitative Assessment

Purpose

Following completion of the qualitative assessment, a quantitative assessment should be performed for an area indicating high potential vulnerability.

For a primary adaptation strategy, an evaluation should demonstrate through quantitative methods the risk reduction that could be achieved.



Quantitative Assessment

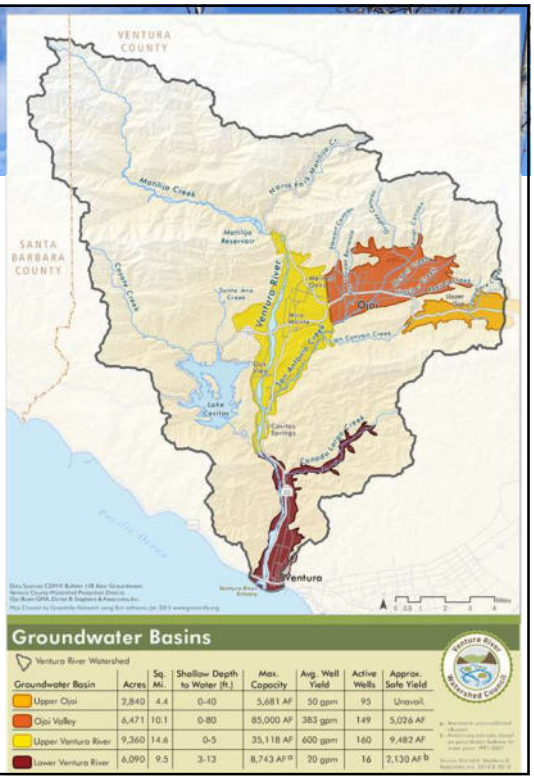
Task: quantitatively assess system-hazard combination

Water Systems

- Water supply
- Flood management
- Groundwater management
- Ecosystems
- Cultural

Hazards

- Extreme precipitation
- Extreme heat
- Sea-level-rise & storm surge
- Drought
- Wildfire
- Declining marine fog



Quantitative Assessment

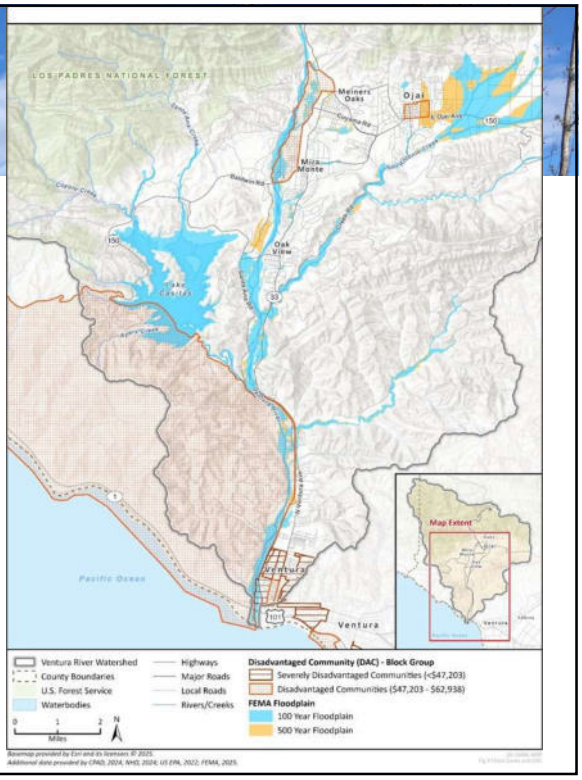
Method Selection

Options:

- **Flood-hazard assessment**
- Drought/extreme heat/sea-level rise combined hazard assessment
- Flood/wildfire combined assessment

Considerations:

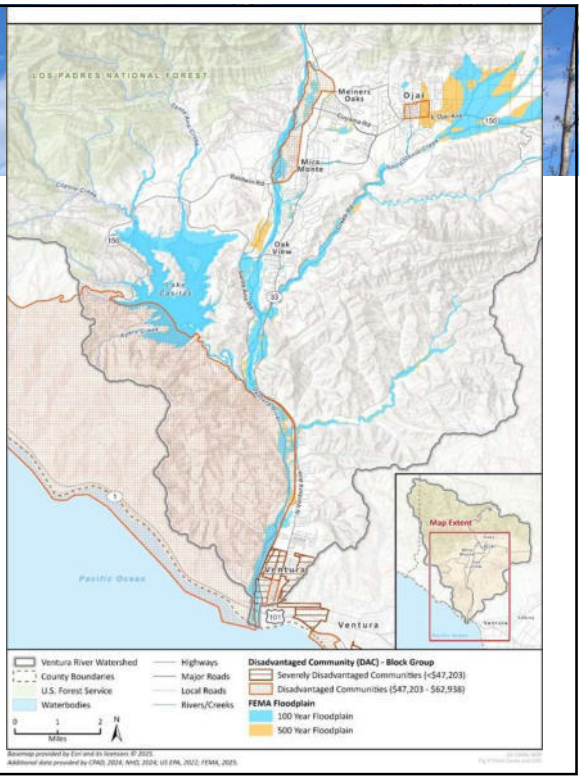
- Interest expressed by asset managers in projections of flood hazards
- Recognition of planning and implementation efforts by asset managers and interested parties in the watershed that are underway to address other hazards
- Potential for redundancies or discrepancies between watershed analyses for related efforts



Quantitative Assessment

Proposal

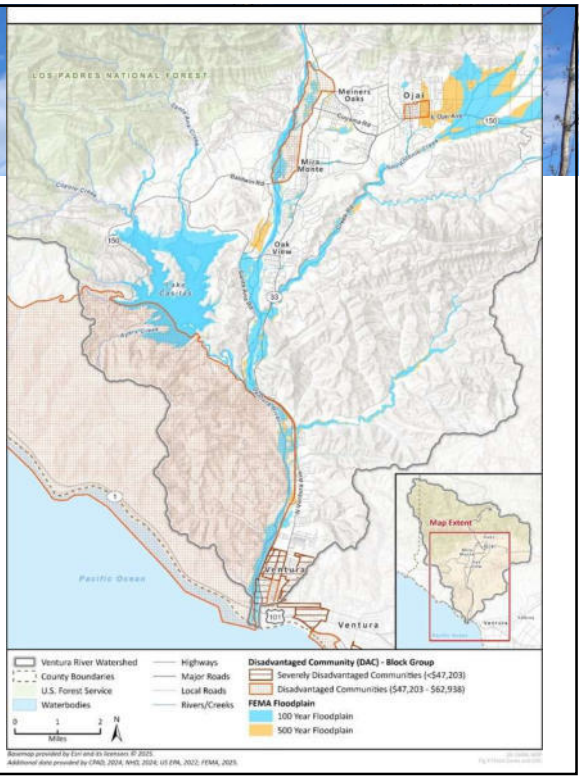
- Analyze flood conditions within recent climate and hydrology projections in the Ventura watershed
- Quantify risk reduction through implementation of an adaptation strategy



Quantitative Assessment

Approach – Driving Data

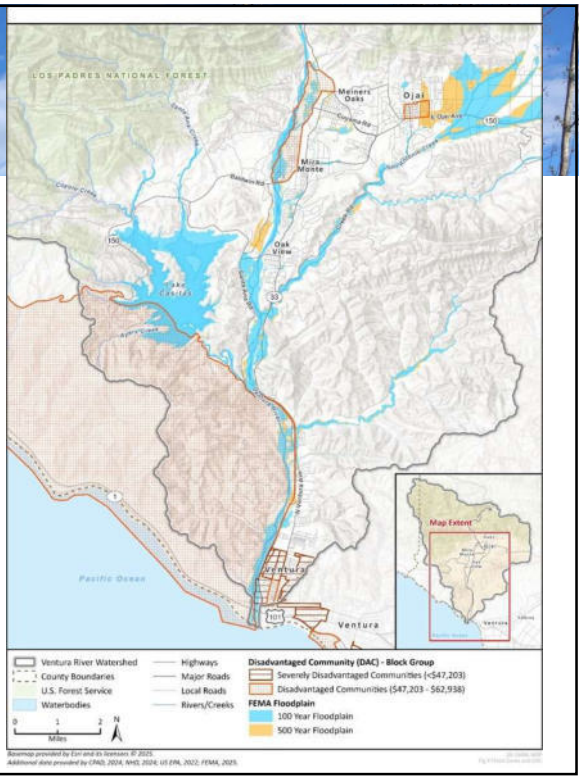
- Leverage recent climate and hydrology projections informing the CA 5th Climate Change Assessment
- These projections (1950-2099) represent CMIP6 global climate projections, LOCA2-Hybrid downscaling, translated into hydrology projections using VIC modeling applied statewide (3-hrly, ~3km res.).
- The effort resulted in daily 20 climate and hydrology projections representing different climate forcing assumptions and climate simulation approaches (emissions, GCMs)



Quantitative Assessment

Approach – Flood Hydrology Changes

- Adopt flood statistics of interest (e.g., Annual Max-1-Day having 20-year, 100-year, or other return period)
- Consider the whole projections ensemble to detect changes in historical to future flood statistics
- Consider change within the projections, from historical period to future periods centered around 2040 and 2070
- Handle bias in the hydrology projections by identifying percent changes within the projection (simulated historical to simulated future) and applying those percentage changes to observed flood statistics.



Quantitative Assessment

Approach - Flood Hydrology Changes

Potential Assessment Sites:

Ventura River
- Near the Robles Diversion
- Near the Santa Ana Bridge
- Near the Ventura Levee
- Near the Casitas Levee

San Antonio Creek
- Near the City of Ojai
- Near outlet to the Ventura River



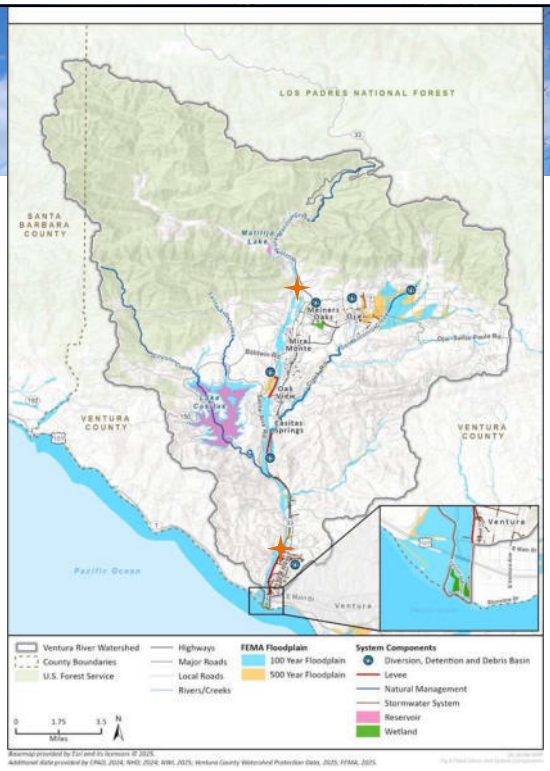
Quantitative Assessment

Approach - Flood Management System

Assessment Sites: Ventura River

1. Near the Robles Diversion to investigate Meiners Oaks levee improvement project area

2. Near the Ventura Levee to investigate the VR1 levee improvement project area



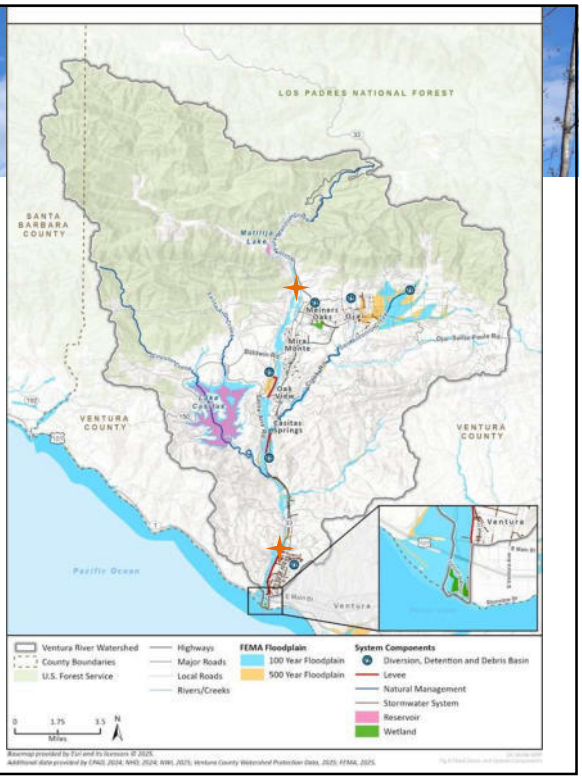
Quantitative Assessment

Approach – Flood Management System

Use metrics/thresholds to quantify consequence of hazard (extreme precipitation/flood event)

Levee performance thresholds:
- Overtopping or Encroachment on Freeboard
- Toe Scour Exceeded
- Dislodgement of riprap

Flood inundation thresholds:
- Increase of regulatory flood boundary
- Temporary loss of access



Quantitative Assessment

Questions?

Coming Soon!

Next AG Meeting – December 15, 2pm - 4pm

Backup Slides

Ventura River Watershed Resilience Pilot Project ~ Advisory Group
Meeting #6
December 15, 2025 at 2:00 pm - 4:00 pm

Zoom Link: https://stantec.zoom.us/j/97540986670

Dial In:	669 900 6833 US (San Jose)
Meeting ID:	975 4098 6670
Find your local number:	https://stantec.zoom.us/u/abAH19Korl

MEETING PURPOSE & OBJECTIVES:

Purpose:

To consider Indigenous approaches to climate change impacts and review the draft Strategies and Actions for the Ventura River Watershed Resilience Plan, share and learn about areas of existing activities and partnerships, and begin identifying gaps where new work may be needed.

AGENDA

Agenda Item	Time Frame
1. **Welcome, Introductions, Agenda Review**	5 minutes
2. Presentation from Native Coast Action Network Regarding Indigenous Practices and Stewardship In Response to Climate Change	20 minutes
3. Adaptation Strategies and Actions Overview	10 minutes
4. Adaptation Strategies and Actions Exercise	25 minutes
5. Adaptation Strategies and Actions Discussion	50 minutes
6. **Wrap Up – What's Next**	10 minutes

Ventura River Watershed Resilience Pilot Project
Advisory Group Meeting #6
December 15, 2025
Virtual Meeting

Facilitators: Mike Antos, Stantec

Attendees:

Advisory Group Members and Guests:

- Bruce Kuebler, Ventura Water District
- Carlie Dominguez, Native Coast Action Network
- Charles Davidson, CA State Parks, Channel Coast District
- Christopher Danch, Ojai Valley Fire Safe Council
- Francisco Pineda, DWR
- Jenna Levine, Ventura County Public Works – Watershed Protection
- Kristian Nunez, CAUSE
- Lauren Zaragoza, VCRCD
- Matthew Vestuto, Chairman of BVBMI
- Pam Lindsey, Ventura County Public Works – Watershed Protection
- Peter Shellenbarger, City of Ventura
- Sam Jenniches, State Coastal Conservancy
- Sarah Mulder, City of Ventura – Ventura Water
- Vivon Sedgwick, Ojai Valley Land Conservancy (Chair)

WRP Team & Consultants:

- Jamie Whiteford, VCRCD (also advisory group member)
- Lynn Rodriguez, WRP Project Manager
- Lara Shellenbarger, WRP Associate Project Manager
- Allegra Roth, Rincon
- Anna Yip, Rincon
- Hannah Gruen, Rincon
- Kiernan Brtalik, Rincon

- Bridget Lowry, Stantec
- Mike Antos, Stantec

Key Outcomes

- Chairman Matthew Vestuto addressed the Advisory Group, affirming Tribal engagement and continued collaboration in the project.
- Carlie Dominguez (Native Coast Action Network) introduced Indigenous Knowledge Systems as a living, intergenerational science framework and raised guiding questions regarding consultation and long-term partnership.
- The Advisory Group reviewed the draft Adaptation Strategies and Actions developed in response to the vulnerability assessment and prior engagement.
- A survey exercise highlighted where actions are underway, where coordination may be strengthened, and where no clear lead is currently identified.
- Discussion reinforced the WRP's role as a coordination and network-strengthening framework.
- The project will next focus on refining strategies and developing Implementation Pathways.

Meeting Agenda and Summary:

1. Welcome and Introductions: The meeting opened with welcome remarks and acknowledgement of Chairman Matthew Vestuto's participation.
    - Chairman Matthew Vestuto, Barbareño/Ventureño Band of Mission Indians (BVBMI), addressed the Advisory Group and expressed appreciation for being included in the Watershed Resilience Pilot Project. He affirmed Tribal interest in continued engagement and collaboration and noted the importance of listening and learning together as the project advances.
2. Native Coast Action Network
    - Carlie Dominguez (Native Coast Action Network) provided an introductory presentation on Indigenous Knowledge Systems and their relevance to climate adaptation and watershed resilience.
    - Carlie described Indigenous knowledge as a living, intergenerational science system grounded in food systems, stewardship practices, ceremony, and ecological relationships. Drawing from recent reports developed by the Institute for Tribal Environmental Professionals (ITEP), she emphasized that Indigenous communities are actively practicing conservation and climate adaptation today, and that these

knowledge systems extend beyond compliance-based cultural resource frameworks.
- Carlie posed several guiding questions for the Advisory Group's consideration:
  - How can Indigenous Knowledge Systems inform watershed resilience planning?
  - What are the limits and possibilities of legal consultation?
  - How can engagement move beyond compliance toward deeper collaboration?
  - How might feedback from this pilot project inform longer-term planning processes?
- She emphasized that humility, ongoing learning, and sustained collaboration beyond the pilot timeframe are essential to building strong relationships and fostering meaningful engagement.
- WRP project team noted that Tribal-focused strategies related to cultural resources will be further developed through targeted workshopping with Tribal leadership and NCAN representatives in early 2026.

3. Adaptation Strategies and Actions Overview
   - Anna Yip (Rincon Consultants) provided an overview of the draft Adaptation Strategies and Actions, describing how they were developed through:

     Identification of watershed assets → Climate projections and qualitative vulnerability assessment → Asset manager interviews → Review of existing adaptation efforts → Gap assessment Advisory Group and community input

   - The draft strategies are organized under seven overarching goal areas and are intended to respond directly to the watershed's key vulnerabilities.
   - Clarified the distinction between: **Goals** (broad resilience objectives); **Strategies** (approaches to achieve those goals); **Actions** (specific steps to implement strategies)
   - The Advisory Group's feedback will inform refinement prior to development of Implementation Pathways.
4. Adaptation Strategies and Actions Exercise
   - Participants completed a rapid survey identifying whether draft actions are currently being advanced by their organization, another organization, or if no clear lead is known.
   - The exercise was framed as a network awareness tool to better understand overlap, gaps, and coordination opportunities across the watershed. Results

were shared in real time and informed discussion regarding implementation status and partnership potential.
    - The meeting facilitator emphasized that the WRP functions as a **network-based resilience plan**, distinct from a single-agency implementation plan. In this model, resilience emerges from coordination, partnership, and mutual support across organizations.
5. Adaptation Strategies and Actions Discussion Highlights
    - Survey results indicated that many actions are underway within the watershed, while others lack a clearly identified lead. Participants discussed the importance of clarifying ownership, improving coordination, and strengthening alignment across organizations.
    - Members noted that the rapid format required quick judgments and that some actions—particularly those related to groundwater recharge and infiltration—may already be occurring at varying scales or under different program structures. There was interest in refining language and clarifying implementation status during the next phase of plan development.
    - The discussion reinforced that the WRP is intended to function as a coordination framework, supporting existing efforts and identifying opportunities for collaboration rather than assigning mandates.
6. Wrap-up – What's Next
    - Distribute a follow-up document for detailed feedback on draft Strategies and Actions.
    - Conduct Tribal workshopping sessions to co-develop cultural resource–focused strategies.
    - Revise draft strategies based on Advisory Group input.
    - Begin development of Implementation Pathways in early 2026.
    - Convene a Final Forum in February to review implementation approaches.

Action Items:

WRP Team:

1. Circulate detailed follow-up review materials.
2. Conduct Tribal workshopping sessions on cultural resource strategies.
3. Revise draft Strategies and Actions.
4. Initiate development of Implementation Pathways.

Advisory Group Members:

1. Provide detailed feedback on draft Strategies and Actions.

2. Participate in upcoming implementation discussions and Final Forum.

Resources Mentioned in the Meeting:

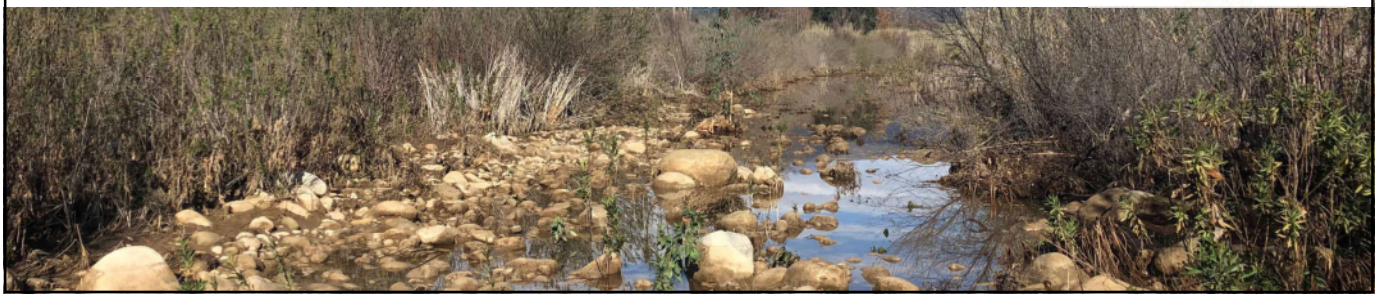
Institute for Tribal Environmental Professionals: Status of Tribes and Climate Change Reports (ITEP STACC) Report 1: https://sites.google.com/view/staccreport/access-the-reports/stacc-volume-1

Institute for Tribal Environmental Professionals: Status of Tribes and Climate Change Reports (ITEP STACC) Report 2: https://sites.google.com/view/staccreport/access-the-reports/stacc-volume-2

Tending and Gathering Garden in Wintun territory: https://cachecreekconservancy.org/tending-gathering-garden/

Ventura River Watershed Resilience Pilot Project

Advisory Group Meeting #6
December 15, 2025



Agenda

1. Welcome and Introductions
2. Matthew Vestuto from Barbareño/Ventureño Band of Mission Indians and Updates from Native Coast Action Network (NCAN)
3. Adaptation Strategies and Actions Overview
4. Adaptation Strategies and Actions Exercise
5. Adaptation Strategies and Actions Discussion
6. Wrap Up and What's Next

Meeting Purpose

To review the draft Strategies and Actions for the Ventura River Watershed Resilience Plan, share and learn about areas of existing activities and partnerships, and begin identifying gaps where new work may be needed.

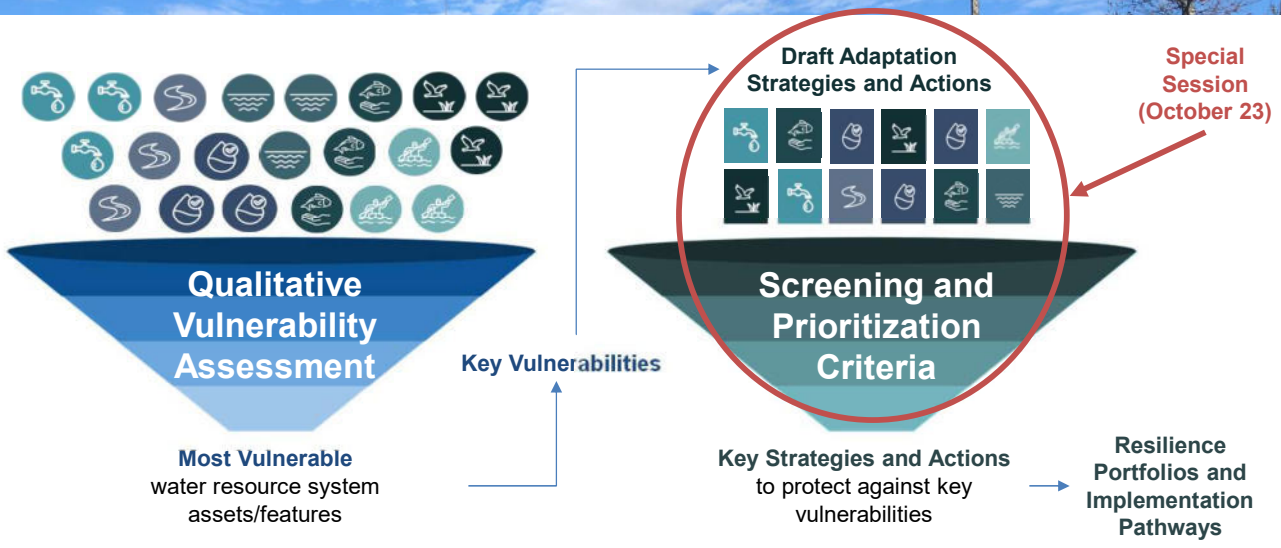
Where We Are in the WRP Process

- Develop list of water system **assets**
- Conduct vulnerability assessment & identify **key vulnerabilities**
- Develop strategy framework and **screening/prioritization criteria**
- Identify gaps between key vulnerabilities and existing efforts; brainstorm **strategies and actions** to fill gaps

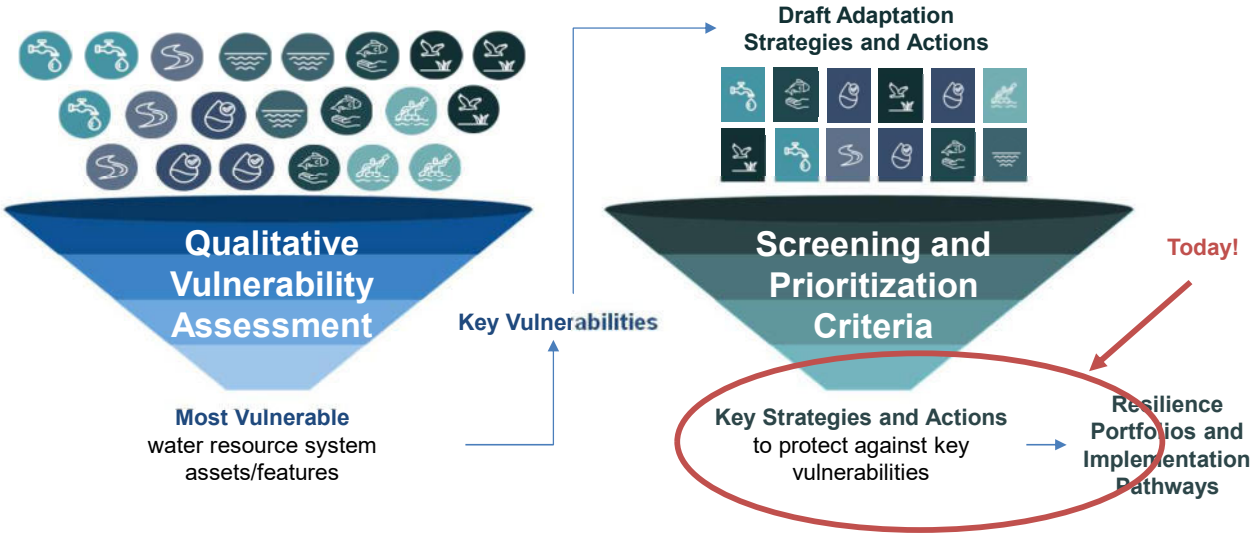
- **Today:** Review full draft list of Adaptation Strategies and Actions
- **Next:** Identify leads, collaborators, and opportunities to strengthen implementation

Key Vulnerabilities → Strategies and Actions

Process: Vulnerabilities → Strategies



Process: Vulnerabilities → Strategies



What Went Into the Strategies & Actions

1. **Qualitative Vulnerability Assessment**
   - Exposure, sensitivity, adaptive capacity
   - Hazard-asset interactions
2. **Existing Adaptation Efforts Review**
   - Inventoried ongoing projects, plans, and programs across partners
   - Identified where work is already happening and opportunities to align
3. **Gap Assessment**
   - Highlighted vulnerabilities not currently addressed by existing initiatives
   - These "gaps" informed new strategies and actions
4. **Community, Asset Manager, Advisory Group, and Tribal Input**
   - *Prior*: Engagement identified key assets, climate impacts, and vulnerability scores and results
   - *Today*: Refinement with AG and develop focus for WRP
   - *Coming*: Workshopping with Tribal groups

WRP Strategies & Actions

Strategies: The approach or pathway for achieving long-term resilience goals.

Example: *"Enhance groundwater recharge and storage capacity to increase drought resilience."*

Actions: Specific, measurable steps taken to implement a strategy.

***Example*:** "Construct three new managed aquifer recharge (MAR) basins in the Ojai Basin by 2030."

Draft Goals, Strategies & Actions

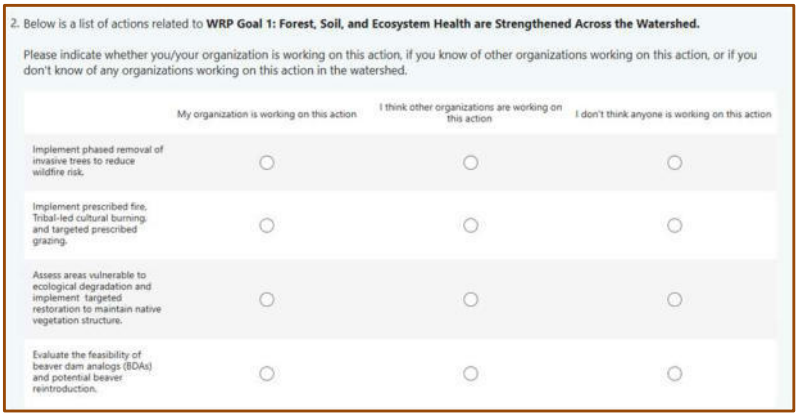
1. Forest, Soil, and Ecosystem Health
2. Water Supply Reliability
3. Coastal Resilience
4. Flood and Erosion Risk Reduction
5. Community Safety and Equitable Access
6. Climate-Smart Agriculture
7. Governance, Funding, and Coordination

Strategies and Actions Exercise

Today's Activity!

- 4 breakout rooms
- 15 minutes to respond to a high-level survey
- Responses will guide full-group discussion
- Opportunity to provide additional feedback after this meeting!

My organization is working on this action	I think other organizations are working on this action	I don't think / am not sure if anyone is working on this action



2. Below is a list of actions related to **WRP Goal 1: Forest, Soil, and Ecosystem Health are Strengthened Across the Watershed.**

Please indicate whether you/your organization is working on this action, if you know of other organizations working on this action, or if you don't know of any organizations working on this action in the watershed.

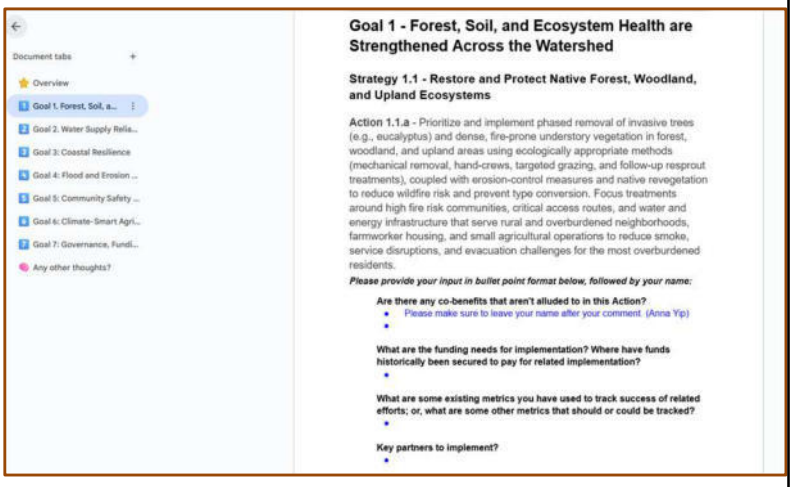
	My organization is working on this action	I think other organizations are working on this action	I don't think anyone is working on this action
Implement phased removal of invasive trees to reduce wildfire risk.	○	○	○
Implement prescribed fire, Tribal-led cultural burning, and targeted prescribed grazing.	○	○	○
Assess areas vulnerable to ecological degradation and implement targeted restoration to maintain native vegetation structure.	○	○	○
Evaluate the feasibility of beaver dam analogs (BDAs) and potential beaver reintroduction.	○	○	○

Vulnerability Assessment Exercise Discussion

Wrap Up & What's Next

Follow Up Opportunity for Additional Input:

- Google Doc with additional questions for each action
- Full, detailed action description included
- Navigate via tabs on left side of screen
- Suggest having open the full list to refer to



Wrap Up & What's Next

- **AG Meeting Opportunity for Additional Input** : December
- **AG Reviews State of the Watershed Chapter**: December/January

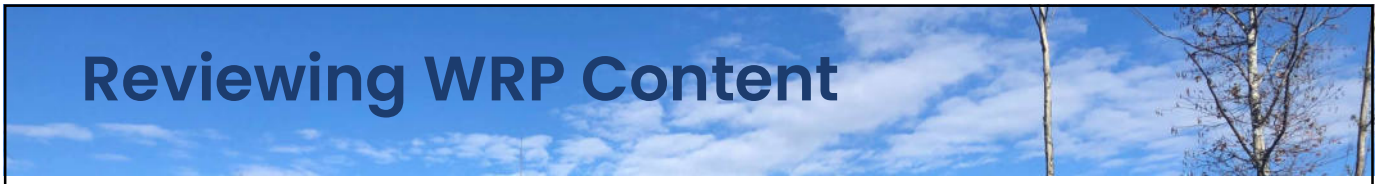
➢ *Team integrates AG feedback*
➢ *Strategies and actions revised*
➢ *Begin drafting Implementation Pathways*

- **Office Hours**: January
- **Final Forum to Review Implementation Pathways**: February

Upcoming Convenings:

- Final Forum: Early February
- Final AG Meeting: March 5th
- Watershed Council Meeting: Early March

Reviewing WRP Content



- Sections to be shared for AG review on a rolling basis
- Additional opportunity to review consolidated WRP in February/March

Accessing Materials for Review:

- SharePoint – access will be granted to you using your email
- Links will be shared; email will need to be verified
- Add comments and make suggested edits ONLINE
- Please review for gaps in the content, unnecessary detail, or content that feels unclear, inaccessible, or misleading
- No need for line edits – technical edit to come

Ventura River Watershed Resilience Pilot Project ~ Advisory Group
Meeting #7
March 2, 2026 at 2:00 pm - 4:00 pm

Zoom Link:

MEETING PURPOSE & OBJECTIVES:

Purpose:

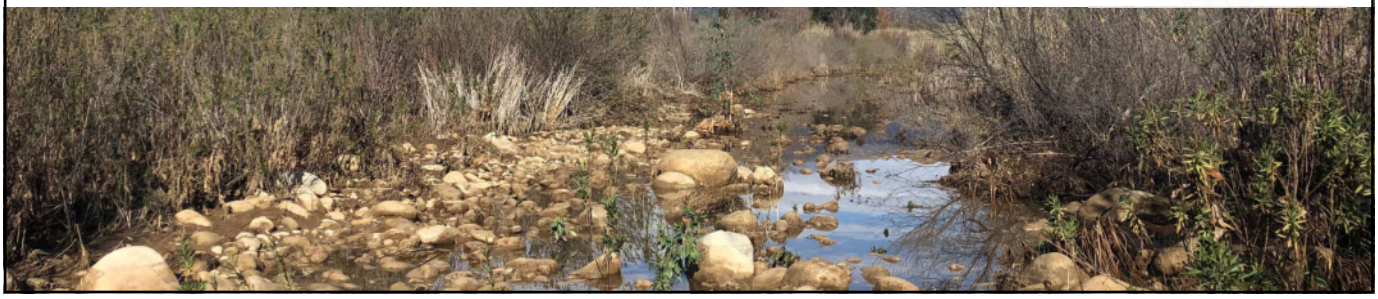
1. Help the Advisory Group feel accomplished in what has been completed.
2. Opportunity for additional feedback from Advisory Group on consolidated plan.

AGENDA

Agenda Item	Time Frame
1. **Welcome, Introductions, Agenda Review**	5 minutes
2. Announcing the Draft Final Ventura River Watershed Resilience Plan	10 minutes
3. Recap of Accomplishments – November through February	15 minutes
4. Discussion of Consolidated Plan	25 minutes
5. Next Steps for the Network	15 minutes
6. Next Steps for the WRP	10 minutes
7. Wrap Up & Thank You	5 minutes

Ventura River Watershed Resilience Pilot Project

Advisory Group Meeting #7
March 2, 2026



Agenda

1. Welcome and Introductions
2. Celebrating the Completion Ventura River Watershed Resilience Plan
3. Recap of Accomplishments
4. Discussion of Complete Draft Plan
5. Next Steps for the Network
6. Next Steps for the WRP
7. Wrap Up & Thank You!

Meeting Purpose

- Help the Advisory Group feel accomplished in what has been completed.
- Opportunity for feedback from Advisory Group on WRP process.
- Provide an overview of the consolidated WRP before review.

Accomplishments Recap: Engagement

Key Engagement Overview

Watershed Council Meetings

- Presentations at key milestones

Seven (!!!) Advisory Group Meetings

- Climate hazard metrics and thresholds; historical water budget approach; quantitative vulnerability assessment approach; qualitative vulnerability assessment review; implementation roadmaps
- Additional office hours and offline reviews

Three Forums

- Two public-facing, in-person forums (vulnerability assessment and vision/goals; Tribal resilience and implementation roadmaps)
- One joint forum with the Watershed Council and AG to review adaptation strategies

Partner Meetings and Interviews

- Focused discussion on points of interest

Phase 1: Network Formation, Early Coordination, and Scoping (August 2024 – January 2025)

- **August 2024** – Watershed Council: VRWRP introduction
- **Fall 2024** – Key partner interviews
- **October 2024** – Watershed Council: Approval of role of Council as WRP Network
- **December 2024** – Watershed Council: Updates on VRWRP scope and timeline, and website launch
- **January 2025** – AG formation

Phase 2: Vision, Watershed Assets, and Challenges (March – June 2025)

- **March 2025** – AG Meeting #1: VRWRP introduction and overview
- **April 2025** – Forum #1: Vision, goals, and watershed assets
- **June 2025** – Watershed Council: Review and approve vision statement

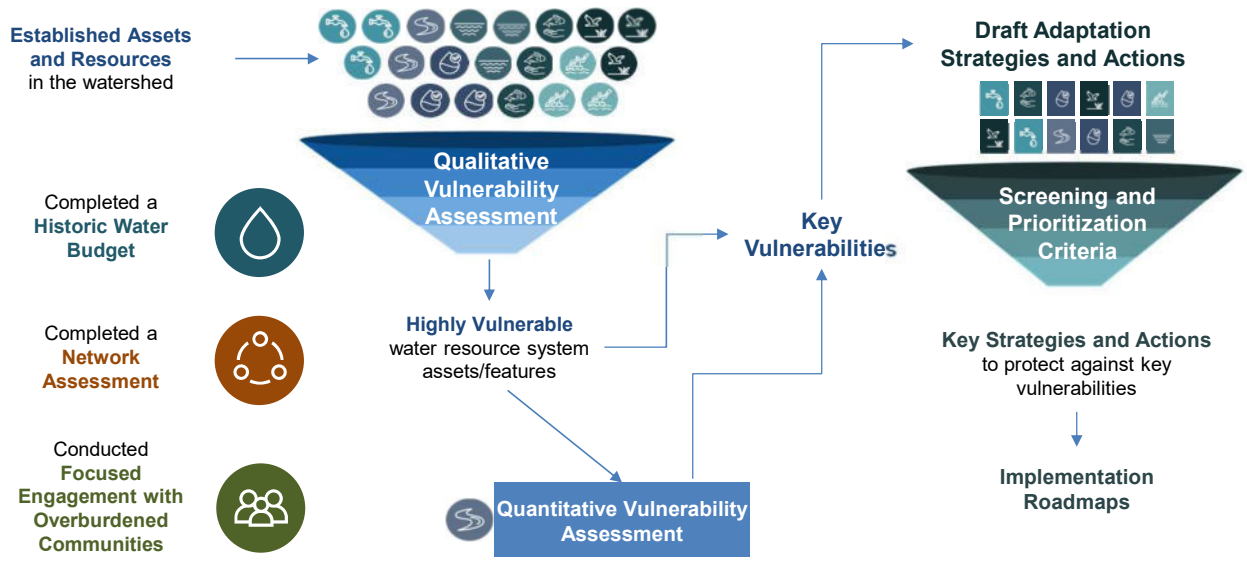
Phase 3: Network Assessment, Vulnerability and Technical Analysis (May – December 2025)

- **May 2025** – AG Meeting #2: Identify climate hazard metrics and thresholds
- **July 2025** – AG Meeting #3: Review historical water budget and problem statements
- **September 2025** – AG Meeting #4: Review initial qualitative vulnerability assessment results
- **October-November 2025** – Regional network assessment survey
- **November 2025** – Community focus groups (West Ventura & Casitas Springs)
- **November 2025** – AG Meeting #5: Review initial quantitative vulnerability assessment results
- **December 2025** – Watershed Council: Regional network assessment results

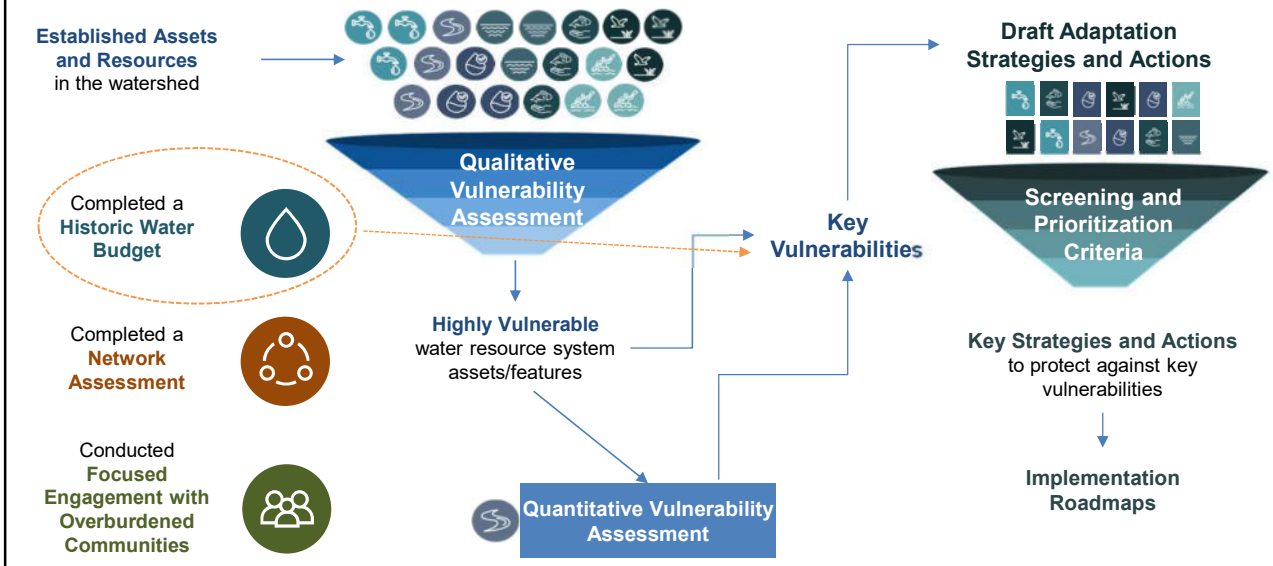
Phase 4: Adaptation and Implementation Strategies (October 2025 – March 2026)

- **October 2025** – Forum #2: Joint workshop with Watershed Council and AG on draft adaptation strategies
- **December 2025** – AG Meeting #6: Revise adaptation strategies
- **February 2026** – Forum #3: Tribal resilience and implementation roadmaps
- **March 2026** – Final Watershed Council Meeting
- **March 2026** – AG Meeting #7: Review compiled VRWRP
- **March 2026** – Watershed Council: VRWRP final presentation

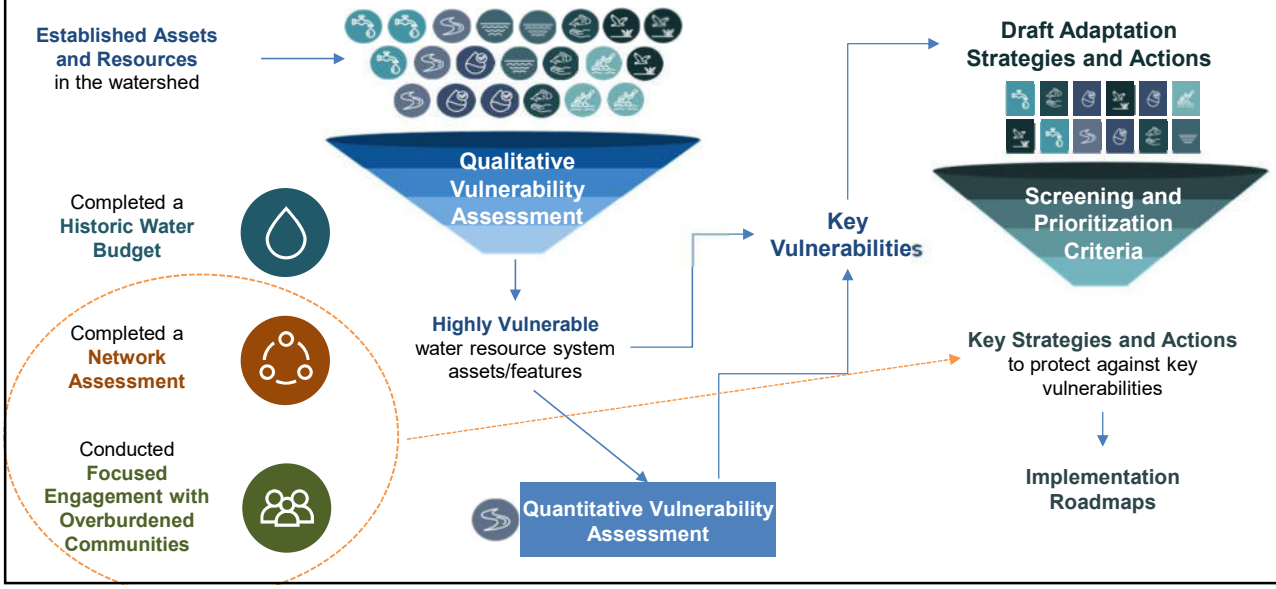
Accomplishments Recap: Technical Work



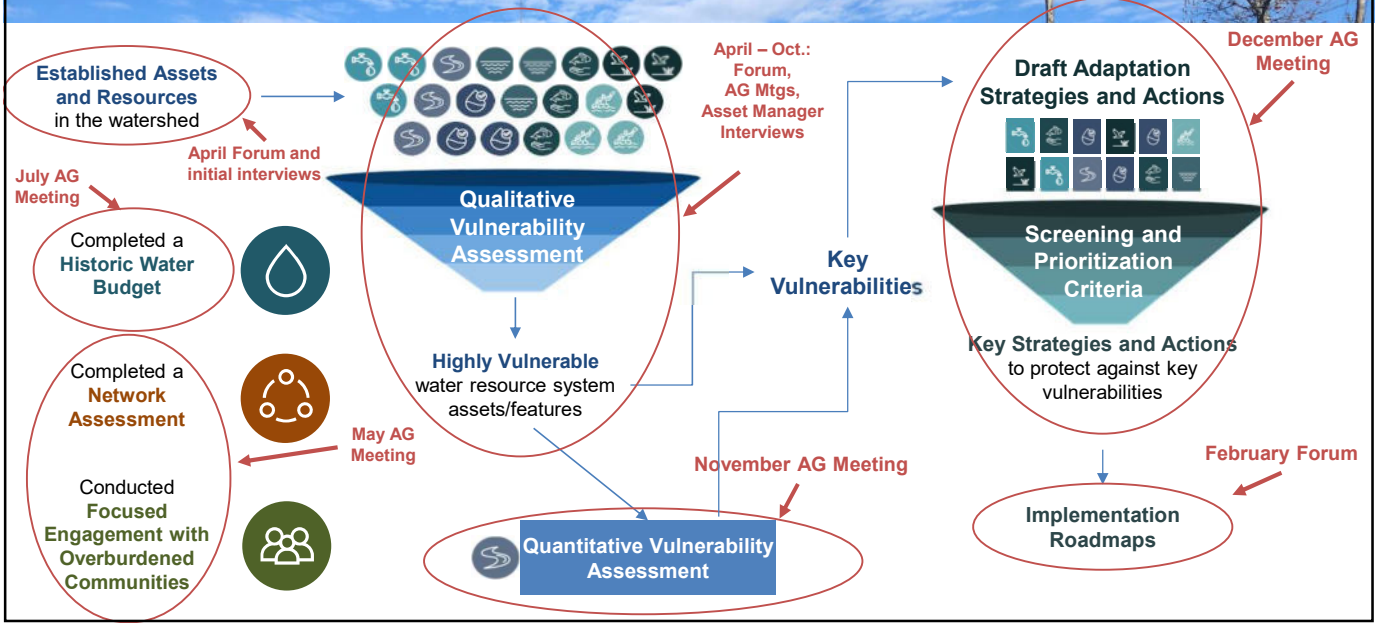
Accomplishments Recap: Technical Work



Accomplishments Recap: Technical Work



Accomplishments Recap: Technical Work



Watershed Resilience Plan Organization

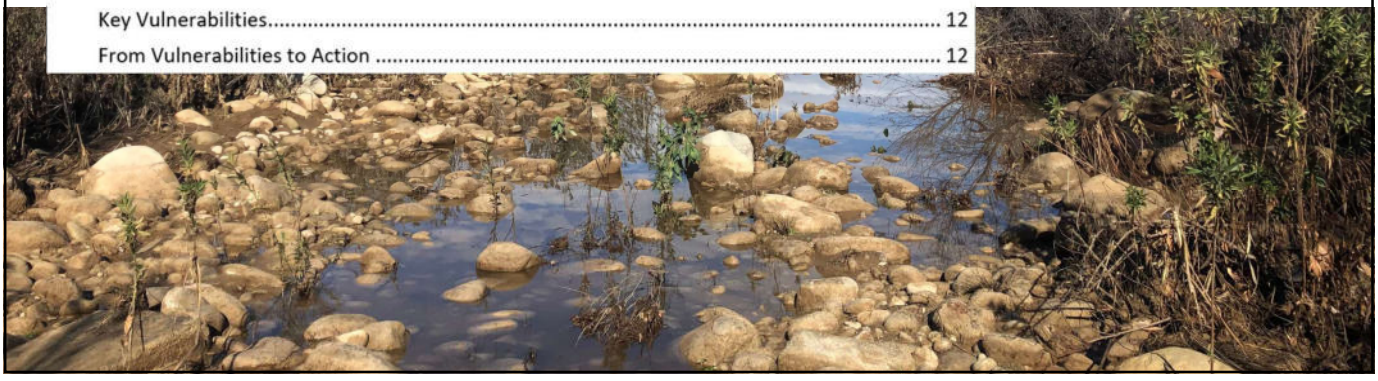
- Executive Summary
- **Chapter 1**: Introduction
- **Chapter 2**: Watershed Network
- **Chapter 3**: State of the Watershed
- **Chapter 4**: Future Climate Conditions
- **Chapter 5**: Climate Vulnerability
- **Chapter 6**: Adaptation Strategies, Actions, and Implementation Roadmaps



Ventura River Watershed
Water Resilience for a Changing Climate

WRP: Executive Summary

Executive Summary 10
A Watershed-Scale Approach to Climate Resilience 10
Guided by the State – Rooted in Local Conditions 10
Goals and Action Framework 11
Collaborative Process Grounded in Local Expertise 11
Impacts from Climate Change 11
Key Vulnerabilities 12
From Vulnerabilities to Action 12



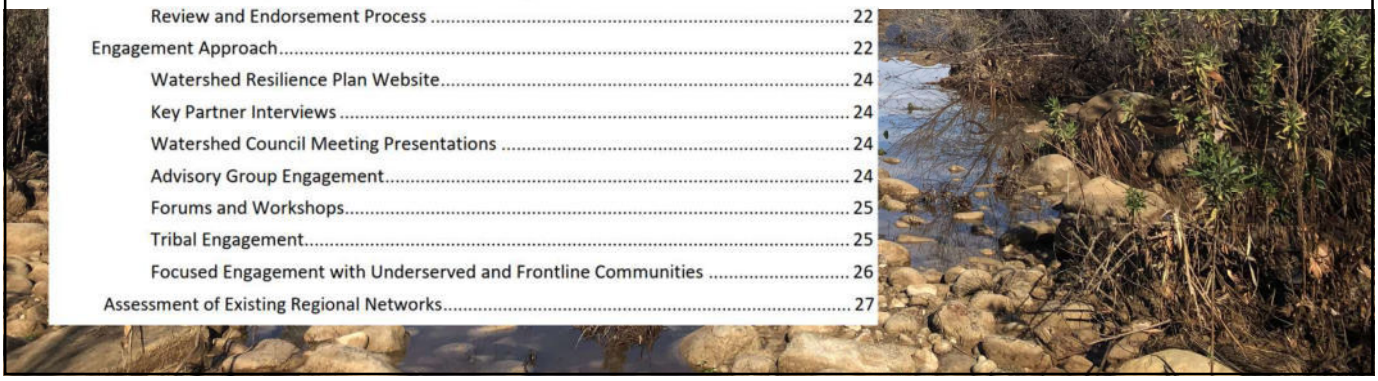
WRP: Chapter 1 - Introduction

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Statewide Watershed Resilience Initiative and Funding Program 18
Plan Organization 18
Planning History and Context in the Watershed 19
2015 Ventura River Watershed Management Plan 19



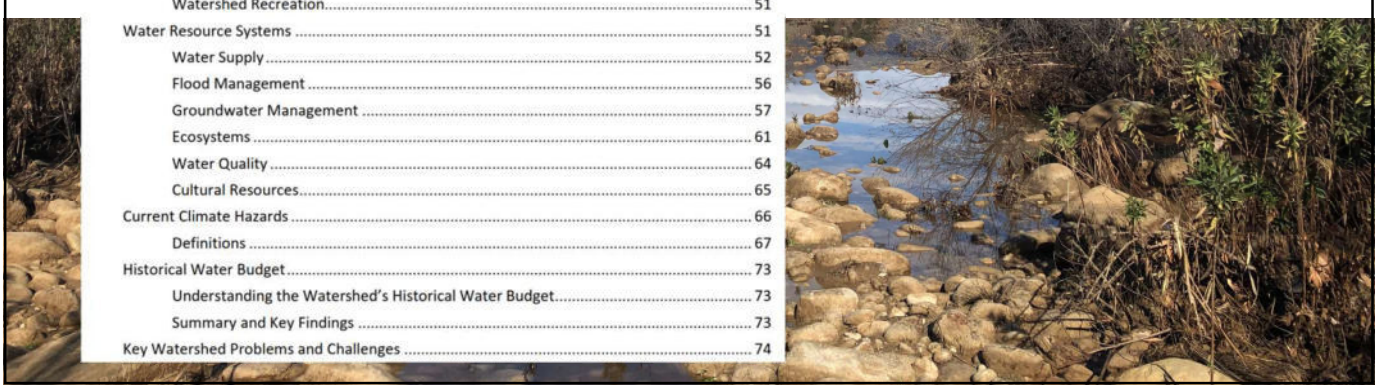
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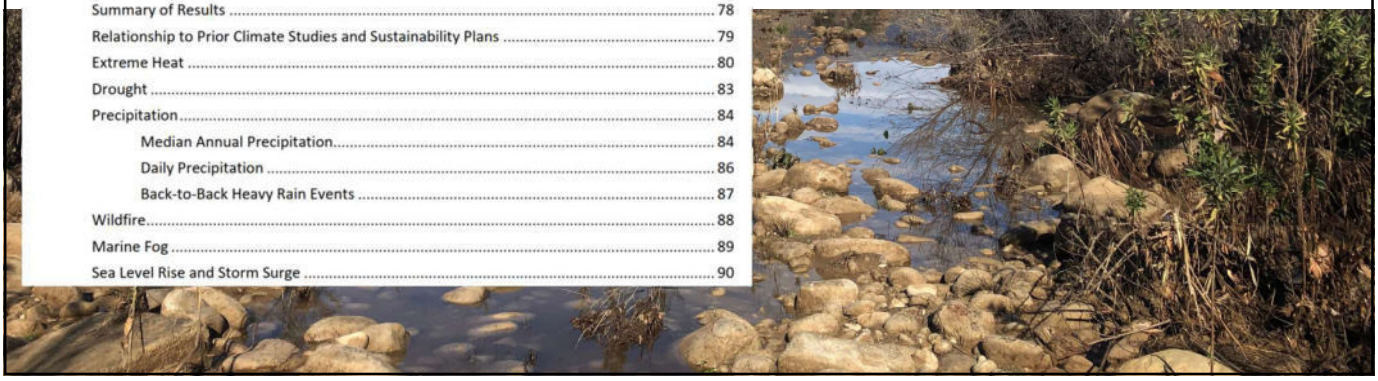
WRP: Chapter 3 – State of the Watershed

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  - Communities and Land Use 47
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WRP: Chapter 5 – Climate Vulnerability & Risk

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WRP: Chapter 6 – Adaptation Strategies, Action, & Implementation Roadmaps

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Approach 106
Methodology 106
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Implementation Roadmaps 1



Implementation Pathways

Overview

- 8 Adaptation Goals ⟶ 8 Implementation Roadmaps



AG Reviews WRP

- Executive Summary
- **Chapter 1**: Introduction
- **Chapter 2**: Watershed Network
- **Chapter 3**: State of the Watershed
- **Chapter 4**: Future Climate Conditions
- **Chapter 5**: Climate Vulnerability
- **Chapter 6**: Adaptation Strategies, Actions, and Implementation Roadmaps



VRWRP to be sent out TUESDAY!
1 week review; optional office hours on Friday (11-1pm)

Ventura River Watershed
Water Resilience for a Changing Climate

Next Steps for WRP

- WRP Goals: catalog progress, plan alignment, reaffirm Council, secure resources
- Plan is a static deliverable, Plan concepts are evergreen
- Call to action: Find yourself and identify your next steps
- Pivot to implementation: elevate leaders, fill in gaps, define support structures
- Upcoming: public access, Council options, roadmap 12+ months

Ventura River Watershed
Water Resilience for a Changing Climate

Upcoming Meetings

- **March 19th Watershed Council Meeting**
  - Opportunity to share the plan and dive into next steps (Consultants available)
  - March 16th-March 30th the plan will be available by PDF on our website for public review

- **Leadership Committee Meeting – *Tentative Date May 11th***
  - Review Watershed Coordinator Workplan, Consider Adoption/ Approval of the WRP, and Charter Revision Discussion

- **June 4th Watershed Council Meeting – Resumes normal schedule** (first Thursday of every other month)
  - Vote on adoption of WRP
  - Vote on Amendments to Charter
  - Implementation Roadmap Next Steps, Funding Solicitations?

Ventura River Watershed
Water Resilience for a Changing Climate

FORUM #1
Interactive Forum to Shape Our Shared Vision

April 30th, 2025 ~ 3:00 p.m. - 5:30 pm ~ Camp Arnaz, Oak View (in-person)

AGENDA

TIME	DESCRIPTION	LEAD	OUTCOME
2:45 PM	**PARTICIPANTS ARRIVE**		
3:00 PM	**WELCOME AND INTRODUCTIONS** • Land Acknowledgement • Agenda Review • Purpose and Goals of Watershed Resilience Pilot Project and Forum • *Welcome from Chumash Elder Julie-Tumamait Stenslie* • Project Team Introductions • Network Overview and Roles • Table Introductions	Lynn Rodriguez	*Understand the purpose and agenda* *Understand goals of the Watershed Resilience Pilot Project* *Understand the network*
3:20 PM	**WATERSHED INTRODUCTION** • About Ventura River Watershed • Climate, Hydrology, and Key Hazards	Lara Shellenbarger	*Understand Watershed boundaries and key characteristics*
3:30 PM	**INTERRELATED WATER RESOURCE SYSTEMS** • Water Resource Systems Defined • Watershed Map • **Activity #1:** Water Resource System Features and Challenges	Lara Shellenbarger	*Understand water resource systems* *Identify important features and challenges*
3:55 PM	*NETWORKING BREAK*		
4:05 PM	**UNDERSTANDING CLIMATE HAZARDS AND IDENTIFYING IMPACTS** • Hazards and Impacts • Problem Statement Framework • **Activity #2:** Co-Create Problem Statements	Lynn Rodriguez and Lara Shellenbarger	*Understand climate threats and collectively identify watershed vulnerabilities*
5:05 PM	**SHAPING OUR SHARED VISION FOR RESILIENCE** • Visioning From Existing Watershed Plans • Defining Resilience • **Activity #3:** Envisioning Watershed Resilience	Lynn Rodriguez	*Help shape a shared vision for response to ongoing climate challenges*
5:25 PM	**CLOSING REMARKS AND NEXT STEPS** • Staying Engaged • Exit Survey • Thank you!	Lynn Rodriguez	*Understand how forum results will inform Watershed Resilience Plan and future opportunities*
5:30 PM	**ADJOURN**		

Ventura River Watershed Resilience Project - Vision Forum
April 30, 2025 - Camp Arnaz, Oak View, CA

Facilitators: Lynn Rodriguez and Lara Shellenbarger

The Ventura River Watershed Resilience Pilot Project hosted its first public forum at Camp Arnaz on April 30, 2025. This event marked an important milestone in gathering local knowledge to **shape a shared vision** for watershed resilience and **identify key climate-related challenges** affecting our water resource systems.

The forum brought together **35 participants**, including environmental stewards, organizations, water agencies, and community members - representing **diverse perspectives** from across the watershed.

The event opened with a Tribal welcome from Chumash Elder Julie Tumamait-Stenslie, followed by **interactive activities** to:

- Map important water resource features and challenges.
- Identify how climate hazards impact people, infrastructure, natural resources, and community services — helping to create watershed-specific problem statements.
- Review and refine the draft Vision Statement for the watershed.

Exit surveys showed participants especially valued the hands-on activities, the opportunity to connect with others, and feeling that their voices were heard. Most said the forum helped advance a shared vision “a lot” or “some.”

Feedback from this forum will guide updates to the Vision Statement, finalize watershed-specific problem statements, and inform the next phases of the plan. The next public forum will take place in **July 2025** to explore vulnerabilities and priority challenges in more depth.











Ventura River Watershed

Watershed Resilience for a Changing Climate

You are invited to:

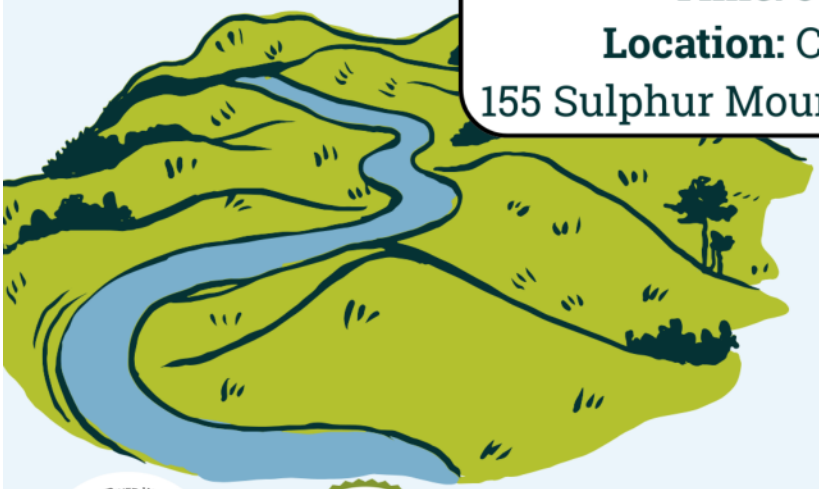
Interactive Forum to Shape Our Shared Vision

Come share your ideas and help guide climate resilience planning for the Ventura River Watershed. We'll discuss local climate concerns, water challenges, and your vision for a healthier, more resilient watershed.

Date: April 30th

Time: 3-5:30pm

Location: Camp Arnaz
155 Sulphur Mountain Rd, Ventura



Scan the QR Code to Register

For more information email
venturawatershed@gmail.com

Ventura River Watershed Resilience Project

Interactive Forum to Shape Our Shared Vision

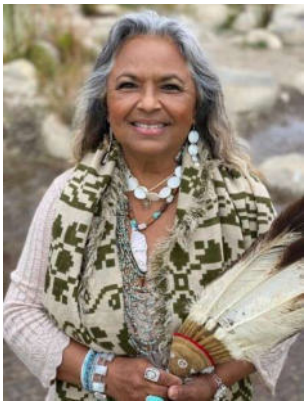


Funding for this project has been provided in full or in part from the Budget Acts of 2022 and through an agreement with the State Department of Water Resources.

Agenda Review

Time	Topics	Interactive Discussions
20 min	Welcome and Introductions	Table Introductions
20 min	Watershed Overview	
25 min	Interrelated Water Resource Systems	**Activity 1** – Water Resource System Features and Challenges
10 min	*Networking Break*	
60 min	Understanding Climate Hazards and Impacts	**Activity 2** – Co-Create Problem Statements
20 min	Shaping a Shared Vision for Resilience	**Activity 3 –** Envisioning Watershed Resilience
5 min	Closing and Next Steps	Exit Survey

Tribal Welcome

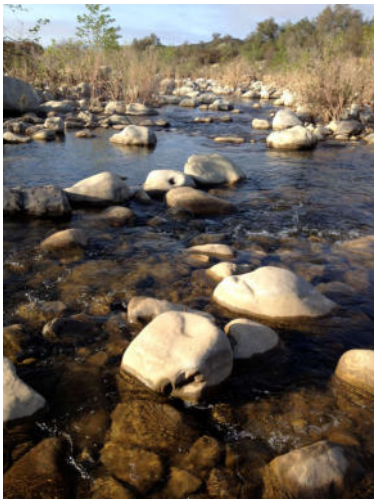


Julie Tumamait-Stenslie
Chumash Elder



Purpose and Goals of Watershed Resilience Pilot Project

- Build on and expand strong network of watershed collaboration
- Integrate and prioritize equity and inclusiveness through expanded partnerships
- Develop a watershed resilience vision
- Assess climate risks and hazards
- Create an equitable plan for a resilient watershed
- Build on past collaborative planning efforts, such as Watershed Management Plan and Integrated Regional Water Management
- Prepare for upcoming funding opportunities



WRP Team

Project Managers
(*consultants to RCD*):
Lynn Rodriguez
Lara Shellenbarger

VENTURA COUNTY RESOURCE CONSERVATION DISTRICT

CAUSE
Central Coast Alliance United for a Sustainable Economy

rincon

Institute for Watershed Resiliency
CALIFORNIA STATE UNIVERSITY, SAN BERNARDINO

Ventura River Watershed Council

EAGLE ROCK ANALYTICS

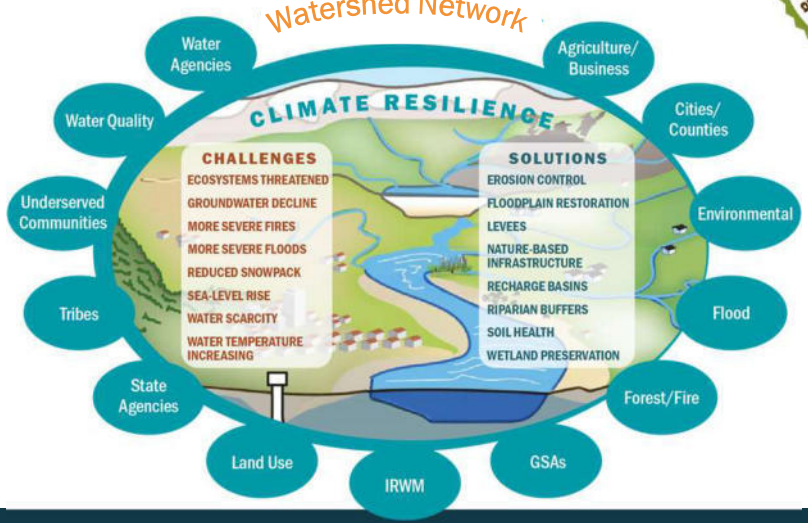
Loyola Marymount University
Center for Urban Resilience

CGST
CENTER FOR GEOSPATIAL SCIENCE & TECHNOLOGY
California State University, Northridge

Stantec

Who is informing the Plan?

Ventura River Watershed Network



Advisory Group

Vivon Crawford – Chair, Ojai Valley Land Conservancy

Bryan Bondy, Upper Ventura River Groundwater Agency

Kathy Bremer, Friends of Ventura River

Christy Cooper, Meiners Oaks Water District

Chris Danch, Ojai Valley Fire Safe Council

Nate Irwin, Channelkeeper

Paul Jenkin, Surfrider Foundation

Bruce Kuebler, Ventura River Water District

Rocio Lozano-Knowlton, MERITO Foundation

Scott Meckstroth, Ojai Valley Sanitary District

Laura Pavliscak, Ventura Land Trust

Alma Quezada, Ventura River Water District

Jodi Switzer, Ventura County Farm Bureau

Jennifer Tribo, Ventura Water

Julie Tumamait-Stenslie, Chumash Elder

Jamie Whiteford, Ventura County Resource Conservation District

Cameron Yee, Central Coast Alliance United for A Sustainable Economy

Table Introductions

Introduce yourself to the people at your table:

- Your Name
- Your Interest in the Ventura River Watershed



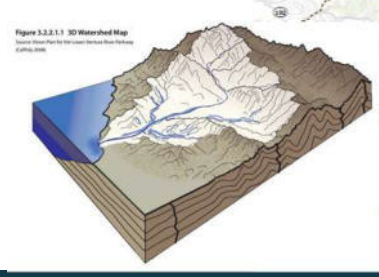
Ventura River Watershed



Ventura River Watershed

- 226 square miles
- Does not rely on imported water
- Major sources of water: Casitas Reservoir, Ventura River diversions, groundwater
- Major uses of water: agriculture and urban

Five Subwatersheds:
- Matilija Creek
- North Fork Matilija Creek
- San Antonio Creek,
- Canada Larga Creek
- Coyote Creek





13% of watershed is developed – excluding cattle grazing.

Ventura River Watershed

- **Two-season climates:** Wet winter-spring & dry summer-fall
- **Flows vary** from dry creekbeds to storm-driven high flows
- **Three climate zones** from upper to lower watershed
- **Orchard crops** primary local agriculture

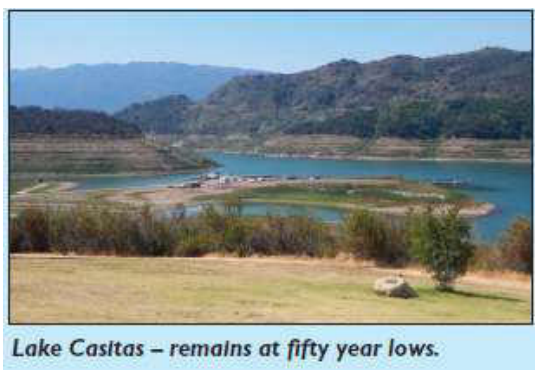
Very few years actually have average rainfall; most years are drier than average, and a relatively few very wet years heavily influence the average



Ventura River Preserve Swimming Hole

Major Weather Events and Disasters

From drought to rapid runoff and flashy flows.



Lake Casitas – remains at fifty year lows.



Foster Park area post 2023 storm events

Major Weather Events and Disasters

Wildfire and post-fire impacts





Interrelated Water Resource Systems

Climate Hazards Impacting Water Resource Systems

- **Climate Hazards**
  - Drought
  - Wildfire
  - Extreme Heat
  - Extreme Precipitation and Flooding
  - Sea Level Rise and Storm Surge
  - Loss of Marine Fog

IMPACT

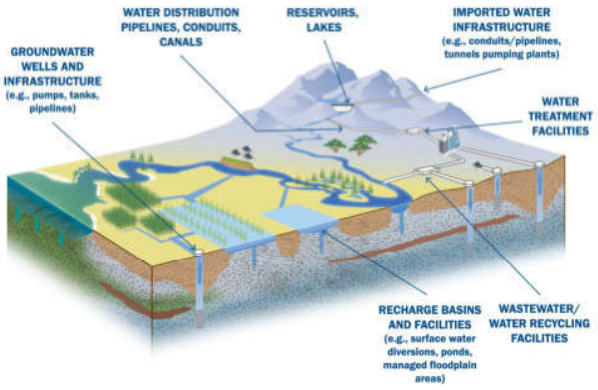
- **Water Resource Systems**
  - Water Supply
  - Flood Management
  - Groundwater
  - Ecosystems
  - Water Quality
  - Recreational Uses
  - Cultural Uses

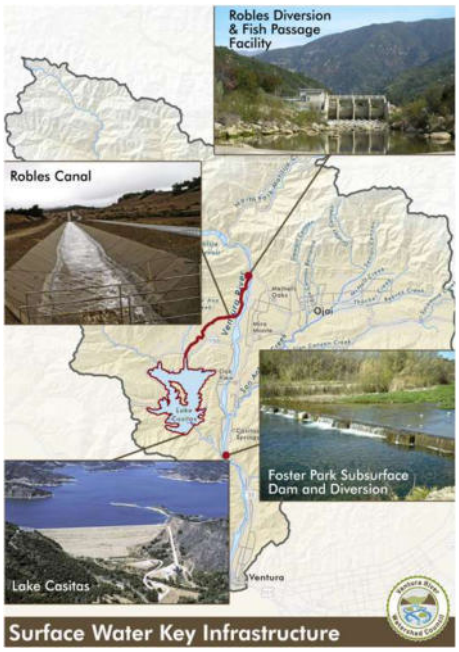
Water Resource Systems

Seven interrelated Water Resource Systems are defined in the Ventura River Watershed that will guide climate resilience planning efforts:



Water Supply





Activity #1: Water Resource System Features and Challenges

Use your Water Resource System lens to identify where important features and challenges in the watershed are.

1. **At your table:** Choose a Water Resources System to focus on.
2. **Identify Water Resource System Features & Challenges:**
   - Place post-it notes on the map to mark **important features** (e.g., wetlands, reservoirs) – include specific locations if known.
   - Place post-it notes to describe **challenges** (e.g., water supply shortage, severe erosion) – include where and under what conditions they occur.
3. **Shift Focus:** After 5 minutes, choose a new Water Resource System to focus on at your table.
4. **Vote:** Place a **red dot** on others' post-it notes you highly agree with or think are especially important – if time allows visit another table.
5. **Report Out:** Summarize key points from your table discussion.



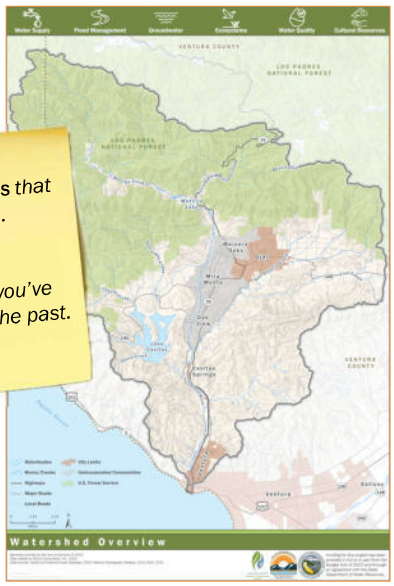
Activity #1: Water Resource System Features and Challenges

- Water Supply
- Groundwater
- Flood Management
- Cultural Resources
- Water Quality
- Ecosystems
- Recreational Uses

Remember: be specific!!!

Important features that resonate with you.

Challenges that you've encountered in the past.



Networking Break

Understanding Climate Hazards And Identifying Impacts

Climate Hazards

- **Drought**: Extended periods of deficient rainfall leading to water shortages, adversely affecting agriculture, water supply, and natural ecosystems.
- **Wildfire**: Uncontrolled fires occurring in forests, grasslands, or other vegetated areas, often intensified by increasing wet/dry cycles and Santa Ana Winds, and capable of causing widespread damage to people, property, and ecosystems.
- **Extreme Heat**: Periods of significantly higher-than-average temperatures, which can pose health risks, strain energy resources, and impact infrastructure.
- **Extreme Precipitation/Flooding**: Intense rainfall events that can lead to flooding, soil erosion, and other challenges to natural and built infrastructure.
- **Sea Level Rise**: Rising sea levels and intensified coastal storms increases the risk of coastal erosion, flooding, and damage to coastal infrastructure and habitats.
- **Decrease in Marine Fog:** Declining fog frequency reduces moisture for ecosystems, increases drought stress, and contributes to rising coastal temperatures.

Potential Climate Change Impact Groups

- Adverse health issues from degraded water quality
- Levee failure triggers floods, damaging homes

→ People/ Community

- Increased operations/maintenance
- Post-fire debris impacts reservoir water quality
- Water pumps go offline due to extended power shutoffs

→ Infrastructure

- Damage and permanent loss to cultural resources
- Agricultural pests/diseases
- Recreational loss/disruptions
- Permanent habitat loss

→ Land Use, Cultural Resources & Natural Systems

- Service/operational disruptions
- Inability to access water facilities to maintain operations

→ Emergency Services & Operations

Purpose of Problem Statements

Purpose of preparing *problem statements*:

1. Identify affected communities, features and systems
2. Understand impacts already experienced from climate hazards
3. Connect impacts to water resource systems
4. Support data-driven decision making
5. Prioritize actions for adapting

Preparing Problem Statements for the Watershed

Guided by today's input, the WRP team will craft *problem statements* that speak to:

- **WHAT** is the problem at hand
- **WHO** and **WHAT** is impacted
- **WHY** it is a problem
- **WHICH** water resource system applies
- **WHERE** the problem take place



Casitas Springs, 2005 Flood
Photo courtesy of Ventura County Watershed Protection District

Example Problem Statement

Problem: Wildfire-damaged hillsides erode, washing ash and sediment into reservoirs and water facilities.
Impact: Water quality drops, treatment costs rise, and supply may be interrupted when water is most needed.
System: Water Supply, Water Quality, Flood Management
Where: Burn scar areas and downstream reservoirs (e.g., post-Thomas Fire zones)

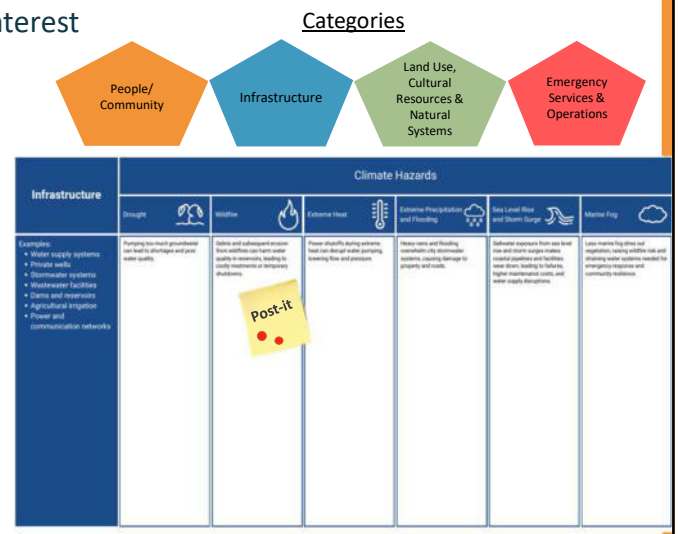
"Wildfire-scorched landscapes in the Ventura River Watershed are contributing to severe erosion, sending debris, ash, and sediment into reservoirs and treatment facilities — as seen after the Thomas Fire. This degrades water quality, increases treatment costs, and can disrupt supply. As wildfires and intense storms become more frequent, these impacts are expected to grow, placing additional strain on water systems and increasing recovery costs."

Infrastructure Category

Reservoirs and water treatment plants

Activity #2: Co-Create Problem Statements

1. **Choose a Station:** Visit a category of interest
2. **Identify Impacts:** Discuss how climate hazards impact the category
   - **Post-it Notes:** Write down specific impacts and place them under the appropriate hazard
   - **Vote with Red Dots:** If you agree an impact is important, place a **red dot**
3. **Rotate every 5 minutes** to complete all categories
4. **Category report-out:** 8 minutes



Ventura River Watershed
Water Resilience for a Changing Climate

Shaping our Shared Vision for Resilience

Shaping our Shared Vision

Ventura River Watershed Management Plan Goals (2015)

1. Sufficient Local Water Supplies
2. Clean Water
3. Integrated Flood Management
4. Healthy Ecosystems
5. Access to Nature
6. Responsible Land and Resource Management
7. Coordinated Watershed Planning

Draft Watershed Resilience Vision Statement

We envision a climate-resilient, thriving, and equitable future for the communities and resources in the Ventura River Watershed.

The Ventura River Watershed will be a resilient, adaptive, and thriving ecosystem where communities, water resources, and natural habitats are safeguarded from climate risks. Through collaborative planning, science-based adaptation, traditional ecological knowledge and cultural practices, and equitable resource management, we will enhance water security, restore ecosystem functions, and strengthen local capacity to address increasing climate variability, including prolonged droughts, extreme heat, flooding, and wildfires. This plan will guide long-term investments in watershed health, ensuring that future generations inherit a watershed that supports sustainable water supply, ecosystem integrity, and community resilience.

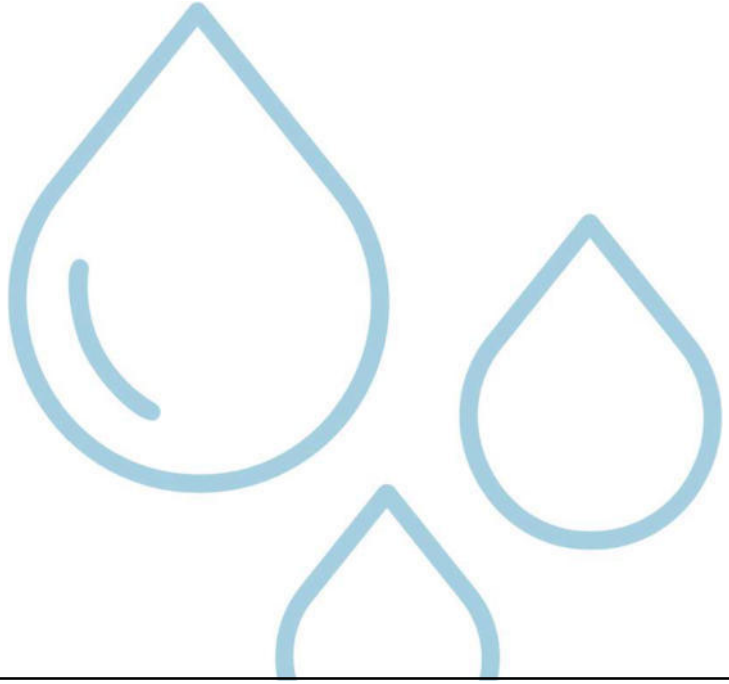
Activity #3: Envisioning Watershed Resilience

Table discussion:

- **Vision Statement**: What does a resilient Ventura River watershed look like?
- **Discuss and edit**: Discuss and provide descriptive statements
- **Take Notes**: Take notes on a single copy for the team to incorporate
- **Report Out**: 5 minutes to share a few suggested edits

We envision a climate resilient, thriving, and equitable future for the communities and resources in the Ventura River Watershed

Closing and Next Steps



Closing

- **Complete Exit Survey**
- **Stay engaged**: Future forums tentatively in July, September and November. Stay tuned for dates and details.
- Check the WRP Website for more information: https://vcrcd.org/venturawatershedresilience/
- Subscribe to the Watershed Council Newsletter.
- Thank you for participating!
- For more information contact: Lynn Rodriguez at lynn.rodriguezwcvc@outlook.com or Lara Shellenbarger at larashellenbarger@gmail.com

Ventura River Watershed
Water Resilience for a Changing Climate

Enter name here

Enter email here

Enter phone# here

FORUM #2

Assets, Impacts, Community Insights

July 30th, 2025 ~ 1:00 p.m. - 4:00 pm ~ Camp Arnaz, Oak View (in-person)

AGENDA

TIME	DESCRIPTION	LEAD	OUTCOME
12:30	*OPTIONAL NETWORKING LUNCH*		
1:00	**WELCOME AND WARM-UP** • *Welcome from Chumash Elder Julie-Tumamait Stenslie* • Agenda Review • Purpose and Goals of Forum • Project Team Introductions • Table Introductions	Kassandra Gale, Lynn Rodriguez, and Lara Shellenbarger	*Understand the purpose and agenda of the forum* *Get to know the Watershed Resilience Project Team and other participants*
1:30	**WATERSHED RESILIENCE OVERVIEW** • About Ventura River Watershed • Climate, Hydrology, and Key Hazards	Anna Yip	*Understand project goals and watershed boundaries* *Understand climate hazards*
1:40	**ACTIVITY 1 – IDENTIFY AND PRIORITIZE ASSETS** • Review Current Water System Assets Lists • Identify any missing assets • Prioritize critical assets	Kassandra Gale, Lynn Rodriguez, Hannah Gruen, and Anna Yip	*Complete water system asset lists* *Identify prioritized assets*
2:25	*BREAK*		
2:35	**VULNERABILITY OVERVIEW** • Calculating Vulnerability • Exposure, Sensitivity, and Adaptive Capacity	Anna Yip	*Understand vulnerability and how it is assessed* *Understand how input collected in Activity 2 will inform process*
2:50	**ACTIVITY 2 – ASSESS ASSET RISK AND VULNERABILITY** • Discuss Impacts on Assets from Hazards • Consider Who Will Feel Impacts • Discuss Assets' Adaptive Capacity	Kassandra Gale, Lynn Rodriguez, Hannah Gruen, and Anna Yip	*Identify key considerations for how climate hazards impacts assets, and how assets adapt to climate change*
3:50	**CLOSING REMARKS AND NEXT STEPS** • Staying Engaged • Exit Survey • Thank you!	Lynn Rodriguez	*Understand next steps of the Watershed Resilience Plan* *Provide feedback on today's forum*
4:00 PM	**ADJOURN**		

Ventura River Watershed Resilience Project
July 30, 2025 - Camp Arnaz, Oak View, CA

Hosts: Ventura River Watershed Council and Ventura County Resource Conservation District – Jamie Whiteford, Executive Director

Facilitators: Kassandra Gale, Anna Yip, Hannah Gruen, Lynn Rodriguez, Lara Shellenbarger

The Ventura River Watershed Resilience Pilot Project hosted its second public forum at Camp Arnaz on July 30, 2025. This gathering built on the momentum of the first forum and focused on identifying key assets in the watershed and exploring how climate hazards affect those assets and the communities that depend on them.

The forum brought together **39 participants**, including community members, water managers, environmental organizations, and other interested parties from across the watershed.

The event opened with a Tribal welcome from Chumash Elder Julie Tumamait-Stenslie. Participants then took part in two interactive activities to:

- **Identify and prioritize watershed assets** across ecosystems, infrastructure, cultural resources, and community services.
- **Discuss how climate change impacts these assets** and the people who rely on them.

In addition to these activities, the project team shared updated on the technical tasks underway, including the vulnerability assessment of watershed resources. This provided participants with context on how their input would be integrated into the analysis.

Exit survey responses reflected appreciation for the rich and collaborative discussions between participants and facilitators. A few noted that there was a lot of material to cover, underscoring the complexity of the issues at hand.

Input from this forum will directly inform the vulnerability assessment being conducted by the technical team, ensuring that the analysis reflects the watershed network's unique priorities and lived experiences.





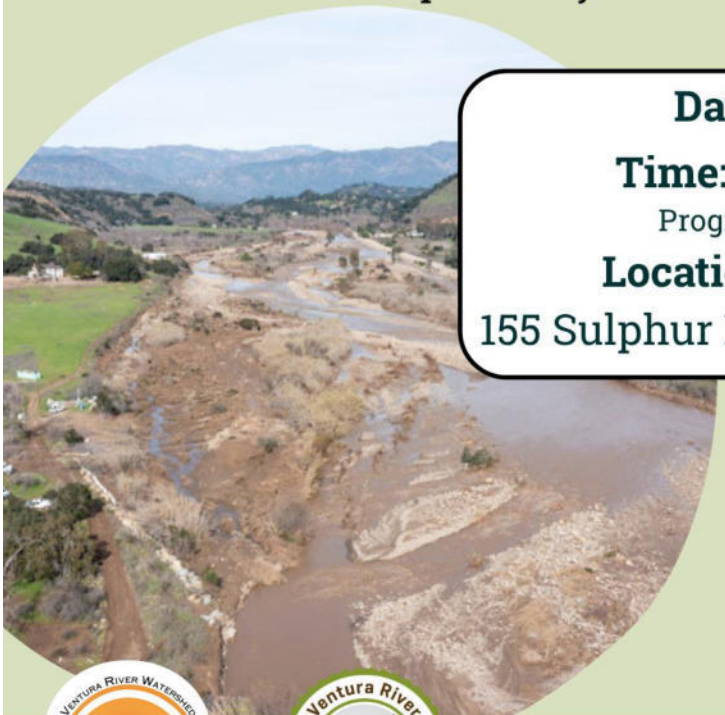
Ventura River Watershed

Watershed Resilience for a Changing Climate

You are invited to

Forum #2: Assets, Impacts, Community Insights

During this forum, participants will help identify and prioritize the watershed's most critical assets and vulnerable communities, and explore how they are impacted by climate change.



Date: July 30th

Time: 12:30pm - 4pm

Program begins at 1pm

Location: Camp Arnaz

155 Sulphur Mountain Rd, Ventura

Scan the QR Code to Register

For more information email
venturawatershed@gmail.com

Assets, Impacts, and Community Insights Forum

Prioritizing Vulnerabilities in the Ventura River Watershed

July 30, 2025



Funding for this project has been provided in full or in part from the Budget Acts of 2022 and through an agreement with the State Department of Water Resources.

Tribal Welcome



Julie Tumamait-Stenslie
Chumash Elder

Welcome

Thank you to our project funders at the State Department of Water Resources (DWR)

This program is funded in full or in part from the Budget Acts of 2022 and through an agreement with DWR.

Thank you, Advisory Group Members & Watershed Council!

Forum Agenda

Welcome – *30 mins*
- Tribal Welcoming
- Visioning Forum Recap
- Warm Up Activity

Watershed Resilience Overview – *10 mins*
- Climate Hazards & Water Resources

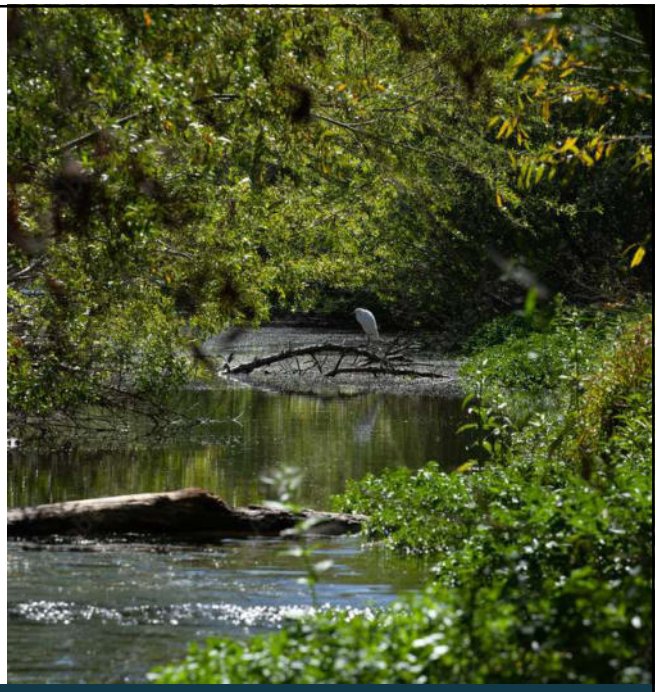
ACTIVITY 1: Identify and Prioritize Assets – *45 mins*

~~ 10 Minute Break ~~

Vulnerability Overview– *15 mins*
- Vulnerability Scoring

ACTIVITY 2: Assess Asset Vulnerability – *1 hour*

Wrap up – *10 mins*
- Report Out
- Next Steps in the VRWRP Process
- Exit Survey



Forum #1: Shaping our Shared Vision



- April 30th, 2025
- 35 participants
- Updated Vision Statement
- Informed Draft Problem Statements

Forum Facilitators



Lynn Rodriguez
Project Manager



Lara Shellenbarger
Project Manager



Kassandra Gale
Senior Program Manager, Rincon



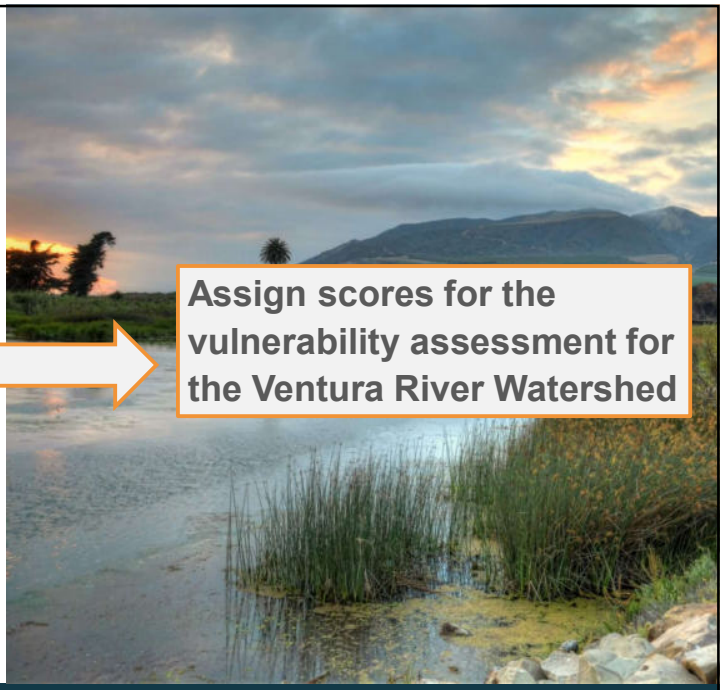
Anna Yip
Senior Climate Planner, Rincon



Hannah Gruen
Climate Planner, Rincon

Forum Goals

1. **Reach a shared understanding** about assessing vulnerability
2. **Review and vet** the list of assets in the Watershed
3. **Discuss the climate vulnerabilities** the community faces



Warm Up

- **Prompt:** What gives you hope when thinking about your community and climate challenges?







1. THINK (1 Min)

Take a quiet moment to reflect and gather your thoughts.

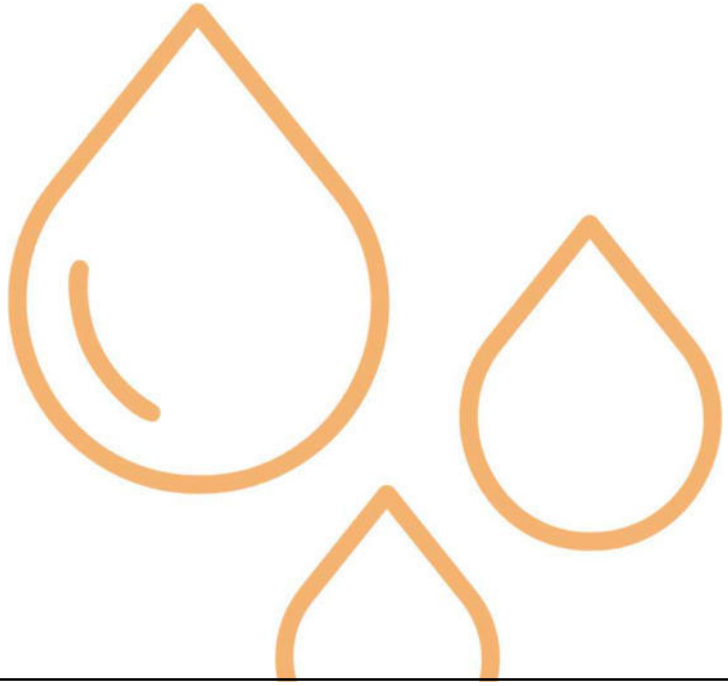
2. PAIR (2 Min)

Turn to someone near you and share your responses.

3. SHARE (5 Min)

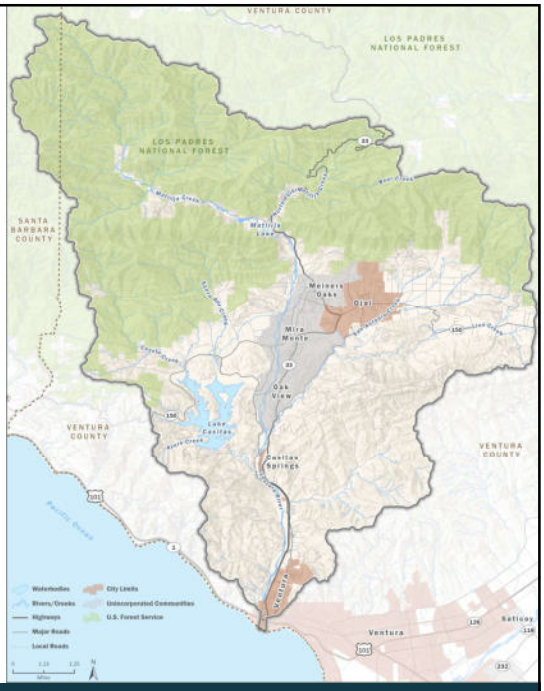
Ask each table to share a highlight from their conversations.

Watershed and Hazard Overview



Ventura River Watershed

- **226** Square Miles
- **Elevation –** 0 ft to 6,010 ft
- **Main Tributaries & Subwatersheds –** *Matilija Creek, North Fork Matilija Creek, San Antonio Creek, Canada Larga Creek, Coyote Creek*
- **Jurisdictions –** *Ventura County, Santa Barbara County, City of Ojai, City of Ventura, Casitas Springs, Oak View, Mira Monte, Meiners Oaks, U.S. Forest Service*



What will the WRP do?

Develop a **holistic plan to sustainably manage** water resources at a watershed scale in the face of climate change

- Identify **climate change vulnerabilities**
- Prioritize **adaptation strategies and projects**
- Integrate and prioritize **equity and inclusiveness**
- Enhance **partnerships across the Watershed**
- Improve regional **competitiveness for funding**

Introduction to Climate Hazards & Water Resources

Climate & Hydrology

- The hydrologic regime of the watershed is highly variable within a year (dry summers to wet winters) and from year to year (droughts to floods)
- Climate change is anticipated to make these swings **more extreme**



Ventura River near Foster Park – Jan 2023 Flooding



Ventura River during dry season

Climate Hazards to be Assessed

- Extreme Heat
- Extreme Precipitation and Flooding
- Wildfire
- Drought
- Sea-Level Rise and Storm Surge
- Marine Fog

Climate Hazards Impact Water Systems

- Extreme Heat
- Extreme Precipitation & Flooding
- Wildfire
- Drought
- Sea-Level Rise & Storm Surge
- Marine Fog

IMPACT

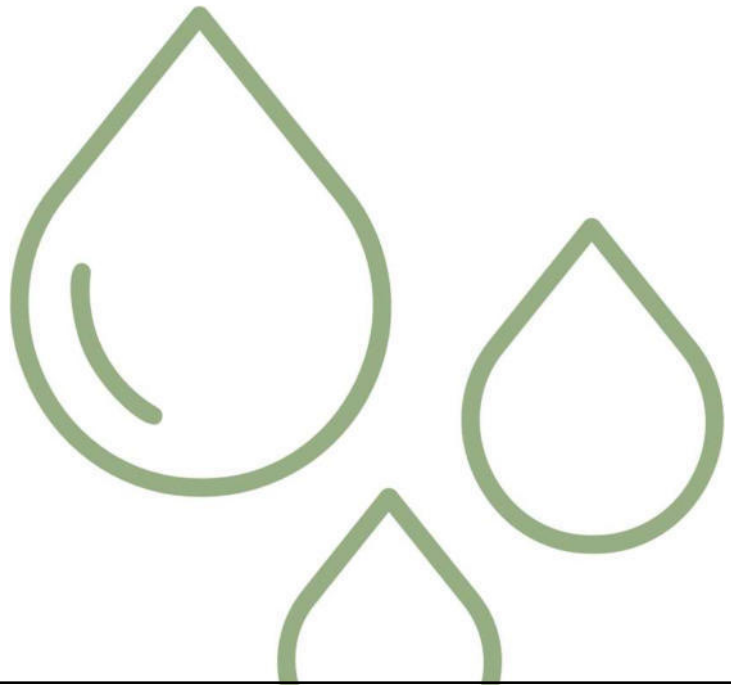


Interactive Activity

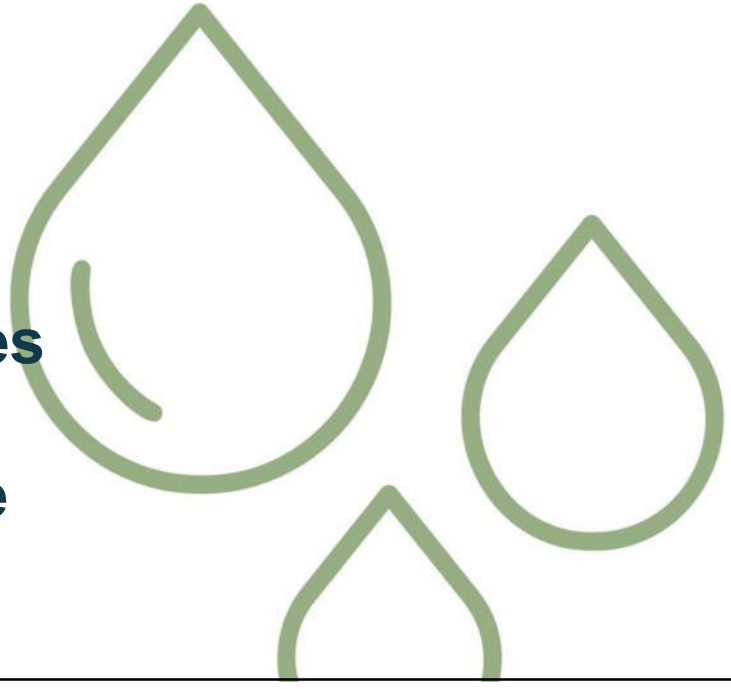
Activity 1: Identify & Prioritize Assets

- **Activity Goal**: Identify water resource assets and features that may have been missed and prioritize assets for further evaluation in Activity 2.
- Join one of the four main activity stations
- Review identified assets, features, and climate hazards
  - **Round 1 – Share:** Each person at the table has around **one minute to answer**: Did we miss any assets? What assets do you view as critical, vulnerable, or at end of its life and in need of replacement/upgrade?
  - **Round 2 – React, Respond, and Prioritize:** Comment on what others said—add, clarify, or challenge. Place colored dots on the assets you think most deserve attention in Activity 2.
- Each participant will **visit all 4 stations**. *Rotate clockwise.*

BREAK

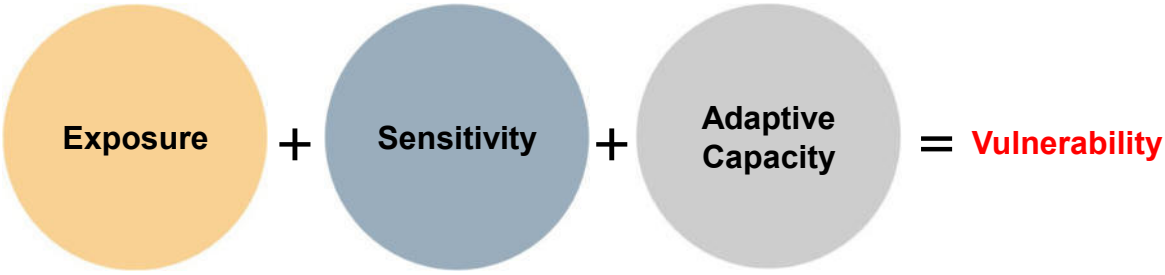


Identifying Water Resources Vulnerable to Climate Change



Defining Vulnerability

Vulnerability is defined based on ***Exposure***, ***Sensitivity***, and ***Adaptive Capacity***



The extent a resource is exposed to a given climate hazard.

The degree to which a resource could be harmed or damaged by that hazard.

The ability of the resource to continue functioning during a climate hazard with minimal changes to its ecosystem or management.

Source: *DWR Watershed Resilience Toolkit*

Exposure

Example for Sea Level Rise and Storm Surge

Low **High**



Orchards along Taylor Ranch Road



Ventura Promenade during a January storm

Sensitivity

Example for Extreme Heat

Low **High**



Native chaparral in Los Padres National Forest



Irrigated avocado orchards in the Lower Valley

Adaptive Capacity

Example for Drought

Low **High**



Shallow domestic well, Upper Ojai



VenturaWaterPure Demonstration Facility

Vulnerability Scoring

Defining Vulnerable Resources

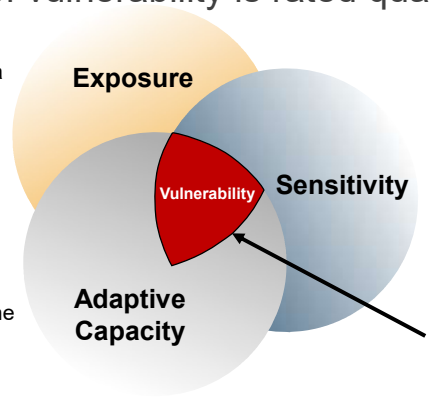
Each component of vulnerability is rated qualitatively from **low** to **high**

Exposure
Is the resource in an area where a climate hazard could occur?

Low — High

Sensitivity
How severe is the impact from the climate hazard?

Low — High



Adaptive Capacity
Ability to adapt or recover from the impacts of a climate hazard

High — Low

High Vulnerability =
High Exposure
High Sensitivity
Low Adaptive Capacity

Source: *DWR Watershed Resilience Toolkit*

Qualitative Vulnerability Scoring

Vulnerability score is listed in colored cells of table, assuming this area has high **Exposure**

		Sensitivity				
		Low = 1	Moderate/Low = 2	Moderate = 3	Moderate/High = 4	High = 5
Adaptive Capacity	Low = 1	L	M/L	H	H	H
	Moderate/Low = 2	L	M	M/H	H	H
	Moderate = 3	L	L	M	M	H
	Moderate/High = 4	L	L	L	M	M
	High = 5	L	L	L	L	M

Low Risk
Moderate Risk
High Risk

Source: *DWR Watershed Resilience Toolkit*

Vulnerability Rating Examples

Asset: Lake Casitas				
Climate Hazard	**Exposure**	**Sensitivity**	**Adaptive Capacity**	**Vulnerability Score**
Extreme Heat	**High** (highly exposed to extreme heat)	**Moderate/High** (evaporation from open reservoir; algal blooms tied to rising water temperatures)	**Moderate** (mandatory water restrictions, no evaporation cover)	**Medium/High**
Drought	**High** (highly exposed to extended drought)	**High** (dependent on local inflow)	**Moderate/Low** (mandatory water restrictions, no outside water input, limited options once storage <30 %)	**High**

Qualitative Vulnerability Examples

Asset: Ventura River Estuary				
Climate Hazard	**Exposure**	**Sensitivity**	**Adaptive Capacity**	**Vulnerability Score**
Sea Level Rise & Storm Surge	**High** (tidal estuary at river mouth, barrier beach already over-topped)	**High** (increased salinity leads to habitat shifts)	**Moderate** (limited room to migrate landward; some shoreline-retreat projects in place)	**High**
Drought	**High** (exposed to extended drought)	**Moderate/High** (river inflow volume declines during multi-year drought; salinity spikes)	**Moderate** (tidal exchange provides partial buffer; estuary management can breach sandbar)	**Medium**

Qualitative Vulnerability Input

We want your input on the specific water resource systems of the Ventura River Watershed you are familiar with:

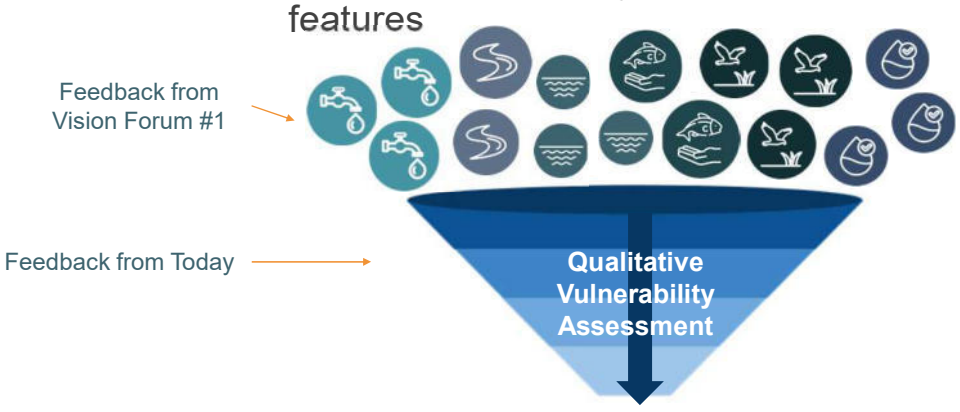
- Are they **exposed** to climate hazards?
- Are they **sensitive** to the projected effects of climate hazards?
- Can they **adapt to or easily recover** from climate hazard impacts?

Vulnerability Rating

Asset Examples	Extreme Heat	Extreme Precipitation & Flooding	Wildfire	Drought	Sea-Level Rise & Storm Surge	Marine Fog
xyz Estuary	Med	Low	Low	**High**	**High**	Med
xyz Water Treatment Plant	**High**	Low	Low	Med	Low	Low
xyz Spreading Grounds	Low	**High**	Low	Low	**High**	Low
xyz Tribal Ceremonial Area	Med	**High**	**High**	Low	Low	Low
Lake xyz	**High**	Low	Med	Med	**High**	Med

Process to Identify Vulnerable Resources

All water resource system assets and features



Most vulnerable
water resource assets/features

Interactive Activity

Activity 2: Assess Asset Vulnerabilities

- **Activity Goal**: Speak to how climate hazards will affect specific assets that matter most to you.
  - *How will specific climate hazards impact this asset?*
  - *Who will feel those impacts?*
  - *What helps or hinders the asset's ability to adapt/recover?*
- This information will inform how we "rate" exposure, sensitivity, and adaptive capacity in the Qualitative Vulnerability Assessment.
- Each participant will self-organize and visit **2 tables**.

Wrap Up

- Activity Report Out
  - Ecosystems
  - Groundwater Management and Water Supply
  - Cultural Resources and Recreation
  - Flood Management
- Upcoming Forum
  - Adaptation Strategies
- CAUSE Survey Input

Please take the exit survey!

View this email in your browser

Turning Risk into Resilience: Special Session on Adaptation Strategies

October 23 • Virtual, 1:00–4:00 pm

Please REGISTER HERE by Monday 10/20 to receive Zoom

Dear Ventura River Watershed Council members,

Join us for a special session of the **Watershed Council + WRP Advisory Group** to help shape climate adaptation strategies for the Ventura River Watershed in response to priority vulnerabilities. This session builds on the first two Watershed Resilience Project forums to focus on solutions. We'll review proposed screening criteria, discuss initial adaptation concepts, and identify gaps where further development is needed. *Facilitated by Rincon Consultants.*

Pre-watch recommended: We request that participants watch a portion of the Oct 2 Council meeting on downscaled climate projections and hazards for the Ventura River Watershed—which sets the stage for this discussion: video link, slides link.

Agenda

- Welcome
- Warm Up Activity
- Presentation: Key Vulnerabilities and Adaptation Strategy Framework
- Break
- Breakout Session 1: Review Adaptation Strategies
- Breakout Session 2: Adaptation Projects and Actions
- Wrap Up

Zoom details and more information will be provided upon registration.
Open to all Council members, previous forum participants, and partners.

Ventura River Watershed Resilience Pilot Project
Joint Meeting of Ventura Watershed Council and WRP Advisory Group
October 23, 2025
Virtual Meeting

Facilitators: Kassandra Gale and Anna Yip (Rincon)

Summary of Key Outcomes:

1. **Welcome**
2. **Warm-up Reflections**

Participants joined a brief warm-up exercise to share perspectives on the watershed. Responses captured a mix of concern about climate change impacts and optimism, as well as attachment and connection to the watershed.

- One word, how would you describe the Ventura River Watershed: *harmed, **special**, impaired, ag-impacted, complex, utam, open, shared legacy, habitat, home*
- One word, how would you describe the impacts from climate change on the Ventura River Watershed? *minimal, significant, **complex**, broad, exaggerated, substantial, looming, minor, concerning, …*
- One word, what gives you hope about the Ventura River Watershed? ***collaboration**, funding, communication, headwater, lampreys, salmon, **community**, resiliency, potential, awareness, children, red-legged frog*

3. Presentation: Vulnerability Assessment & Adaption Strategy Framework

A. Rincon presented the final **qualitative vulnerability assessment results**, summarizing **key vulnerabilities** across the water-resource systems, which aligned with findings discussed at the September 15 Advisory Group meeting. See slides for key qualitative vulnerability results.

B. The consultants introduced the Adaptation Strategy Framework, including **proposed screening and prioritization criteria** for evaluating strategies. Meeting participants provided preliminary feedback on whether any criteria was missing, if equity was

sufficiently captured, feasibility/level of detail of the cost & benefit criteria, and interdependencies.

4. Breakout Sessions: Review Adaptation Concepts & Develop Adaptation Projects and Actions

Participants joined breakout groups aligned with the water-resource systems – ecosystems, recreation & agriculture, groundwater & water supply, water quality & flood management, and cultural resources.

Across all groups, participants worked collaboratively to co-develop initial adaptation strategies and supporting actions. Breakout room discussion reinforced several shared themes:

- Strong interest in **nature-based solutions**, especially those that improve ecosystem health and function, support wildfire and flood resilience, or enhance groundwater recharge.
- Broad support for strategies that generate **multiple benefits** and strengthen connections across water systems.
- Emphasis on aligning with **existing planning efforts**, including GSPs, watershed restoration initiatives, Tribal climate planning, and regional water management efforts.
- Opportunities for **collaboration with partners**, such as the Regional Water Quality Control Board and U.S. Fish and Wildlife Service.
- Desire to incorporate **local expertise, Tribal stewardship practices, and community perspectives** into strategy development and eventual implementation.

Participants also began identifying potential types of actions (projects, programs, partnerships, **and policy approaches) to advance the strategies.**

5. Wrap Up and Closing Remarks

RCD and project team shared next steps, including review of refined strategies at the November 17 (subsequently moved to December 15) Advisory Group meeting and preparation for the February 11 final form.

Advisory Group and Council Attendees/Registered Participants:

- Vivon Sedgwick, Ojai Valley Land Conservancy (Chair of AG)
- Bruce Kuebler, Ventura Water District
- Bryan Bondy, Upper Ventura River Groundwater Agency
- Cameron Yee, CAUSE
- Carlie Dominguez, Native Coast Action Network
- Christopher Danch, Ojai Valley Fire Safe Council
- Lauren Zaragoza, VCRCD
- Nate Irwin, Santa Barbara Channelkeeper
- Peter Shellenbarger, City of Ventura
- Sarah Mulder, Ventura Water
- Scott Meckstroth, Ojai Valley Sanitation District
- Sudeep Motupalli Roa, Ojai Valley Fire Safe Council
- Teresa Romero, Native Coast Action Network
- Aaron Engstrom, County of Ventura
- Abigail Convery, County of Ventura
- Angela Bonfiglio Allen, PWA-Watershed Protection District
- Burt Handy
- Brian Bennan
- Conner Plaice, CA Senator Monique Limon's office
- David Lee, David N Lee Consulting
- Desert Weeks, LA Regional Water Quality Control Board
- Elizabeth Burns, CalTrout
- Jamie Harvie, County of Ventura
- Kathy Bremer, Friends of the Ventura River
- Larry Rose
- Leslie Purcell
- Chairman Matthew Vestuto, Barbareño/Ventureño Band of Mission Indians
- Martin Schenker, Ojai Valley Land Conservancy
- Melonie Morgan, County of Ventura
- Michelle Sevilla, CA Assemblymember Steve Bennett's office
- Vahagn Nahabedian, Numeric Solutions

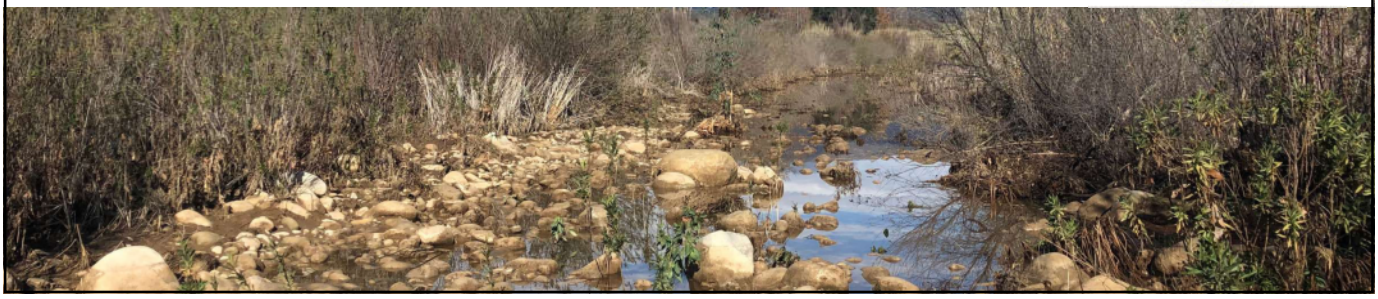
WRP Team & Consultants:

- Jamie Whiteford, VCRCD (also advisory group member)

- Anna Yip, Rincon
- Kassandra Gale, Rincon
- Hannah Gruen, Rincon
- Allegra Roth, Rincon
- Lynn Rodriguez, WRP Project Manager
- Lara Shellenbarger, WRP Associate Project Manager

Ventura River Watershed Resilience Pilot Project

Special Session on Adaptation Strategies
October 23, 2025





Land Acknowledgement

Welcome Remarks

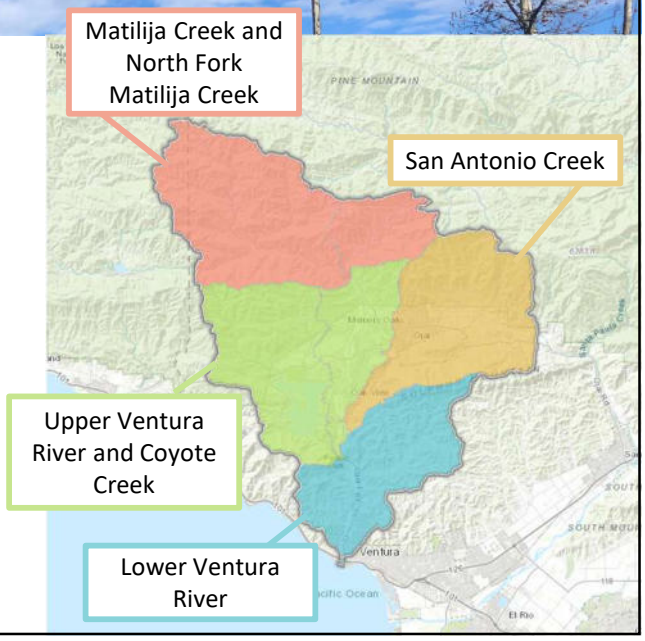
Agenda

- **Welcome & Warmup**
- **Climate Vulnerability Assessment Results**
- **Adaptation Strategy Framework**
- **Strategy Screening and Prioritization Criteria**
- **Breakout Activities: Preliminary Adaptation Strategies**
  - –Activity #1 – Present and discuss strategy development
  - –Activity #2 – Identify actions and implementation needs
- **Closing and Office Hours!**

Warm Up

In the chat, please share:

Name, Organization, and:
Where do you primarily live and/or work in the watershed?



Ventura River Watershed Resilience Program

- Build and strengthen **community-based networks**
- Assess local **climate vulnerability and risks across watershed systems and communities**
- Develop **adaptation strategies**
- Strengthen the resilience of **vulnerable communities**
- **Build on previous regional planning efforts** (i.e., VR Watershed Management Plan and IRWM Plan)



Water Resource Systems and Climate Hazards

Identify Water Resource System Assets and Features:

- Water Supply
- Ecosystems
- Flood Management
- Water Quality
- Groundwater Management
- Cultural Resources

Assess and Model Climate Hazards of Concern:

- Extreme Heat
- Extreme Precipitation & Flooding
- Wildfire
- Drought
- Sea Level Rise & Storm Surge
- Marine Fog

Qualitatively Rank for Exposure, Sensitivity, and Adaptive Capacity:

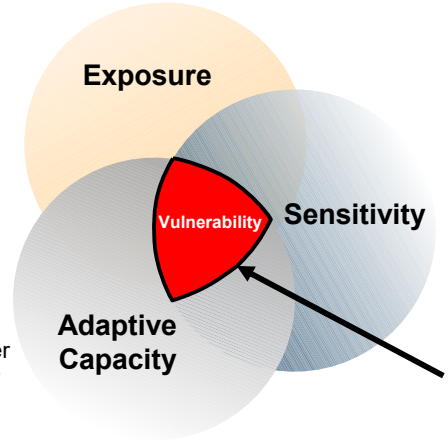


Most vulnerable
water resource system assets/features

Process to Identify Vulnerable Resources

Exposure
Is the resource in an area where a climate hazard could occur?

Sensitivity
How severe is the impact from the climate hazard?



Adaptive Capacity
Is the resource able to adapt or recover from the impacts of a climate hazard?

Highest Vulnerability =
High Exposure
High Sensitivity
Low Adaptive Capacity

Vulnerability Assessment Results – Ecosystems, Recreation, and Agricultural Lands

- Drought causes widespread vulnerabilities across **ecosystems** in the watershed.
- **Aquatic areas, wetlands, and riparian corridors** in the Lower Ventura planning area are vulnerable to extreme heat, sea level rise and storm surge, drought, and wildfire.
- **The estuary** in the Lower Ventura planning area is vulnerable to extreme precipitation and flooding, sea level rise and storm surge, and drought.
- **Agricultural lands and orchards** in the Lower Ventura planning area are vulnerable to extreme precipitation and flooding, sea level rise and storm surge, and drought.
- **State beaches, parks, and recreational access areas** (rivers, reservoirs, trails) are vulnerable to extreme precipitation and flooding.
- **Recreational access** in the Lower Ventura planning area is vulnerable to decreasing marine fog, disproportionately impacting underserved communities.

Vulnerability Assessment Results – Cultural Resources

- Wildfire threatens **cultural resources and heritage assets** across the watershed.
- **Traditional subsistence resources** (vegetative and animal) are vulnerable to drought in the upper watershed.
- Sea level rise and storm surge create vulnerabilities for **cultural resources** in the Lower Ventura planning area.
- Extreme precipitation and flooding endanger **villages, sacred sites, and ceremonial places** near floodplains.
- Declining marine fog increases vulnerability for **cultural resources** in the Lower Ventura planning area.
- Lower Ventura **villages, sacred sites, and ceremonial places** face flooding, sea level rise, wildfire, and declining marine fog.

Vulnerability Assessment Results – Flood Management and Water Quality

- Extreme precipitation and flooding create vulnerabilities for **flood management systems**, including diversions, detention and debris basins, reservoirs, and sanitation infrastructure.
- Sea level rise and storm surge create vulnerabilities for **flood management infrastructure** in the Lower Ventura planning area.
- Drought and extreme heat increases vulnerabilities to water quality in **natural waterways, waterbodies, and source-water protection areas**.
- Extreme precipitation and flooding threaten water quality in areas with high **septic system concentrations** across the watershed.

Vulnerability Assessment Results – Groundwater and Water Supply

- Drought causes widespread vulnerabilities across **groundwater assets** throughout the watershed.
- **Natural groundwater recharge** areas in the Lower Ventura planning area are vulnerable to sea level rise, storm surge, and drought.
- **Water supply and supply infrastructure** is broadly at risk from **drought.**
- **Water bodies important to supply** (eg. Senior Canyon Reservoir) are vulnerable to reliability issues from extreme heat, flooding, drought, and wildfire.
- Casitas MWD and Ventura Water management and infrastructure systems face vulnerability to damage from **flooding, drought, and wildfire impacts.**

Resilience Strategies & Actions

Strategies: The approach or pathway for achieving long-term resilience goals.

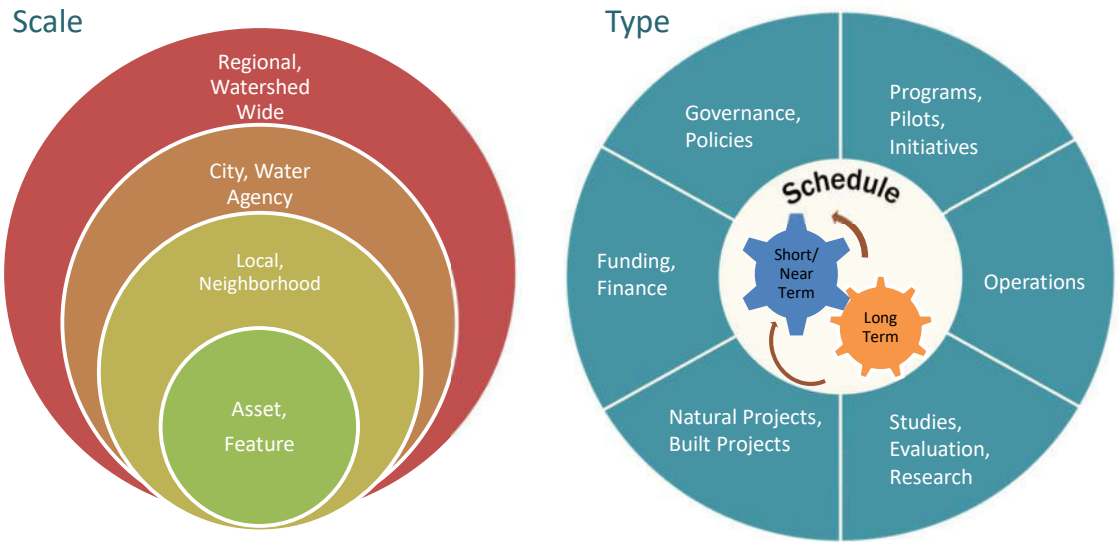
Example: *"Enhance groundwater recharge and storage capacity to increase drought resilience."*

Actions: Specific, measurable steps taken to implement a strategy.

***Example*:** "Construct three new managed aquifer recharge (MAR) basins in the Ojai Basin by 2030."

Climate Adaptation Strategy Framework

Scale | Type | Schedule



Proposed Screening Criteria

- **Achieve Equitable Outcomes –** Does this strategy promote equity and advance fair outcomes across communities?
- **Align with VRWRP Mission, Vision, and Goals** – Does this strategy align with the mission, vision, and goals of the VRWRP?
- **Address Acute or Chronic Issues** – Does this strategy address acute (short-term/urgent) issues and/or chronic (long-term/persistent) challenges?
- **Strengthen Water Resource System Infrastructure Resilience** – Does this strategy improve the performance, reliability, or resilience of water resource system infrastructure (built or natural)?
- **Reduce Risk to Communities** – Does this strategy reduce risks and vulnerabilities to communities?
- **Technical Feasibility** – Is this strategy technically feasible to design, implement, and maintain?

Proposed Prioritization Criteria

- **Achieves Multiple Benefits –** Does this strategy achieve multiple benefits (e.g., social, environmental, economic)?
- **Adaptable to Climate Uncertainty –** Can this strategy adapt over time to account for climate uncertainty?
- **Committed Leadership –** Is there committed leadership to champion and carry out this strategy?
- **Cost and Benefits –** What is the magnitude of costs? Of benefits?
- **Funding Availability –** Are there viable funding sources available to support this strategy?
- **Political / Policy Feasibility –** Is this strategy politically and policy-wise feasible?
- **Regulatory / Permitting Complexity –** Are the regulatory and permitting requirements for this strategy manageable within a reasonable timeframe?

Proposed Screening & Prioritization Criteria

Anything missing from these criteria?

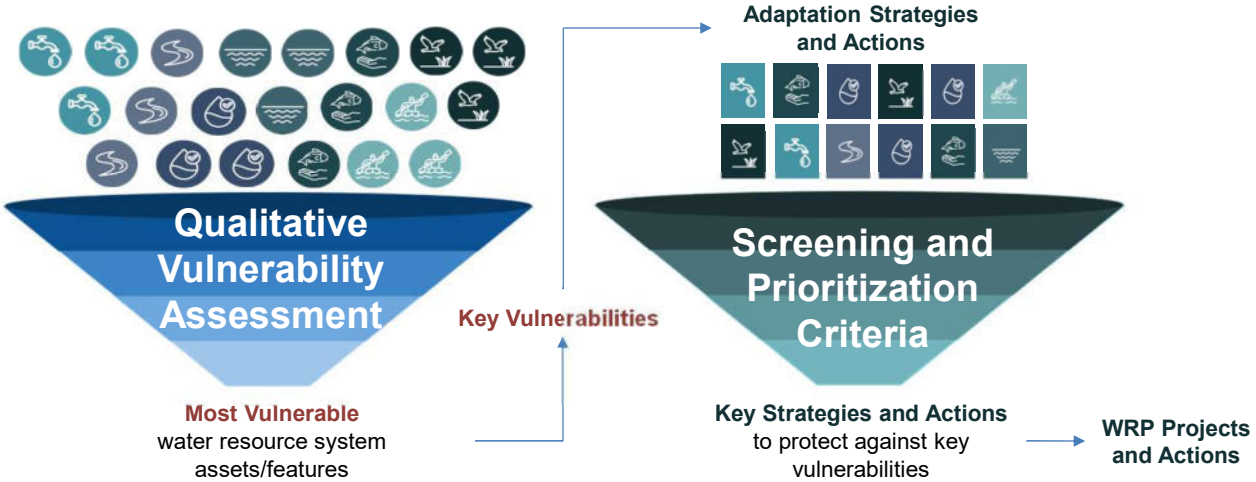
Screening Criteria

- Achieve Equitable Outcomes
- Achieve VRWRP Mission, Vision, and Goals
- Address Acute or Chronic Issues
- Improve Performance of Water
- Reduce Risk to Communities
- Technical Feasibility

Prioritization Criteria

- Achieves Multiple Benefits
- Adaptable to Climate Uncertainty
- Committed Leadership
- Cost and Benefits
- Funding Availability
- Political / Policy Feasibility
- Regulatory / Permitting Complexity

Vulnerabilities → Strategies



Breakout Session 1:
Review Adaptation Strategies

Time: 30 minutes

Objective: Review draft adaptation strategies for your assigned system. Identify additional strategies to address key vulnerabilities.

Discussion

- What strategies or themes are missing?
- Do any feel unrealistic or duplicative?
- Which strategies offer the best multiple benefits (ecological, social, economic)?

Round Robin & Close: Share a key takeaway or missing idea.

Breakout Session 2:
Adaptation Projects and Actions

Time: 40 minutes

Objective: Identify specific projects, programs, or policies to implement the strategies discussed in Session 1

Discussion

- What projects, programs, or policies could implement these strategies?
- Where should these occur, and who should lead or collaborate?
- What barriers exist (funding, permitting, governance, capacity)?
- How could we measure success?

Round Robin & Close Share a key takeaway or key project.

Breakout Session Activities

What system would you like to discuss today?

- Ecosystems, Recreation, and Agricultural Lands
- Groundwater and Water Supply
- Cultural Resources
- Flood Management and Water Quality

Breakout Session Activities

Report Out

Looking Ahead

- **Follow-up Email:** Opportunity to provide additional input for another week, especially other breakout rooms.
- **November 17th AG Meeting**: Review Final Adaptation Strategies; Initial Implementation Strategies
- **January/February Forum**: Implementation Strategies Forum (date TBD)
- **January 19th AG Meeting**: Review Final Implementation Strategies and WRP Outline

Thank You!

Your time and input is so appreciated.
Please be in touch if you have any follow up questions!

Anna Yip
ayip@rinconconsultants.com

Lynn Rodriguez
lynn.rodriguezwcvc@outlook.com

Lara Shellenbarger
larashellenbarger@gmail.com

Jamie Whiteford
jamie.whiteford@vcrcd.org

FORUM #3
kišunuškuy: Planning for Resilience

February 4th, 2026 ~ 11:00 am - 4:00 pm ~ Camp Arnaz, Oak View

AGENDA

TIME	*DURATION*	*SESSION*
11:00 –11:30	*30 min*	**Welcome & Grounding** • *Opening remarks and grounding led by Barbareño/Ventureño Band of Mission Indians Tribal Chairman Matthew Vestuto*
11:30 – 11:45	*15 min*	**Tribal Engagement Practice** • *Tribal engagement approach within the Watershed Resilience Project and VC RCD* • *Agenda overview for the day*
11:45 – 12:30	*45 min*	**Lunch *(provided)***
12:30 – 1:20	*50 min*	**Tribal Knowledge Systems & Case Studies** • *Sharing Tribal knowledge, perspectives, and examples relevant to climate resilience and adaptation*
1:20 – 1:30	*10 min*	**Break**
1:30 – 3:30	*2 hrs*	**Implementation Strategies Workshop** • *Collaborative working session focused on prioritizing adaptation strategies and outlining implementation pathways*
3:30 – 3:40	*10 min*	**Wrap-Up & Next Steps**
3:40 – 4:00	*20 min*	**Closing Reflections**
4:00 PM		**Adjourn**

Forum # 3
kišunuškuy: Planning for Resilience;
Advancing Priority Actions in the Ventura River Watershed





Ventura River Watershed Resilience Project

February 4, 2026 - Camp Arnaz, Oak View, CA

Hosts: Barbareño/Ventureño Band of Mission Indians (BVBMI), Ventura River Watershed Council and Ventura County Resource Conservation District (RCD)

Facilitators: BVBMI Chairman Matthew Vestuto, Kassandra Gale, Anna Yip, Adriana Stovall, Jasneet Heyward, Lara Shellenbarger, Lynn Rodriguez, Teresa Romero

The Ventura River Watershed Resilience Pilot Project hosted its third public forum at Camp Arnaz on February 4, 2026. This gathering built on the momentum of the first two forums and focused on developing implementation roadmaps for priority actions to advance watershed and climate resilience.

The forum brought together **40 participants**, including community members, Tribal members, water managers, environmental organizations, city and county representatives and other interested parties from across the watershed.

The event was hosted by BVBMI with a welcome from Chairman Matthew Vestuto, who then led the opening session to ground the conversation in place and cultural context. This opening session was followed by a presentation by Lauren Zaragoza (RCD)addressing Tribal engagement best practices and lessons learned from their experience building relationships, supporting Tribal participation, and distinguishing between Tribal consultation and broader collaboration. Next, Native Coast Action Network representatives Carlie Domingues and Teresa Romero provided an overview of Tribal knowledge, perspectives, and examples relevant to climate resilience and adaptation, including examples of Indigenous stewardship approaches, case studies from Tribal-led climate adaptation efforts, and findings from regional Tribal water needs

assessments.

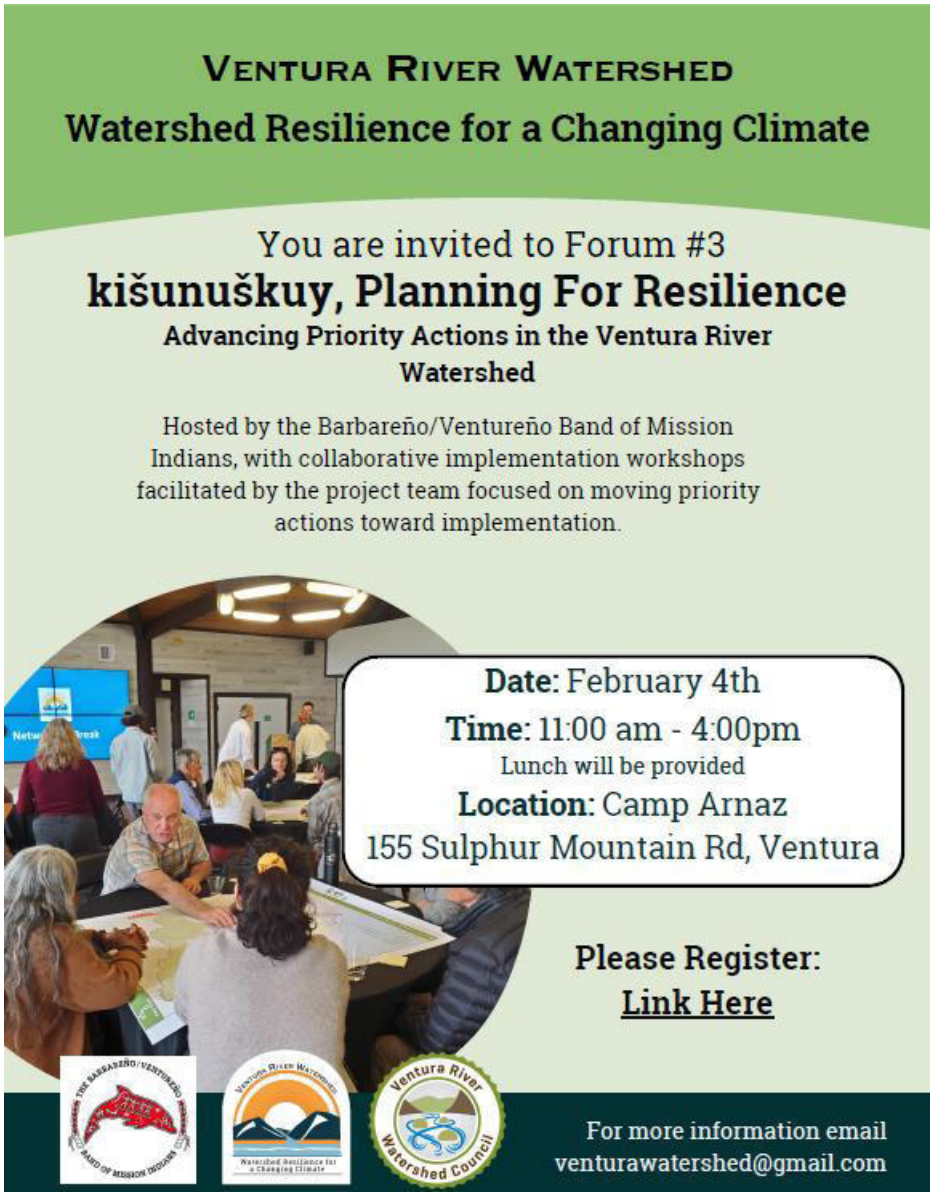
Participants then took part in two interactive activities to:

- **Review and vote for the previously developed adaptation strategies and actions** that would benefit most from an Implementation Roadmap
- **Gather input that will directly inform the Implementation Roadmaps**

In addition to these activities, the project team shared updates on the technical tasks underway, and next steps in the process. This provided participants with context on how their input would be integrated into the Watershed Resilience Plan.

Input from this forum will directly inform the implementation pathways being compiled by the technical team, ensuring that priority adaptation strategies and actions include clear implementation roadmaps (such as key partners, funding sources, and specific action elements) to address the watershed's unique environment, communities, and resource needs.




VENTURA RIVER WATERSHED
Watershed Resilience for a Changing Climate
You are invited to Forum #3
kišunuškuy, Planning For Resilience
Advancing Priority Actions in the Ventura River Watershed
Hosted by the Barbareño/Ventureño Band of Mission Indians, with collaborative implementation workshops facilitated by the project team focused on moving priority actions toward implementation.
Date: February 4th
Time: 11:00 am - 4:00pm
Lunch will be provided
Location: Camp Arnaz
155 Sulphur Mountain Rd, Ventura
Please Register:
Link Here
For more information email
venturawatershed@gmail.com

kišunuškuy: Planning for Resilience

TIME	DURATION	SESSION
11:00 –11:30	*30 min*	**Welcome & Grounding** • *Opening remarks and grounding led by Barbareño/Ventureño Band of Mission Indians Tribal Chairman Matthew Vestuto*
11:30 – 11:45	*15 min*	**Tribal Engagement Practice** • *Tribal engagement approach within the Watershed Resilience Project and VC RCD* • *Agenda overview for the day*
11:45 – 12:30	*45 min*	**Lunch *(provided)***
12:30 – 1:20	*50 min*	**Tribal Knowledge Systems & Case Studies** • *Sharing Tribal knowledge, perspectives, and examples relevant to climate resilience and adaptation*
1:20 – 1:30	*10 min*	**Break**
1:30 – 3:30	*2 hrs*	**Implementation Strategies Workshop** • *Collaborative working session focused on prioritizing adaptation strategies and outlining implementation pathways*
3:30 – 3:40	*10 min*	**Wrap-Up & Next Steps**
3:40 – 4:00	*20 min*	**Closing Reflections**
4:00 PM		**Adjourn**

Water Resilience for a Changing Climate

kišunuškuy: Planning for Resilience

Ventura River Watershed Resilience Plan: Forum #3

February 3, 2026



Funding for this project has been provided in full or in part from the Budget Acts of 2022 and through an agreement with the State Department of Water Resources.

NATIVE COAST ACTION NETWORK

Prayer for a Good Meeting

xutaš, kaqunupmawa yəla'a kakiy'ał'aliwə'ə.
mother earth, father sky and all our relatives

kəpə kiyišmotš katšiwašətš he'sikišpoš
Today we come together and we have good heart-minds

'oyoniyuw
help us!

kahukiẏoyotšəš kakiyəla'a hukiẏoyonuswu
We will help each other and we will help all.

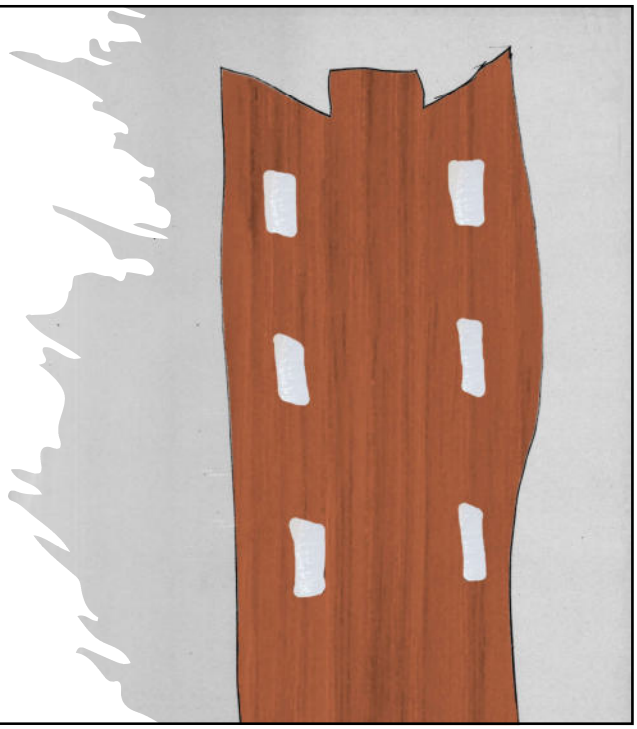
tšaqwin tšaqwin tšaqwi'in
that is all, that is all, that is all

kišunuškuy

to plan, to set a date, to promise

’o

water







THE BARBAREÑO/VENTUREÑO BAND OF MISSION INDIANS



Secretary
Salvador Tumamait-Ambriz

secretary@bvbmi.com



Vice-Chair
Lisa Godoy

vice-chair@bvbmi.com



Councilmember
Andrew Gutierrez

council_andrew@bvbmi.com



Councilmember
Eza Lopez

council_eza@bvbmi.com



Treasurer
Alex Ramos

treasurer@bvbmi.com



Chairman
Matthew Vestuto

chair@bvbmi.com



Council member
Kim Wachter

council_kim@bvbmi.com

www.bvbmi.com



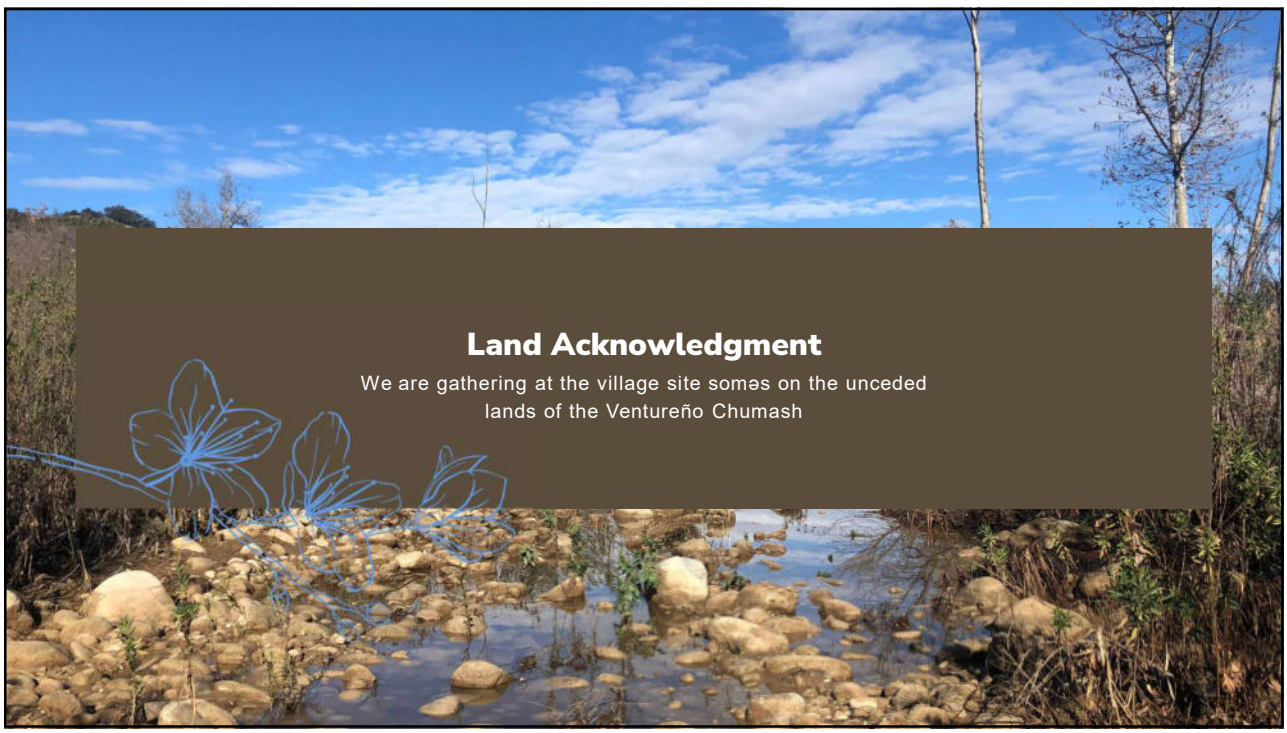
wəyə wəyə

thank you very much!

Tribal Engagement –

VCRCD

summary, ongoing learning, reflections



DWR Tribal Protocols for Outreach and Engagement

NAHC - AB 52 CEQA Tribal Consultation

Tribal Consultation List Request & Sacred Lands File Search Form

- 18 contacts that range across multiple counties: current day Ventura, Santa Barbara, Orange, Kern, San Luis Obispo, Riverside, San Bernardino
- Barbareño/Ventureño Band of Mission Indians







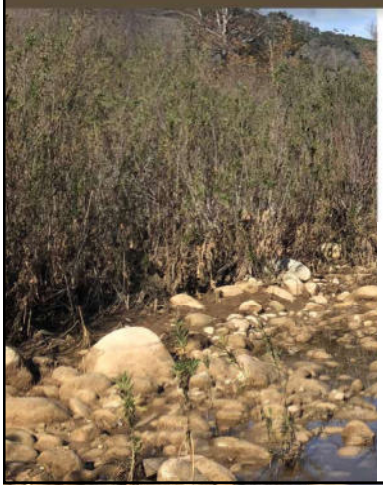
Native-Lands.Ca

- does not reflect definitive legal boundaries of any Indigenous nations and is a work in progress
- errs on the side of more expansive
- highlights relationships, connections, and presence rather than strict borders.
- glowing points linked together in a constellation
- invites users to have an interconnected lens
- Just a starting point

Tribal Government, The Barbareño/Ventureño Band of Mission Indians

Chumash Elder, Julie Tumamait-Stenslie

Indigenous Non-Profit, Native Coast Action Network



WRP Involvement

- Advisory Committee Meetings
- Asset Manager Interviews (Cultural Resources)
- Community Engagement Forums
- Invitation to review draft WRP chapters
- Assistance in developing adaptation strategies
- Involvement in planning Final Community Forum

How did they do it??

1. phone calls, meetings, text messages, lost emails
2. found emails, contracts, stipends,
3. a ton of allyship videos and educational resources, and
4. a lot of learning curves and patience.
5. ongoing and evolving everyday

Key Takeaways

- Being in community and working with indigenous non-profits and private contractors doesn't replace consultation and the importance of building a relationship with your local tribal government.
- As much as the state or environmental agencies are highlighting the importance of "tribal involvement" or "traditional ecological knowledge" our frameworks we use for project planning are still inherently very western and therefore the shoe doesn't always fit (we could dive into this a lot).

Key Takeaways

- Tribal community members are experts on their own communities and their expertise must be recognized and COMPENSATED, so grant managers write those resources in!
- Stray from the tokenization of Chumash community members. Seek input from designated representatives or give meaningful space for people to decide to share.
- Learn about the history of California Native American tribes especially in respect to water and forced removal in Ventura County

Key Takeaways

- Continue to listen and engage with respect, intent, understanding, and compassion
- Give ample time. This pilot project in its totality is barely over a year and it has felt like a huge limiting factor.
- Focus on meaningful capacity building through resource sharing or by seeking how you can uplift Chumash community goals/priorities.
- Practice early, often, and meaningful engagement and relationship building.

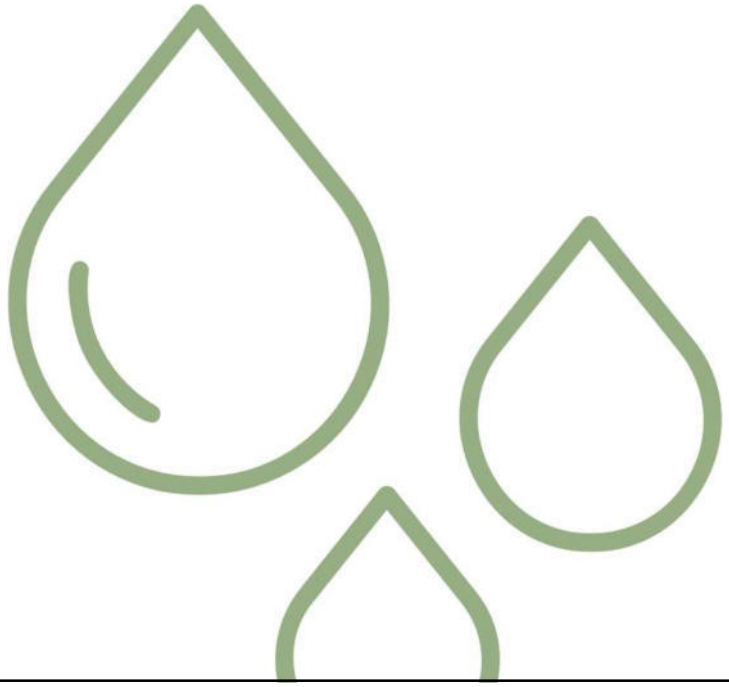


Existing Resources

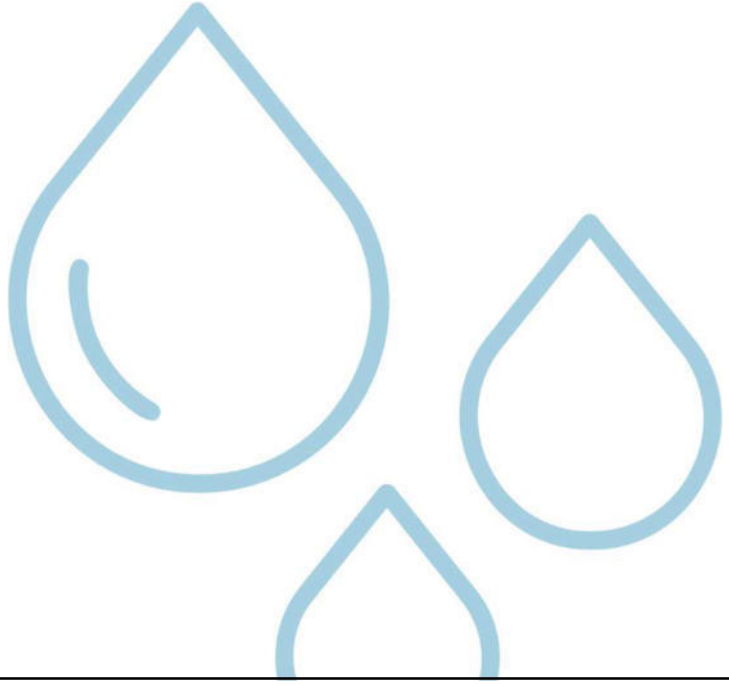
- DACTI - Water Talks Tribal Allyship Webinar Series
- DACTI - Tribal Water Needs Assessment Ventura County, 2023
- DWR Tribal Protocols for Outreach and Engagement
- American Indian and Alaska Native Culture Card



Lunch!



Tribal Knowledge Systems & Case Studies



Sharing Tribal knowledge, perspectives, and examples relevant to climate resilience and adaptation

NATIVE COAST ACTION NETWORK

Cultural & Ecological Preservation & Education

Tribal and Indigenous Climate Stewardship

2/4/2026
kišunuškuy
Planning for Resilience
VRWR Forum

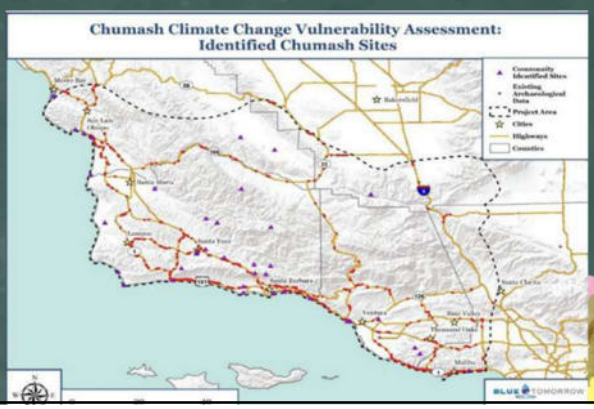
Teresa Romero
Carlie Domingues M.A.
Native Coast Action Network



Survey - Planning for Watershed Resilience with local Tribes and Indigenous Communities

O, ‘

1. Uplifting Indigenous Science, Chumash Science and Chumash Knowledge systems
2. Case studies with successful outcomes



Uplifting Indigenous Science Chumash Science Chumash knowledge systems

- Words and knowledge from Ventureño Barbareño Band of Chumash Indians
- Presence and contributions of all Native people present today
- Indigenous Knowledge Systems in Climate Change reports
- Chumash knowledge in tribal needs assessment report for Ventura County

Indigenous Science: Institute for Tribal Environmental Professionals - Status of Tribes and Climate Change Reports 1 & 2 (ITEP STACC 1 & 2)

Indigenous Knowledge Systems

"Traditional practices such as subsistence farming, hunting and gathering, ceremonial life, and languages have been and continue to be taught through intergenerational sharing. In contexts of intercultural communication, these practices are often referred to as ***Traditional Ecological Knowledge, Traditional and Indigenous Knowledges, or Indigenous Knowledge Systems****. IK Systems are considered to be the lifelines of communities due to the deep seeded connection to the earth that has been with the people since time immemorial and has fostered crucial knowledge ranging from how to maintain food systems to how to support positive mental health. The collective information sharing is intertwined with multiple aspects of society, such as ceremonies, songs, prayers, dances, clothing, food gathering and preparation, and so on."*

Tribal Water Needs Assessment Report for Ventura County prepared by Sacred Places Institute and submitted 2/17/23

- "The ocean, rivers and stream ways were often used as a means of travel… Chumash and neighboring Nations used tule reed and plank canoes to paddle up and down freshwater and saltwater ways.
- Ceremonies of significance were also held in both salt and freshwater. Gathering of fish, clams, shells and other life, including basket weaving materials, was done by the water.
- Daily cleansing practices were also held near or in the water.
- Baskets were and are made near water by the material gathered near the water, and play many roles including water jugs.
- The lifeforce of water and the value of human relationship to water was taught at the stage of infancy and became a lifelong practice for Chumash peoples and neighboring Nations."

Results of surveys:

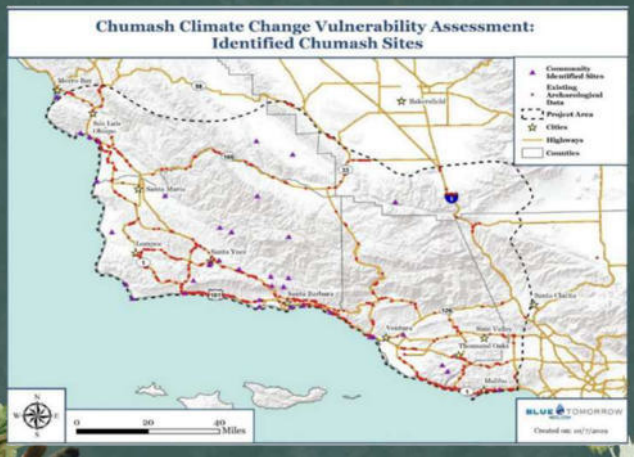
- " Water brings community together which is healing to the spirit and community, of still having knowledge and connection to the spirit of the land and water, being water and ocean protectors, resilience of culture and tradition, and developing relationships with government agencies, organizations, universities and colleges to access land and water for cultural use.

Tribal Water Needs Assessment Report for Ventura County prepared by Sacred Places Institute and submitted 2/17/23.

- "Overwhelmingly Tribal community members prioritized their cultural and spiritual relationship to water as both a significant strength and need in terms of something needing to be protected, expanded, and even re-established in some instances.
- Some community members noted that their relationship to water consists of gathering aquatic plants, gathering aquatic animals, holding ceremony with water, making sure to leave offerings to the water, participating in Tribal community gatherings around water, participating in the launching of the traditional tomols and tule boats,
- recognizing the water as a living relative that has stories tied to the Chumash, Tataviam and Tongva people,
- understanding that we are connected to the water and that it has become scarce so we must do our best to protect water,
- acknowledging that people have become disconnected from water and are reclaiming their connection,
- having daily practices to conserve water, and recognizing the need for education around water and taking it out of ownership of major manufactures and companies."

Native Lead Climate Case Studies

Case Study: Santa Ynez Band of Chumash Indians



Cycles of Renewal: Collaborative Project

- California Indian Science - relationship of water and fire
- Collaboration and funding resources from Climate funds
- Native Science + Climate Change Adaptation funders



Case Study : Karuk Climate Adaptation Plan

Case Study: Amah Mutsun Tribal Band

Common strategies, terms and helpful information when we work together

1) Relationship building
2) Collaboration
3) Engagement and Outreach
4) Education
5) Consultation
6) Project timelines
7) Government to Government
8) Good Will

1) Relevance of California History
2) We're on a journey to know what it means to work together

CA Natural Resource Agency Tribal Consultation Policy

Appendix 2 - best practices and step by step instructions
Page 34

Plan for Chumash Resilience and Climate Stewardship

1) Native People continue cultural knowledge, science, practices etc.
2) ITEPP Conference
3) 5th California Climate Change Assessment - Summer 2026
4) National Adaptation Forum - Indigenous Track
5) CA Natural Resources - Tribal Affairs

What will the WRP do?

Develop a **holistic plan to sustainably manage** water resources at a watershed scale in the face of climate change

- Identify **climate change vulnerabilities**
- Prioritize **adaptation strategies and projects**
- Integrate and prioritize **equity and inclusiveness**
- Enhance **partnerships across the Watershed**
- Improve regional **competitiveness for funding**

Where We Are in the WRP Process

- Developed list of **water system assets**
- Conducted vulnerability assessment & identify **key vulnerabilities**
- Developed strategy framework and screening/prioritization criteria
- Identified **gaps** between key vulnerabilities and existing efforts
- Drafted **strategies and actions** to address vulnerability gaps

Today: Identify leads, collaborators, and opportunities to **strengthen implementation**

Vulnerabilities → Strategies and Actions → Implementation

Activity Goals

1. **Reach a shared understanding** about goal, strategy, and action framework
2. **Review and vote** for the actions that would benefit most from an Implementation Roadmap
3. **Gather input** that will directly inform the Implementation Roadmaps



Goal, Strategy, and Action Framework

Goals: Clear statements of the desired long-term outcomes we want to achieve.

Example: *"Recreational Access for Community Enjoyment is Protected and Enhanced Across the Watershed."*

Strategies: The approach or pathway for achieving long-term resilience goals.

Example: *"Build Climate-Adaptive, Multi-Functional Public Spaces."*

Actions: Specific, measurable steps taken to implement a strategy.

Example: *"Develop and implement Flood Operations & Public Safety Plans for floodplain parks, river access points, and trails."*

Vulnerabilities → Strategies → Implementation



Vulnerabilities → Strategies → Implementation



Key Vulnerabilities

Most Vulnerable
water resource system
assets/features

Vulnerabilities → Strategies → Implementation



Draft Adaptation Strategies and Actions

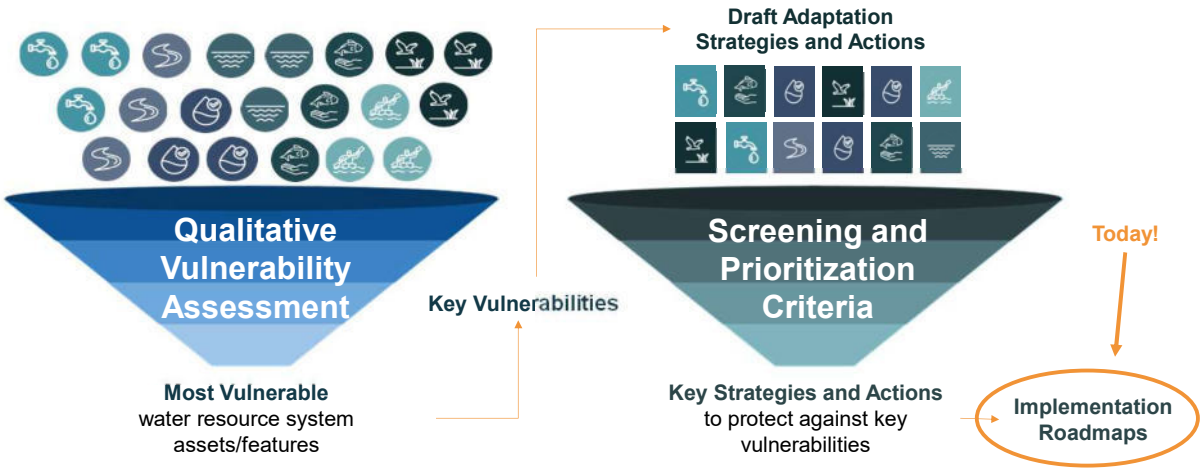


Key Vulnerabilities

Most Vulnerable
water resource system
assets/features

kišunuškuy: Planning for Resilience

Vulnerabilities → Strategies → Implementation



Interactive Activity #1

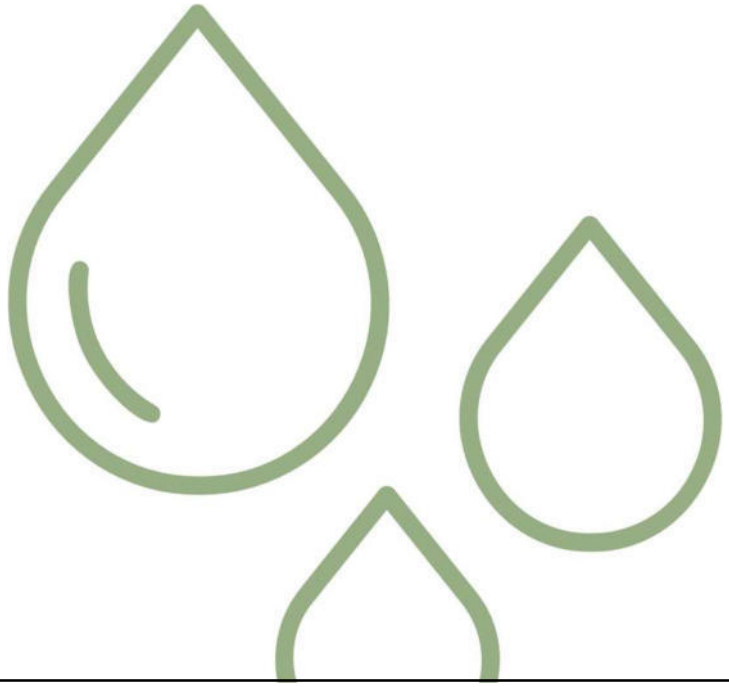
Activity 1: Voting on Actions

Activity Goal: Review and vote for the actions that would benefit most from an Implementation Roadmap.

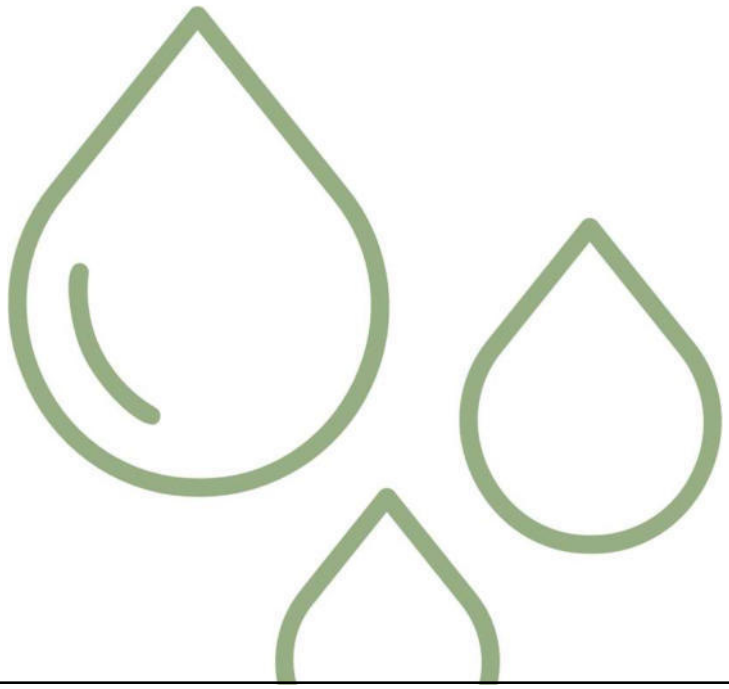
- Walk around room to cast votes on different posters.
- Write a few words that describe your vote on each sticky.
- Everyone is limited to 5 stickies, with one *super* vote!

You have 20 minutes!

Activity Report Out



BREAK



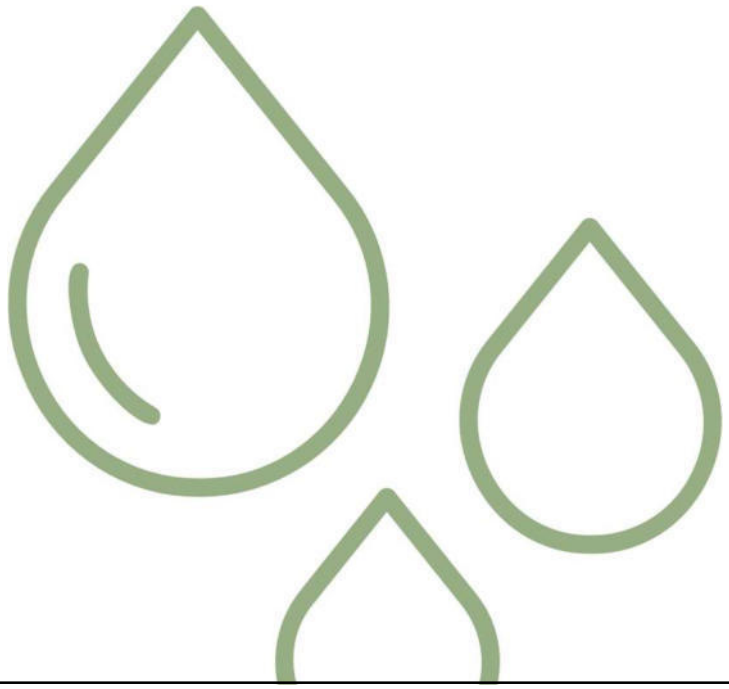
Activity 2: Implementation Roadmaps

Activity Goal: Gather input that will directly inform the Implementation Roadmaps

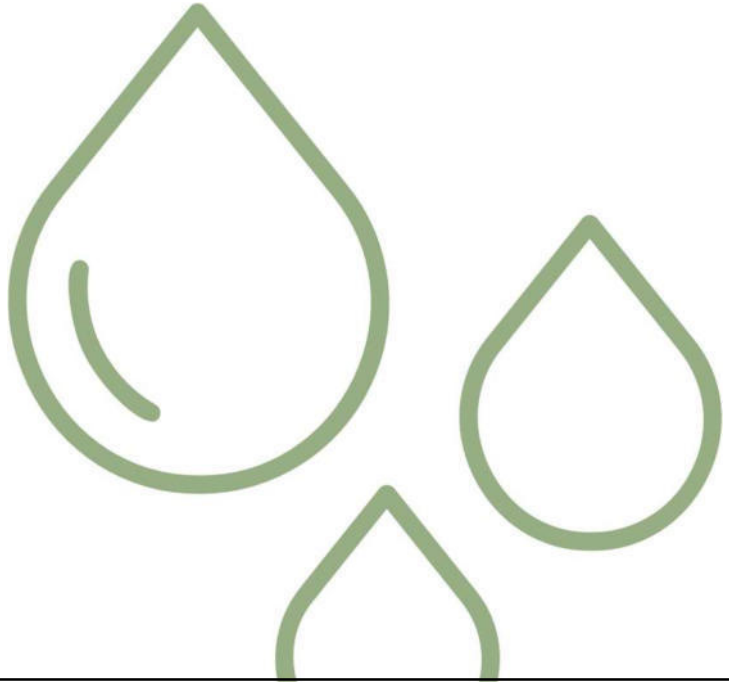
- Select which action you would like to focus on for this activity.
  - *Please help us keep group sizes relatively even!*
- Discuss key implementation considerations for your activity.

You have 35 minutes!

Activity Report Out



Wrap Up and Next Steps



Wrap Up and Next Steps

- Finalize adaptation strategies and actions
- Develop implementation strategies
- Continue review of draft chapters - networks assessment and engagement, climate vulnerability and risk assessment, water budget
- Review entire WRP compiled

Final Meetings

- Advisory Group – March 2nd
- Watershed Council – March 19th

Reflections

La1

kišunuškuy: Planning for Resilience

La1 add the website.
Lara.Shellenbarger, 2025-07-23T21:34:11.288

Ventura River Watershed Resilience Project

Newsletter #1 – August 2025

Dear Watershed Council Network,

Thank you to everyone who has participated in recent forums and meetings for the Ventura River Watershed Resilience Project. With technical work and community input shaping the process, we're excited to share progress and next steps. This effort builds on the foundation of the 2015 Watershed Management Plan and the collaborative strength of the Council.

Many of you have been part of these discussions through Watershed Council and Advisory Group meetings, or the two community forums held so far. Together, we are developing a locally informed Watershed Resilience Plan, funded by **DWR's Watershed Resilience Pilot Program.** The plan will identify vulnerabilities and outline strategies to strengthen long-term resilience.

This is a joint effort led by the Ventura County Resource Conservation District (as grantee), with support from contracted project managers, Rincon Consultants and their subconsultants Stantec and Eagle Rock Analytics, CSU Northridge, and Central Coast Alliance United for a Sustainable Economy.

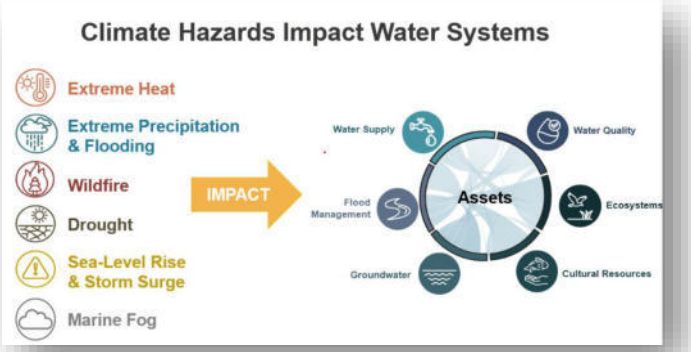
Foundations for the Plan

Vision Statement

A draft Vision Statement has been developed to guide both the creation of the Resilience Plan and its future implementation. It captures shared goals for a resilient Ventura River Watershed—supporting healthy ecosystems, reliable water supplies, and strong communities. A final version will be presented at the October Watershed council meeting for adoption.

State of the Watershed Chapter

The draft *State of the Watershed* Chapter, including a set of problem statements outlining key climate resilience challenges, was shaped by community input gathered at Forum #2, and key partner discussions. The chapter highlights the watershed's most pressing challenges and outlines the issues that must be addressed to build long-term resilience. These Problem Statements will guide the planning process, connecting challenges with potential solutions. The draft will be shared for review in the coming months.



Engagement Highlights

Forum #2 Recap

On July 30, more than **40 watershed partners and community members** gathered at Camp Arnaz for the second forum. Participants identified watershed assets, including water supply and flood infrastructure,



Forum participants at Camp Arnaz

recreational resources, and cultural resources, and explored how climate hazards like wildfire, drought, and flooding affect those assets.

Community Engagement

To support engagement of underserved and frontline communities, the Ventura River Watershed Resilience Project has partnered with Central Coast Alliance United for a Sustainable Economy (CAUSE), a local community-based organization, to conduct a survey and two focus groups. CAUSE is helping ensure that community priorities are reflected in the plan.

CAUSE brings extensive experience in community-based organizing and engagement, including its role in the Prop. 1 funded *WaterTalks* program. Building on that foundation, CAUSE is gathering local perspectives to ensure that community priorities are reflected in the plan. Updates from this work will be shared at upcoming Watershed Council meetings.

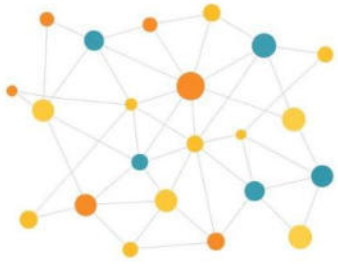


CAUSE Climate Youth Fellows leading the frontline community surveys

In addition, we are coordinating with the Barbareño/Venturano Band of Mission Indians, including the Tribal Council and community members to assess potential risks to cultural resources and incorporate tribal voices into the plan.

Network Assessment

CSU Northridge is leading the network assessment component of the project to better understand how organizations, agencies, and community groups connect across the watershed. The survey, which received strong participation from local organizations, will provide insight into how the network functions and where connections could be strengthened to enhance overall resilience. Results will be shared at the December Watershed Council meeting.



Technical Work Underway

Climate Metrics & Hazards Analysis

Climate modeling, led by Eagle Rock Analytics, is assessing how the Ventura River Watershed may be affected by hazards such as extreme heat, drought, wildfire, flooding and intense storms, decreased coastal fog, and sea level rise. The analysis uses data from 15 climate models and 137 simulations, downscaled to a 3 km resolution for local accuracy. Results are organized by Global Warming Levels (e.g., 1.5C, 2.0C of warming), a method that aligns with IPCC and California climate planning and provides a clearer picture of how risks will change over time. Climate metrics and thresholds were informed by input from the Advisory Group.

Findings, expected next month, will provide a clearer picture of local climate risks and help us identify the most effective strategies for resilience.

Looking Ahead

This grant-funded pilot project will result in a stronger collaborative network and a Watershed

Resilience Plan that builds on the 2019 Integrated Regional Water Management Plan (IRWM) Plan and the 2015 Ventura River Watershed Management Plan. Council members will have the opportunity to review the draft chapters of the plan as they are developed.

Upcoming opportunities to connect:

September 4: Watershed Council Meeting – project updates and water budget results

October 2: Watershed Council Meeting – climate hazard analysis results

October 23: Special Session (virtual) – discussion of adaptation strategies

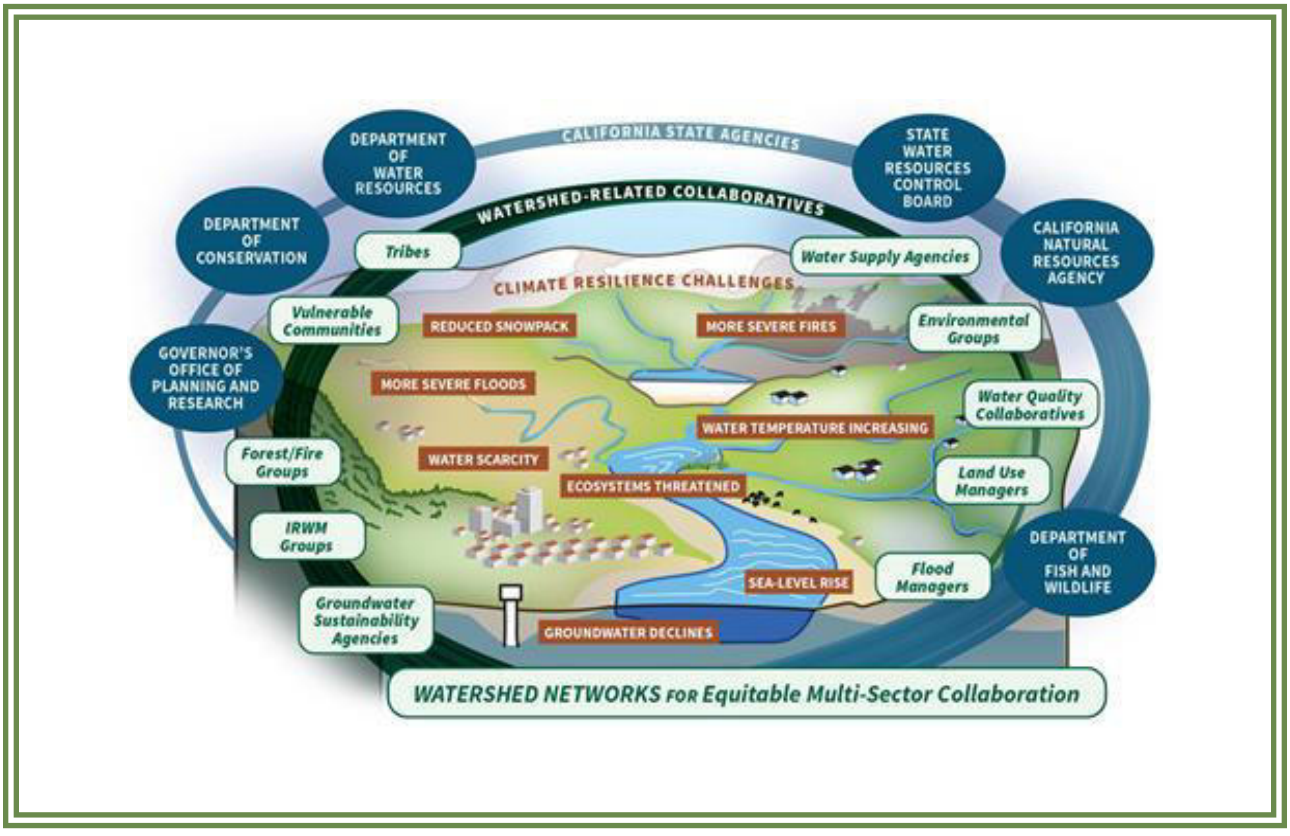
The full schedule will be posted on the Ventura River Watershed Resilience Project webpage and announced in future newsletters. Your continued participation is key to shaping a plan that reflects the needs and priorities of communities in the Ventura River Watershed.

For more information about the WRP visit the project website: Ventura River Watershed Climate Resilience

Other Resources:
Ventura County Resource Conservation District: https://vcrcd.org/

Ventura River Watershed Council: https://venturawatershed.org/

Watershed Resilience Framework and Toolkit – A Guide to Accelerate Resilience in California's Watersheds DRAFT, CA DWR





About the Project | Watershed Council | Goals | Meeting Schedule | Advisory Group

Now Available for Council Review!

Ventura River Watershed Resilience Plan (VRWRP)

Ventura River Watershed Resilience Plan Appendices

Please submit comments using this **online form**.

About the Project

The Watershed Resilience Program was designed by the California Department of Water Resources to be the next evolution of the Integrated Regional Water Management Program. The goal of the program is to accelerate locally led watershed resilience planning and implementation. This program would expand coordination and emphasize integrated, multi-sector, and outcome-based planning, action, and monitoring in response to climate challenges. This program is being piloted in five different watersheds throughout the State, with the Ventura River Watershed serving as one of the five pilots. Ventura River Watershed: Water Resilience for a Changing Climate program is the name for the Ventura River Watershed pilot project. The Ventura County Resource Conservation District is the administrator of the project.

This Project will develop a watershed network and watershed resilience plan that assesses multi-factor climate vulnerabilities and evaluates regionally equitable adaptation and implementation strategies.

The program will build on previous regional planning efforts.

- Holistically study, plan, and manage water from headwaters to groundwater to outflow, at a watershed scale.
- Integrate and prioritize equity and inclusiveness.
- Analyze climate vulnerabilities/risks and potential adaptations at the defined watershed scale.
- Plan and collaborate across water supply, flood, groundwater, water quality, forest/fire, ecosystem, and land use sectors.
- Develop and apply performance indicators and metrics to measure, track, and report on outcomes at the regional and statewide level.

Funding for this project has been provided in full or in part from the Budget Act of 2022 and through an agreement with the State Department of Water Resources.

Learn More:
State Water Plan
DWR Watershed Resilience Program

Project Contacts:
Lynn Rodriguez, **lynn.rodriguezwcvc@outlook.com**
Lara Shellenbarger, **larashellenbarger@gmail.com**

Lynn Rodriguez, lynn.rodriguezwcvc@outlook.com
Lara Shellenbarger, larashellenbarger@gmail.com

Meeting Schedule

To receive email alerts for scheduled meetings, posted agendas, virtual meeting links, and available recordings, please join our mailing list below

Join Watershed Mailing List

Event	Location	Date	Presentation
Watershed Council February Meeting	Hybrid	Thursday, Feb 6, 2025, 9:00 AM – 12:00 PM	Agenda Slides Video
Watershed Council April Meeting	Virtual	Thursday, April 3, 2025, 9:00 AM – 12:00 PM	Agenda Slides Video
Forum #1 – Shape Our Shared Vision	Camp Arnaz	Wed, Apr 30, 2025, 3:00 PM – 5:30 PM	Agenda Slides Summary
Watershed Council June Meeting	Virtual	Thu, Jun 6, 2025, 9:00 AM -12:00 PM	Agenda Video
Forum #2 – Assets, Impacts, Community Insights	Camp Arnaz	Wed, July 30 2025, 12:30 PM – 4:00 PM	Agenda Slides Summary
Watershed Council September Meeting	Hybrid	Thu, Sep 4, 2025, 9:00 AM – 12:00 PM	Agenda Slides Video
Watershed Council October Meeting	Virtual	Thu, Oct 2, 2025, 9:00 AM – 12:00 PM	Agenda Slides Video
Downscaled Climate Projections & Hazards for Ventura River Watershed	Virtual	Presentation during 10/2/25 VRWC meeting	Slides Video
Ventura River Watershed Council & Advisory Group Special Session	Virtual	Thu, Oct 23, 2025 1:00 PM – 4:00 PM	Agenda Slides Video Summary



Watershed Resilience Project Advisory Group

The Ventura River Watershed Resilience Pilot (VRWRP) Project is directed by the Ventura River Watershed Council, which serves as the primary project network. In January 2025, the Council's Leadership Committee formed a technical sub-group—the WRP Advisory Group—to provide technical review, collaborative guidance, and recommendations to strengthen the WRP planning effort. This Advisory Group includes interested members of the Leadership Committee and other entities and interested parties invited to lend their expertise and ideas. The Advisory Group's priority is to support equitable, collaborative, and sustainable watershed resilience planning. The Advisory Group advises both the WRP technical consultant team and the Council, which retains final decision-making authority



Members

Central Coast Alliance for a Sustainable Economy (CAUSE) – Cameron Yee, Kristian Nunez

Chumash Elder and Educator – Julie Tumamait-Stenslie

City of Ventura – Jennifer Tribo, Sarah Mulder, Peter Shellenbarger

County of Ventura Watershed Protection District – Earthea Nance, Pam Lindsey

Farm Bureau of Ventura County – Jodi Switzer, Maureen McGuire

Meiners Oaks Water District – Christy Cooper, Justin Martinez

MERITO Foundation – Rocio Lozano-Knowlton

Ojai Basin Groundwater Management Agency – Cece Vandermeer

Ojai Valley Fire Safe Council – Chris Danch, Kalli O'Conner

Ojai Valley Land Conservancy – Tom Maloney, Vivan Crawford Sedgwick, Martin Schenker

Ojai Valley Sanitation District – Scott Meckstroth, Allison Young

Santa Barbara Channelkeeper – Nate Irwin

Surfrider Foundation – Paul Jenkin

Upper Ventura River Groundwater Agency – Bryan Bondy

Ventura County Board of Supervisors – Office of Matt LaVere

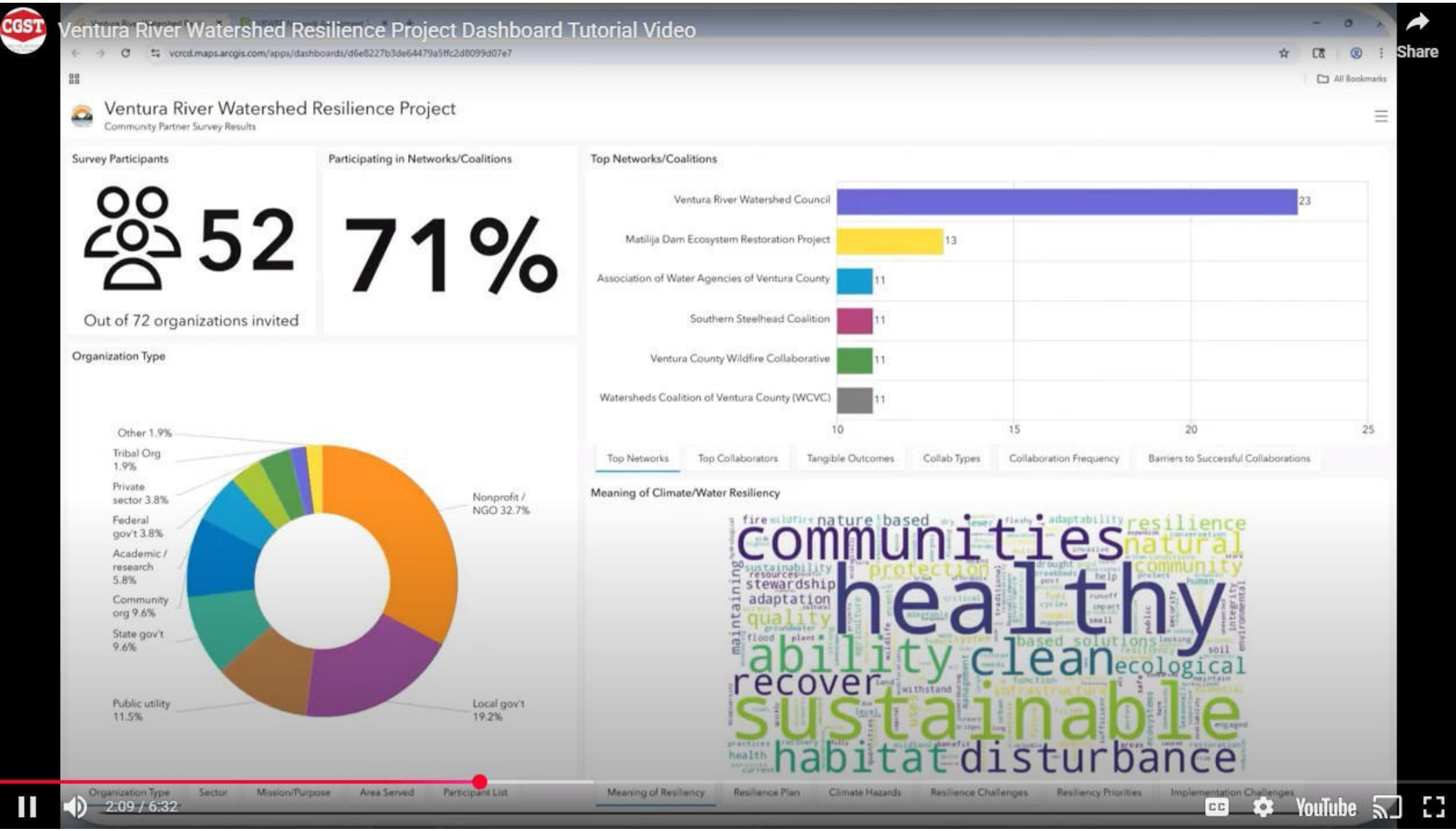
Ventura County Resource Conservation District – Jamie Whiteford

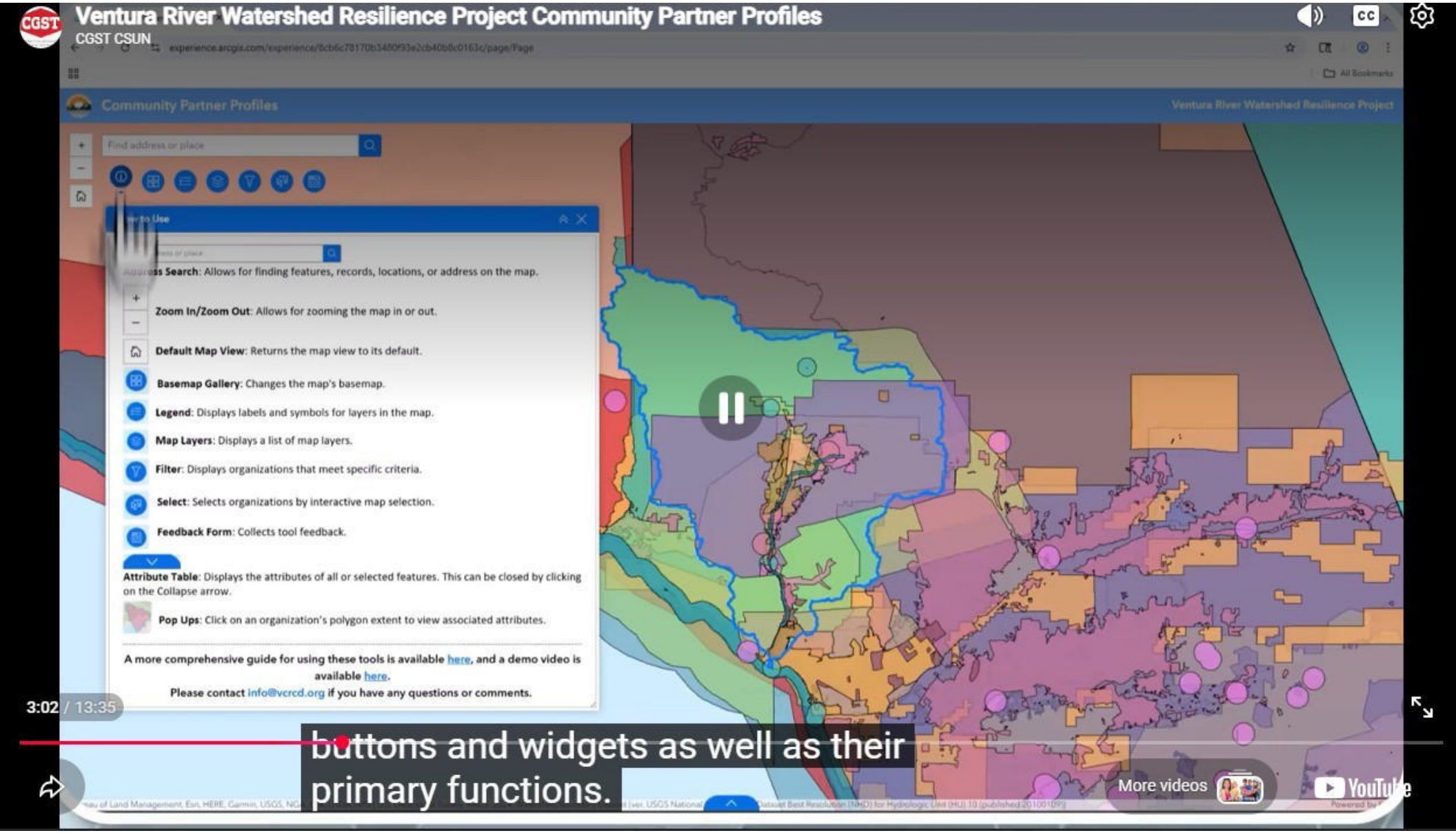
Ventura Land Trust – Melissa Balla, Laura Paviscak, Dan Hulst

Ventura River Water District – Alma Quezada, Bruce Kuebler

Meetings

Date	Agenda	Meeting Minutes	Resources
March 17, 2025 **2 pm – 4 pm**	Meeting #1 Agenda	Meeting Summary	Presentation Slides
May 19, 2025 **2 pm – 4 pm**	Meeting #2 Agenda	Meeting Summary	Presentation Slides
July 21, 2025 **2 pm – 4 pm**	Meeting #3 Agenda	Meeting Summary	Presentation Slides
September 15, 2025 **2 pm – 4 pm**	Meeting #4 Agenda	Meeting Summary	Presentation Slides


Ventura River Watershed Resilience Project Dashboard Tutorial Video
Share
vcrcd.maps.arcgis.com/apps/dashboards/d6e8227b3de64479a5ffc2d8099d07e7
Ventura River Watershed Resilience Project
Community Partner Survey Results
Survey Participants
52
Out of 72 organizations invited
Participating in Networks/Coalitions
71%
Top Networks/Coalitions
Ventura River Watershed Council 23
Matilija Dam Ecosystem Restoration Project 13
Association of Water Agencies of Ventura County 11
Southern Steelhead Coalition 11
Ventura County Wildfire Collaborative 11
Watersheds Coalition of Ventura County (WCVC) 11
10
15
20
25
Top Networks
Top Collaborators
Tangible Outcomes
Collab Types
Collaboration Frequency
Barriers to Successful Collaborations
Organization Type
Other 1.9%
Tribal Org 1.9%
Private sector 3.8%
Federal gov't 3.8%
Academic / research 5.8%
Community org 9.6%
State gov't 9.6%
Public utility 11.5%
Local gov't 19.2%
Nonprofit / NGO 32.7%
Meaning of Climate/Water Resiliency
communities
healthy
ability
clean
recover
sustainable
habitat
disturbance
natural
resilience
protection
community
stewardship
adaptation
quality
ecological
maintaining
Organization Type
Sector
Mission/Purpose
Area Served
Participant List
Meaning of Resiliency
Resilience Plan
Climate Hazards
Resilience Challenges
Resiliency Priorities
Implementation Challenges
2:09 / 6:32
YouTube


Ventura River Watershed Resilience Project Community Partner Profiles
CGST CSUN
Community Partner Profiles
Ventura River Watershed Resilience Project
Find address or place
Address Search: Allows for finding features, records, locations, or address on the map.
Zoom In/Zoom Out: Allows for zooming the map in or out.
Default Map View: Returns the map view to its default.
Basemap Gallery: Changes the map's basemap.
Legend: Displays labels and symbols for layers in the map.
Map Layers: Displays a list of map layers.
Filter: Displays organizations that meet specific criteria.
Select: Selects organizations by interactive map selection.
Feedback Form: Collects tool feedback.
Attribute Table: Displays the attributes of all or selected features. This can be closed by clicking on the Collapse arrow.
Pop Ups: Click on an organization's polygon extent to view associated attributes.
A more comprehensive guide for using these tools is available here, and a demo video is available here.
Please contact info@vcrcd.org if you have any questions or comments.
3:02 / 13:35
buttons and widgets as well as their primary functions.
More videos
YouTube

Appendix F

Summary of Feedback Received

Summary of Major Revisions to the Draft VRWRP

The Ventura River Watershed Resilience Plan (VRWRP) was shaped by an extensive collaboration involving Tribes, local agencies, water managers, community-based organizations, agricultural partners, and other community members. Throughout the planning process, these partners and interested parties provided critical feedback that strengthened the VRWRP's technical accuracy, cultural relevance, and ability to respond to future climate conditions. The VRWRP reflects the insights, direction, and recommendations from the partners and interested parties in response to feedback via advisory group meetings, surveys, workshops, watershed council, and individually drafted chapters.

This appendix summarizes the most significant refinements made after the Draft VRWRP was distributed for review. These updates reflect the project team's commitment to transparency, continuous improvement, and honoring the knowledge shared by community members, Tribal representatives, and agency partners. They also demonstrate how the plan evolved in response to technical review, community insight, and Advisory Group guidance.

The list is intended as an accessible reference for the public and all partners invested in the long-term resilience of the Ventura River Watershed. Given the depth and breadth of feedback received, this appendix is not a complete record of all comments or edits, but rather a summary of the most substantial changes that shaped the final VRWRP.

New Content & Structural Updates

- Added Chapter 7: Performance Indicators for Watershed Resilience to guide ongoing tracking and adaptive management.
- Added Chapter 8: Conclusion to outline the recommendations and next steps at the end of the document. Also added a "Recommendations and Next Steps" section to the Executive Summary.
- Standardized terminology in strategy/action tables to "Potential Implementation Metrics," and aligned Implementation Roadmaps with a consistent "Implementation Metrics" framework.

Methodology & Technical Clarifications

- Clarified the scope and spatial boundaries of the study.
- Expanded explanation of exposure-scoring methodology in the vulnerability assessment.
- Increased reliance on technical data sources beyond the 2015 Watershed Management Plan.
- Specified when statements apply to sub-regions rather than the entire watershed.
- Brought in additional detail and clarity around the historical water budget and vulnerability assessments, including adding the qualitative vulnerability assessment result tables to the main VRWRP (previously just in the appendix).
- Updated hydrologic and infrastructure narratives to improve accuracy around peak-flow behavior, pollutant mobilization, wildfire-driven sediment dynamics, and wastewater system vulnerabilities, strengthening consistency across chapters.

Graphics & Figures

- Added additional key milestones to the Recent History timeline.
- Updated climate projection maps in Chapter 4: Future Climate Conditions to be zoomed into the watershed boundary and updated stylistically.

- Re-created the Executive Summary and the Implementation Roadmaps in InDesign for enhanced accessibility and aesthetics.

Leads & Partners

- Updated lead and partner agency lists in action tables based on organizational feedback.
- Updated references to existing and ongoing efforts to leverage in action tables.

Cultural Resources

- Expanded the introduction to cultural resources to present a broader and more accurate framing and clarified the scope and focus of "cultural resources" within this planning effort.
- Enhanced and clarified Tribal engagement and perspectives throughout the document.
- Co-developed cultural resources-focused adaptation strategies, actions, and an implementation roadmap with Tribal partners.
- Incorporated edits from Tribal partners into strategies and actions that intersect with Tribes and cultural resources.

Groundwater & Recharge Clarifications

- Updated groundwater language to align with SGMA and the Groundwater Sustainability Plans.
- Clarified that recharge and infiltration actions should be pursued only where feasible and effective, not uniformly across the watershed.
- Explained that managed recharge opportunities are limited, especially in the Upper Ventura River Groundwater Basin, and emphasized co-benefits of permeable surfaces where applicable.
- Removed generalized statements about groundwater basins and clarified that each basin behaves and is managed differently.

Agriculture & Water Quality

- Reframed agricultural strategies to reflect that irrigated agriculture's water quality impacts are generally low and well-monitored, aside from legacy pesticide concerns.
- Highlighted that livestock and manure-related operations may pose higher climate-sensitive water-quality risks.
- Noted that climate change may increase water quality risks even in areas with historically low impairments.
- Refined surface- and stormwater-quality discussions to correct technical inaccuracies, incorporate long-standing MS4/TMDL monitoring programs, and more clearly distinguish wastewater, stormwater, and agricultural contributions under extreme climate conditions.

Ecosystems

- Restructured the Ecosystems subsection of the "State of the Watershed" chapter for better flow and reduced redundancies.
- Added explicit recognition of invasive weeds as a significant ecological challenge that may worsen under climate extremes.
- Coordinated with Matilija Dam Ecosystem Restoration Project team to ensure VRWRP highlights progress and align recommendations appropriately.

Water Supply & Coordination

- Emphasized the need for stronger interagency coordination across stormwater, flood management, water supply, and land-use programs to reduce administrative silos.
- Strengthened language around transparency and cross-agency communication in water supply planning.

Appendix G

Full Tribal Engagement Report

Tribal Engagement Report

Ventura River Watershed Resilience Pilot Project

Compiled by Ventura County Resource Conservation District – February 2026

Land Acknowledgment

The Ventura River Watershed is the homeland of the Chumash people, who remain present here and in active relationship with the watershed as a living system connecting to xutaš. Through embarking on this planning effort, and in conversation with Chumash leadership, we have learned that all planning and resilience efforts sit inside that reality. They also sit within the truth that the landscape has been shaped by colonization, missionization, removal, and by later land and water decisions that can continue harmful impacts. Naming that history matters because it is part of the conditions we are planning within and intertwined with our work. As we talk about resilience and stewardship in this plan, we do so with the awareness that Indigenous governance, knowledge, and presence are ongoing here. We offer this acknowledgement to set the tone for how we continue planning, with the intention of moving in partnership towards future endeavors.

Background: To address increasing climate risks to water resources and to incentivize inclusive, watershed-scale collaboration, the California Department of Water Resources (DWR) established the Watershed Resilience Pilot (WRP) Program with funding authorized in the 2021 and 2022 Budget Acts. This Pilot Project aligns with the 2023 California Water Plan's key priority to achieve climate and watershed resilience across the state.

DWR launched the pilot program in 2024, awarding funds to five diverse regional planning efforts across California, including in the Ventura River Watershed. These pilot projects are intended to test and refine watershed-scale resilience planning approaches that integrate climate science, community engagement, and multi-sector water management strategies – resulting in detailed Watershed Resilience Plans that take a headwaters-to-outlets approach to:

- Center equity in all water decisions
- Assess current water conditions and climate risks
- Analyze threats such as drought, floods, wildfire, and water quality
- Develop strategies such as conjunctive use, water use efficiency, flood management, removal of invasive species, and ecosystem restoration

This report describes the process and outcomes associated with development of the Ventura River Watershed Resilience Plan.

Importance of Tribal Engagement

As stated in the land acknowledgement above, the Ventura River Watershed is within the ancestral and contemporary homelands of the Ventureño Chumash, whose cultural, ecological, and stewardship connections to the watershed continue to this day. The Barbareño/Ventureño Band of Mission Indians (BVBMI) is a sovereign Tribal government representing Ventureño Chumash descendants in the watershed.

The Watershed Resilience Pilot Program, administered by the Department of Water Resources (DWR), places emphasis on meaningful engagement with Tribes and encourages incorporation of Indigenous Science and Traditional Ecological Knowledge where appropriate. Engaging with local Tribes and Tribal members was important to the success of developing and implementing the Ventura River Watershed Resilience Plan.

Tribal Consultation

As a local government, the lead agency on this project, VCRCD, followed the consultation protocol outlined by DWR which includes adherence to Government Code §65352.3 and §65352.4 which requires local governments to consult with California Native American tribes identified by the Native American Heritage Commission (NAHC) for the purpose of avoiding, protecting, and/or mitigating impacts to cultural places when creating or amending General Plans, Specific Plans and Community Plans.

In addition to formal engagement with BVBMI leadership, including Tribal chairman Matthew Vestuto, the WRP process also built on a long-standing relationship with Chumash culture bearer, educator and community member Julie Tumamait-Stenslie who has participated in watershed planning efforts over many years. Ms. Tumamait-Stenslie is a respected Chumash Elder whose family has longstanding ties to the watershed. She has consistently provided cultural perspective within Watershed Council activities.

The VCRCD also relied on previous work conducted, and existing partnerships, to not only consult Tribal Governments but also nurture relationships and identify opportunities for collaboration with Tribal Governments, Chumash culture bearers, and Indigenous/Chumash led non-profits.

For the WRP project, VCRCD staff requested a Local Government Tribal Consultation List and a Sacred Lands File search from the Native American Heritage Commission and included the Ventura River Watershed boundary as the project scope area.

The VCRCD received a list of 18 contacts and 12 entities with traditional lands or cultural places/ceremonial practices located within the boundaries of the Ventura River Watershed. Additionally, the Sacred Lands File (SLF) check conducted through NAHC identified cultural resources within the project areas and directed VCRCD to contact the Barbareño/Ventureño Band of Mission Indians (BVBMI) for more information.

With this, VCRCD developed a questionnaire to accompany the project notification and consultation request that included key questions such as, “Would your Tribal government like to have an introductory meeting with Ventura County Resource Conservation District to discuss your perspectives, concerns, and expectations for the Wildfire Resilience Prioritization Plan and the Ventura River Watershed Resilience Plan implementation and future initiatives?”, “Are there specific topics related to watershed resilience that you are most interested in?”

Although initial outreach resulted in little response, VCRCD continued to pursue other methods of engagement. VCRCD was ultimately successful in connecting with BVBMI’s current Chairman, Matthew Vestuto, and following this introduction, VCRCD met with the Chairman and his representatives a

number of times to discuss the Watershed Resilience Project. and the role the Tribal government wished to have in the WRP planning effort.

The Barbareño/Ventureño Band of Mission Indians (BVBMI)

The Barbareño/Ventureño Band of Mission Indians (BVBMI), like many Tribal governments, operates with limited staffing and resources relative to the breadth of engagement requests they receive and, for this reason, joined the WRP planning effort half-way into the project. Despite these constraints, Tribal representatives participated in developing parts of the plan related to cultural resources, Tribal representation, and place-based stewardship.

The BVBMI Chairman and BVBMI representatives also participated in an asset manager interview, the final community forum, one Advisory Group meeting, and communicated directly with the WRP team. Additionally, BVBMI hosted the WRP's final community forum. For more information about the community forums see section below.

Broader Chumash Community Involvement

During this initial outreach to Tribal governments, VCRCD and Project Managers leaned on existing relationships and studies compiled in past watershed planning efforts. This included reviewing the Tribal Needs Assessment for Ventura County facilitated by the Sacred Places Institute in 2023 as part of the Water Talks Program and engaging with Chumash Elder, Julie Tumamait-Stenslie and the Chumash led Indigenous non-profit, Native Coast Action Network. Meetings were held with both parties to understand how involvement and collaboration could best align with and support the Watershed Resilience Plan and to gauge interest in further developing and expanding the Watershed Network.

As part of the Watershed Resilience Planning Process, 3 in-person community forums were held at Camp Arnaz in Oak View (located on sacred Chumash land). The first two WRP forums were attended by Chumash community members and cultural practitioners, prior to participation from BVBMI. Broader group discussions emphasized interest in incorporating Indigenous knowledge and cultural resource protection within watershed resilience planning. This further highlighted the importance of seeking meaningful relationships with Tribal governments to understand their priorities and reaffirmed sovereignty.

At the first two forums, Chumash Elder, Julie Tumamait-Stenslie welcomed participants with a custom prayer that acknowledges Chumash ancestry and presence but also extended her welcome and gratitude to all living beings.

BVBMI hosted the WRP's final community forum, titled ***kišunuškuy – Planning for Resilience***, creating space for BVBMI to articulate their values, stewardship principles, and implementation perspectives directly with the Watershed Council, elevating Tribal voices and visibility within the Plan's development and future implementation.

Advocacy and Incorporation of Indigenous Science

Through engagement with Native Coast Action Network (NCAN), and engagement with Chumash Elder Julie Tumamait-Stenslie, the WRP Network became more aware of Chumash perspectives on climate change and deepened its understanding of broader applications of Indigenous science within climate adaptation and resilience planning.

These discussions emphasized that much of this knowledge is already documented and practiced, and that the central challenge lies not in generating new information, but in thoughtfully building bridges

between Indigenous knowledge systems and Western planning frameworks and the language associated with each.

Representatives from Barbareño/Ventureño Band of Mission Indians (BVBMI), Native Coast Action Network (NCAN), and Chumash Elder Julie Tumamait-Stenslie, consistently elevated Indigenous perspectives throughout WRP Advisory Group meetings, Watershed Council (Network) meetings, Community Forums and discussions with WRP consultants. Their input helped ensure the adaptation strategies and implementation actions reflect Indigenous perspectives and priorities, while aligning with existing Tribal and regional planning efforts.

Expanding Trust and Relationships

Engagement with the sovereign Tribal government BVBMI - as well as the broader Chumash community during the WRP planning effort has resulted in stronger connections and relationships through informal gatherings and at WRP-related meetings. Building trust and relationships is supported not only through the WRP planning process, but also through concurrent land stewardship efforts and projects such as the Matilija Dam Ecosystem Restoration Project.

A notable area of strong collaboration is a shared interest in the ecological benefits of fire. Concurrent with development of the WRP, VCRCD was awarded a fuels reduction and fire prevention grant to expand its work with the prescribed fire community. Cultural burning has been practiced by Chumash people for thousands of years as a form of livelihood, cultural continuity, and ecological management. Following colonization in the late 18th century, these practices were criminalized, leading to the disruption of Indigenous land management systems and contributing to the long-term consequences of fire suppression that continue to shape California's landscapes today.

Through partnerships with private landowners and volunteer-based prescribed burn efforts, VCRCD is supporting the reintroduction of beneficial fire to reduce hazardous fuels, improve ecological function, and enhance community safety. As VCRCD coordinated and implemented these projects, they became spaces for shared learning and collaboration across a broad cross-section of the community, including Chumash community members.

Participating together in hands-on land stewardship creates opportunities for strengthening relationships beyond formal planning processes. Participants regularly attending meetings, burn projects, community events and training sessions together, get to know each other, which breaks down barriers to communication and encourages ongoing dialogue. This sustained engagement contributed to collaboration across multiple initiatives and fostered deeper involvement from Barbareño/Ventureño Band of Mission Indians.

Ongoing relationship-building, collaboration, and the recognition of Tribal government sovereignty will be important in continuing to build trust moving forward and during implementation of the Watershed Resilience Plan, recognizing that the nature and extent of engagement will continue to be guided by Tribal priorities and capacity.

Opportunities for Enhanced Tribal Engagement in the Future

Engagement in the Watershed Resilience Planning process was shaped by important constraints and lessons learned. The limited duration of the grant period impacted the depth and pace of relationship-building among the WRP Team, VCRCD, BVBMI, Native Coast Action Network and other local Chumash people, and consultants. Native Coast Action Network and BVBMI Tribal government entered the process at different stages and engaged according to their own priorities and capacity. While progress

was made, the engagement achieved through this planning process represents an initial step. Additional time and capacity in the future will allow for stronger, more effective, Tribal engagement, collaboration, and deeper relationships across the Watershed.

Further Resources and Reading Materials

Numerous additional resources are available to help you learn more about Indigenous climate adaptation and tribal consultation within the region. The materials listed below provide deeper context on protecting cultural resources and incorporating Traditional Ecological Knowledge into watershed management. These references serve as a starting point for building informed and respectful collaborative partnerships.

Chumash and Indigenous Climate Change Resources

Applegate, R. B. (1974). Chumash Placenames. *Journal of California Anthropology*, *1*(2), 187–205.

Librado, F., Solares, M., Ygnacio, L., Garcia, L., Soto, Juan de Jesus, Pico S. (1975) *December's Child: A Book of Chumash Oral Narratives*. Ed. Blackburn, T.C. University of California Press.

Indian Country Today, 2025/9/30, *Native Voices Rising at Land Conservation Conference*. https://youtu.be/7qgtsvf_eaQ?si=RXMm6e-vdKIVlHpW.

Institute of Tribal Environmental Professionals (2025). Status of Tribes Climate Change Report. https://sites.google.com/view/staccreport/access-the-reports/stacc-volume-2?authuser=0

Librado, F. (1979). *Breath of the sun : life in early California* (J. P. Harrington; T. Hudson, Ed.). Malki Museum Press.

Librado, F., & Harrington, J. P. (1977). *The eye of the flute : Chumash traditional history and ritual* (C. Grant, Ill.; T. Hudson, Ed.; Limited edition.). Santa Barbara Museum of Natural History.

MacCarthy, J., Richter, J., Borcea, S., Barriaga I., (Sept, 24, 2025, Sept 24). "How Indigenous Leadership can Reduce Extreme Wildfire Risk." World Resources Institute. https://www.wri.org/insights/extreme-wildfires-indigenous-community-leadership

Pala Band of Mission Indians & Santa Ynez Band of Chumash Indians (2021). Summary of the Southern California Tribal Listening Session (March 9-10 and April 13-14, 2021), hosted by the Pala Band of Mission Indians, Santa Ynez Band of Chumash Indians, and the Office of Environmental Health Hazard Assessment. https://oehha.ca.gov/sites/default/files/media/downloads/climate-change/document/socallssummary.pdf

Sacred Places Institute. (2022). Tribal Water Needs Assessment for Ventura County.

Santa Ynez Band of Chumash Indians (2022). Impacts of Climate Change on the Santa Ynez Band of Chumash Indians. In: OEHHA 2022 Indicators of Climate Change in California. https://oehha.ca.gov/sites/default/files/media/epic/downloads/06santaynez.pdf

State of California OEHHA. Indicators of Climate Change: Impact on California Tribes. (2025, 10/13). https://oehha.ca.gov/climate-change/general-info/indicators-climate-change-impacts-california-tribes

Tribal Alliance Productions. *Doctrine of Recovery.* 2022.

Consultation with California Indian Tribes Resources

Ortiz, B., & Castro, G. (2025). Respectful Tribal Consultation Protocols from Native California Perspectives. *Parks Stewardship Forum*, *41*(1), 83–93. https://www.jstor.org/stable/48806948

California Natural Resources Agency. CNRA Tribal Consultation Policy, Best Practices and Resources. https://resources.ca.gov/Initiatives/Tribalaffairs/TribalConsultation

Appendix H

CAUSE Engagement Final Report

January 16, 2026

Dear Ventura River Watershed Resilience Project Team,

This report fulfills CAUSE's scope of work as a community engagement partner supporting the Ventura River Watershed Resilience Project through targeted outreach to the West Ventura Avenue community through community survey development and implementation and the facilitation of community focus groups. The purpose of this engagement was to elevate community voices, document lived experiences related to climate hazards, and identify community informed strategies to strengthen environmental resilience within the Ventura River Watershed and surrounding neighborhoods.

CAUSE first developed and implemented a survey focused specifically on the climate and water challenges in the Ventura River Watershed. CAUSE collected 113 surveys during July and August of 2025 and focused on high volume places like the Red Barn Market and door to door neighborhood outreach. Over half of the 113 surveys collected were completed in Spanish.

CAUSE conducted two community focus groups to ensure inclusive and representative participation across age groups and language access needs during November of 2025. One focus group was held in Spanish with (8) adult residents, and a second focus group was conducted in English with (13) Ventura High School youth. Both groups received the same background presentation on watershed conditions, projected climate impacts, and potential adaptation strategies, and were guided through structured discussions on extreme heat, drought, flooding, and wildfires. Participants were also invited to prioritize resilience strategies through a voting exercise to identify the solutions they felt were most urgent and impactful.

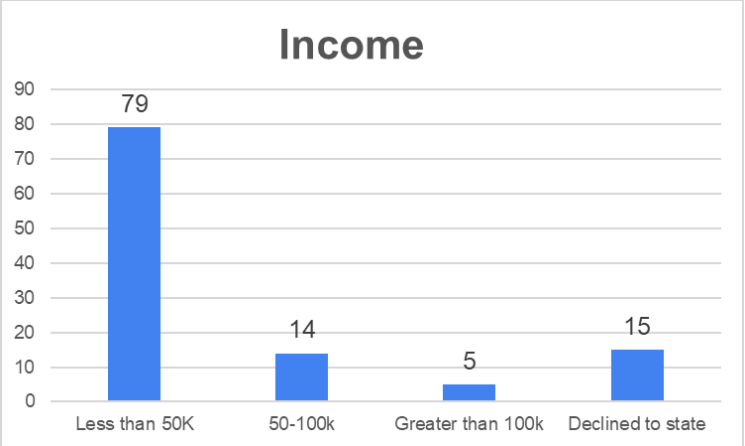
The report below synthesizes key themes, priorities, and recommendations that emerged from the surveys collected and focus groups. These insights reflect shared experiences across generations and demonstrate strong alignment on the types of investments and strategies needed to improve climate preparedness, protect vulnerable populations, and support equitable access to safe, resilient environments. More detailed findings and prioritized recommendations are included throughout the full report.

VRWRP Survey Key Findings

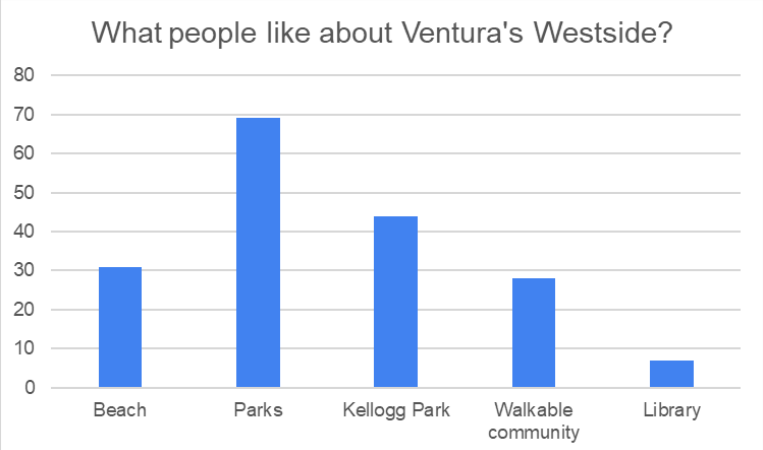
CAUSE worked with the VRWRP team to develop a community survey to assess the community's perception of their neighborhood and the impact of climate change and extreme weather events. The team decided on eight open ended questions, with two initial questions focused on perceived positives and negatives in the community and six follow up questions focused specifically on the climate and water challenges in the Ventura River Watershed. Two CAUSE staff members trained five CAUSE Youth Fellows to do community outreach and survey collection. Together this team collected 113 surveys and focused on high volume places like the Red Barn Market and door to door neighborhood outreach. Surveys were collected in July and August of 2025. Over half of the 113 surveys collected were completed in Spanish.

Demographics of survey participants:

92% of survey participants were West Ventura residents, with the rest from Oakview or Casitas Springs. 77% of those surveyed were Latino and 15% identified as white. The vast majority of those surveyed, 70%, made under $50,000 per year.



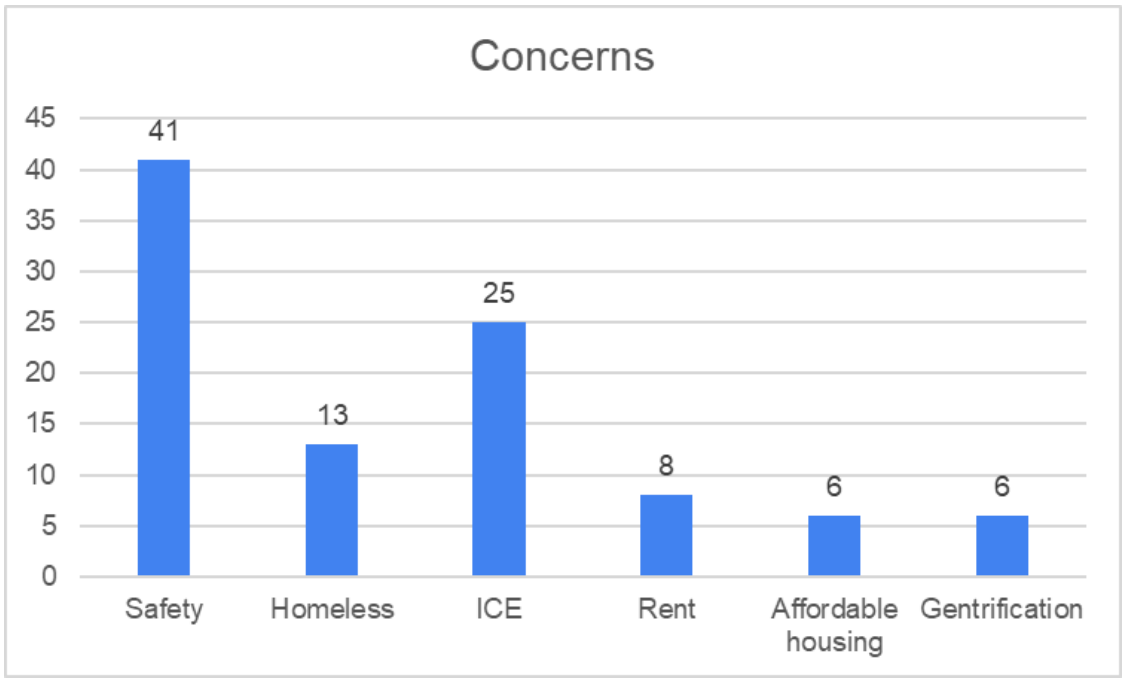
The benefits of living on the Westside:



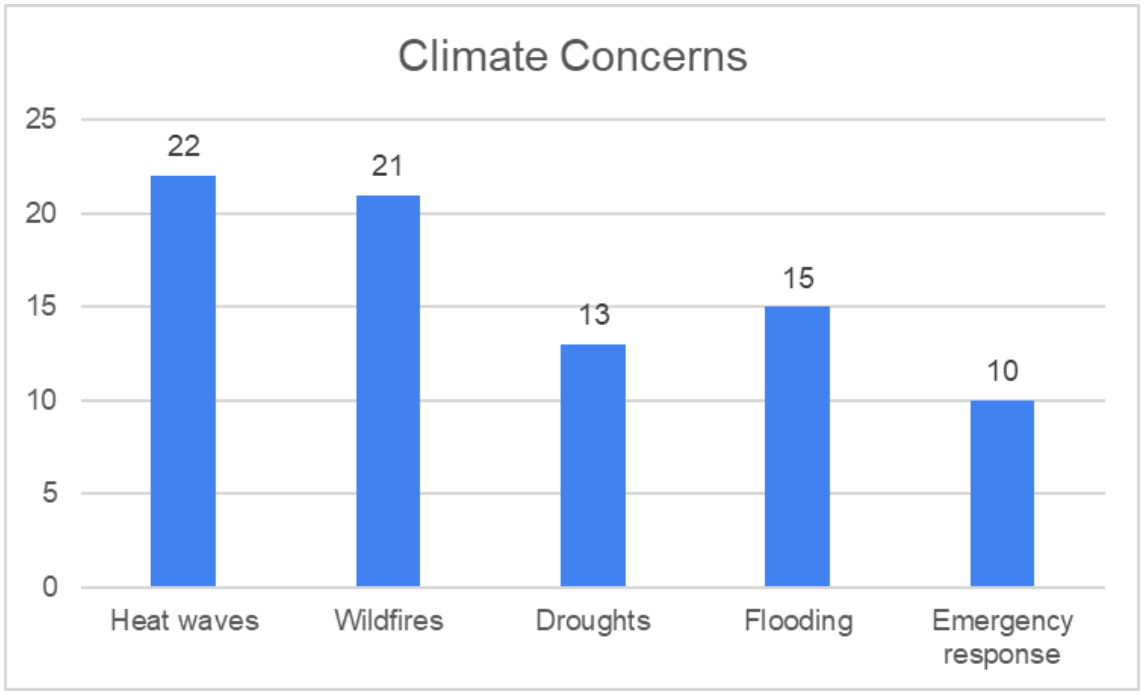
The amenities people enjoy on the westside are mostly outdoor activities and many respondents enjoy walking to places. The Avenue feels like a community where people have all the things they need within walking distance or close by. Many other activities that had more than 10 responses included walking on Main Street, frequenting local stores and markets, and accessing bike trails for exercise.

The most notable **concerns** people had were regarding safety due to crime and ICE activity and housing needs, a problem throughout California. Aggregating the issues of Homeless, Rent,

Affordable Housing, and Gentrification, means that over a ¼ of respondents mentioned housing as a concern.



People concerned equally about different extreme weather events

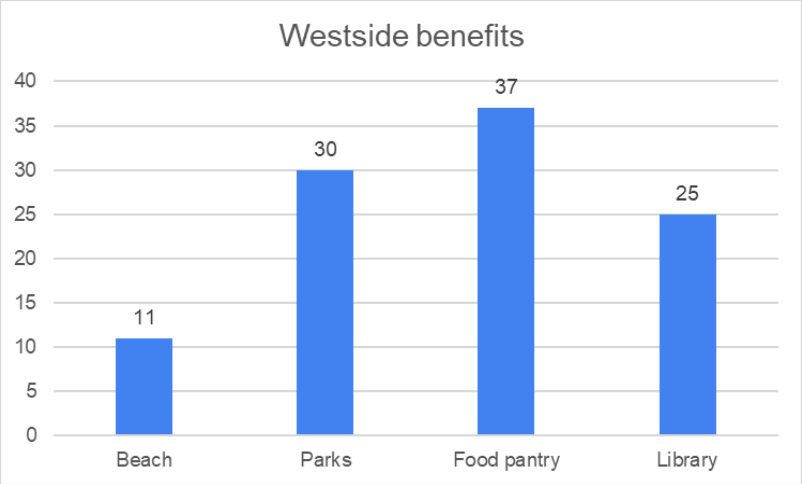


Heat waves, wildfire, droughts, and flooding all had a similar number of responses. About a quarter of participants mentioned emergency response to extreme weather events as a major

concern; respondents expressed it in different ways including the need for evacuation routes, gridlock during emergency evacuation, and the lack of an evacuation plan for the Westside.

Survey respondents lived through the Thomas fire. The impact of the Thomas Fire is still widely remembered and felt. Over two-thirds of those surveyed mentioned experiencing the Thomas Fire which means many of the people surveyed have lived on the Avenue for at least 10 years. Also some people mentioned other impacts due to wildfires like poor air quality and the lack of safe drinking water. The next largest concerns were flooding and mudslides.

People find that the number of food pantries accessible to residents along with public amenities, such as the Library and parks, benefit those living on the westside.



Finally, people do think that worsening climate events will impact the Avenue as 3 out of every 5 respondents said yes to this. People look to the police and fire department during times of emergencies with churches also mentioned. We were surprised social media platforms weren't as mentioned but overall people use a combination of emergency alerts, social media, and public entities like the police and fire department in times of emergency.

VRWRP Focus Group Key Findings

Summary of Key Findings:

Across surveys and two community focus groups held in November of 2025, one with Spanish-speaking adults (8 participants) and one with English-speaking youth (13 participants - ages 13-17), clear and consistent themes emerged about climate resilience, the Avenue community and the Ventura River Watershed. While participants expressed a strong desire to protect local natural green spaces and conserve vital water resources, they also emphasized that the impacts of climate change are deeply connected to the everyday realities they experience at home, at school, and in their neighborhoods. Both adults and youth identified similar concerns related to extreme heat, drought, flooding, and wildfires, highlighting how these hazards directly affect family health, housing stability, transportation, access to water, and overall community safety. These shared experiences revealed three key issue areas that shape how residents engage with their environment: the need for cooling and shade infrastructure, addressing existing gaps in emergency response and communication, and the importance of accessible, culturally relevant education. Together, these themes illustrate that effective climate resilience planning must address not only long-term environmental protection, but also the immediate, lived impacts climate hazards have on community members' daily lives, access to resources, and ability to safely enjoy and care for the Ventura River Watershed and surrounding ecosystems.

Focus Group Main Themes:

Need for More Shade, Trees, and Cooling Infrastructure

Across both focus groups, participants consistently identified the need for expanded shade, tree canopy, and cooling infrastructure as a top priority for climate resilience in West Ventura. Extreme heat was described as a growing barrier to outdoor activity, community gatherings, and daily routines, particularly during peak summer months. Participants emphasized that cooling solutions must be integrated into both public spaces and residential areas to protect community health and improve overall quality of life.



Spanish-speaking adult participants strongly emphasized the importance of tree planting along major corridors, long streets, and avenues, particularly

in areas where people walk, wait, or gather, such as near schools, bus stops, parks, and key intersections. Shade was viewed as a critical, low cost strategy to reduce heat exposure for families, children, seniors, and people waiting for transit. They consider these spaces as especially important during the summer, when families want safe places for children to be outdoors without risking heat-related illness. Adults also identified cooling centers that provide access to cooler indoor spaces, drinking water, and bathrooms or showers as a solution to extreme heat.

Adult participants also raised concerns about housing conditions, noting that many homes do not have air conditioning or that families cannot afford to install AC units. In some cases, keeping windows open during heat waves was described as ineffective or unsafe due to high outdoor temperatures. Participants expressed interest in programs that could support AC unit rentals, refurbished or recycled cooling equipment, and other low-cost cooling options. Additionally, adults expressed enthusiasm for solar integrated shade infrastructure, referencing examples such as solar panel canopies at public facilities, which provide both shade and renewable energy benefits.



Youth participants echoed many of these concerns and emphasized similar priorities. They highlighted the need for trees along cross streets and major corridors, particularly near schools, bus stops, and commonly traveled routes. Youth placed strong emphasis on hydration stations at bus stops, noting that students and community members often wait for extended periods in direct sunlight during the hottest parts of the day. Access to water fountains, misting systems, or other cooling features at transit stops was seen as essential for safety and equity.

In addition, youth expressed a strong desire for community pools, cooling zones, and water based recreation spaces, such as waterparks or splash areas. These spaces were viewed not only as recreational amenities but as important climate adaptation tools that allow residents to remain active outdoors while staying cool and hydrated during extreme heat events.

Shared Takeaway:

Across generations, there is strong alignment that cooling infrastructure, including shade trees, hydration access, cooling centers, and climate adapted public spaces is one of the most urgent and widely supported climate adaptation strategies for West Ventura. Both adults and youth see these investments as essential to protecting health, supporting outdoor activity, and ensuring equitable access to safe, livable environments as temperatures continue to rise.

Concerns About Emergency Response and Communication

Participants across both focus groups expressed significant concern about gaps in emergency response, communication, and preparedness during climate related disasters. Many referenced past experiences, particularly during wildfire events such as the Thomas Fire, where examples of slow, unclear, or last minute communication left residents feeling confused, unsafe, and under informed. Overall, participants emphasized that current emergency systems do not adequately reach all residents, especially Spanish-speaking households and those living closest to high risk areas.



Both focus groups identified evacuation routes and evacuation planning as a major area of concern. Participants expressed a desire for clearer and more consistent information from the City regarding how evacuation routes are determined and updated, particularly for neighborhoods near hillsides and fire prone areas. Suggested improvements included mailed notices, flyers, social media alerts, and local educational events or workshops that explain evacuation protocols in advance. Spanish-speaking adults specifically emphasized the need for evacuation education and materials available in Spanish to ensure families understand when and how to evacuate safely.

Participants also highlighted shortcomings in emergency alerts and warning systems. Many felt that alerts during past emergencies were delayed, inconsistent, or lacked clear direction. Both groups expressed interest in stronger, more immediate warning systems, such as Amber Alerts, loud street level alarms or sirens, and frequent real time updates through digital platforms. There was a shared expectation that emergency communication should be proactive, timely, and coordinated across agencies, rather than reactive or fragmented.

In addition to official alerts, participants discussed the importance of broader communication systems between agencies and the public. Spanish-speaking adults, in particular, emphasized the need for clear, consistent communication in Spanish from city departments and emergency responders. At the same time, adults also noted that communities should be empowered to build their own communication networks, such as neighborhood group chats, WhatsApp groups, or phone trees to share information quickly during emergencies when official channels may be delayed or overwhelmed.

Traffic flow during evacuations emerged as another major concern shared by both groups. Participants described evacuation related traffic congestion as chaotic and dangerous, particularly for residents attempting to leave high risk areas quickly. Youth and adults alike questioned how the City plans to manage traffic during large scale evacuations and how different agencies (such as police, fire departments, and city officials) will coordinate to reduce panic, confusion, and gridlock. There was a strong desire for greater transparency around evacuation planning and inter agency coordination.

Participants also raised concerns about sheltering and temporary housing options during emergencies. Several individuals described experiencing housing instability for days or weeks following disasters due to evacuation orders or home damage. Many families cannot afford hotels or extended stays, prompting questions about how the City and partner agencies can provide accessible, short-term emergency shelter or housing support during and after climate events.

While both groups shared similar concerns, each brought distinct perspectives. Spanish-speaking adults emphasized the need for community alert systems such as sirens, flashing lights, expanded shelter options, and neighborhood based communication networks. Youth participants focused more on stronger warning systems, improved evacuation routes, and centralized resource centers that provide real time emergency information. Together, these perspectives highlight a shared sense of vulnerability and a strong desire for clearer guidance and better preparedness.

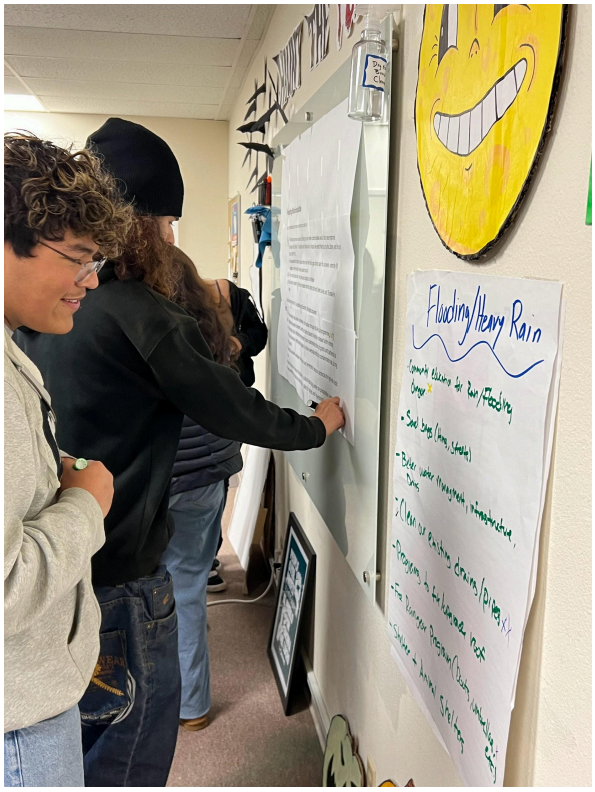
Shared Takeaway:

Both generations expressed that they feel unprepared and underinformed during climate-related emergencies, underscoring the need for improved communication systems, clearer evacuation planning, multilingual outreach, and accessible sheltering options to ensure community safety during future disasters.

Desire for Community Education and Spanish-Language Resources

Both adult and youth participants independently emphasized the importance of **accessible, community-centered climate education** as a foundational component of climate resilience in West Ventura. Across discussions, participants expressed a strong desire for information that is easy to understand, culturally relevant, and delivered in ways that feel welcoming and inclusive to the communities most affected by climate hazards.

Spanish-speaking adult participants highlighted the need for **Spanish-language education on climate safety and preparedness**, including topics such as home cooling strategies, wildfire prevention and evacuation, flood preparation, and extreme heat response. Adults noted that many existing meetings, trainings, and public workshops do not feel accessible or welcoming for Spanish-speaking families, either due to language barriers or the format in which information is shared. Participants stressed the importance of **intentional outreach** to Spanish-speaking residents and the expansion of Spanish-oriented educational opportunities throughout the city so families can better understand climate risks and how to respond before emergencies occur.



Participants from both focus groups also emphasized the value of **education through schools for parents and students**. Schools were consistently identified as trusted and accessible spaces that already serve as a direct link between government agencies and households (particularly for Spanish-speaking and immigrant families). Participants expressed interest in school based workshops, take home materials, and family centered educational events that allow students and parents to learn together about climate hazards, emergency preparedness, and available resources. This approach was viewed as an effective way to ensure information reaches entire households rather than individuals alone.

Youth participants echoed the need for more education but focused on **content and delivery**. They expressed interest in learning more about drought impacts, vegetation health, flood safety, and wildfire preparedness, while also noting that climate information can sometimes feel overwhelming or overly technical. Youth emphasized the need for **interactive, engaging, and hands-on educational opportunities**, such as workshops, demonstrations, or youth-led learning

spaces, that make climate resilience topics easier to understand and more relevant to their daily lives.

Both groups also stressed the need for **culturally relevant preparedness information**, particularly for Spanish-speaking households. Participants emphasized that emergency alerts, hazard updates, drought and water information, and evacuation guidance should automatically reach families in the languages they use at home. While many families rely on Spanish, participants also acknowledged that some neighbors speak Indigenous languages, further reinforcing the need for multilingual communication. In addition, participants expressed a desire for preparedness plans, maps, and educational materials that are **tailored specifically to West Ventura**, reflecting local evacuation routes, flood prone areas, and neighborhood conditions rather than one size fits all citywide messaging.

Shared Takeaway:

Education emerged as a central pillar of community resilience across both focus groups. Participants consistently emphasized that **multilingual, culturally relevant, and community-based education(delivered through trusted spaces like schools and neighborhood hubs) is essential to improving preparedness, strengthening communication, and supporting safer outcomes during climate related emergencies**. The community's repeated call for education, cooling resources, and accessible information also points to the potential value of developing a **Westside community resilience hub** that combines learning, preparedness, and support services in one accessible location.

Recommendations:

Based on survey results and focus group feedback from Spanish-speaking adults and English-speaking youth in West Ventura, the following recommendations reflect community identified priorities to strengthen climate resilience, improve access to resources, and protect both residents and the Ventura River Watershed. Recommendations are organized into three key categories: Amenities, Programs & Cultural Gaps, and Access & Infrastructure.

Amenities:

- **Expand Shade and Tree Canopy** - Prioritize the planting of trees along major corridors, cross streets, near schools, bus stops, parks, and walking routes. Expanded tree canopy was consistently identified as a critical strategy to reduce heat exposure, improve walkability, and support community health during extreme heat events.
- **Develop Cooling Centers and Cooling Zones** - Create accessible cooling centers and shaded cooling zones that provide relief during heat waves. These spaces should offer cooler indoor temperatures, drinking water, and restroom access, and be located in trusted community spaces such as libraries, schools, or community centers.
- **Increase Hydration Infrastructure** - Install water fountains, hydration stations, and misting systems at bus stops, parks, schools, and high traffic pedestrian areas. Reliable access to water was identified as essential for public safety, particularly for youth, families, and unhoused residents during heat and drought conditions.
- **Integrated Solar Shade Infrastructure** - Incorporate solar powered shade structures, such as shaded parking areas, walkways, or public gathering spaces, to provide heat relief while supporting renewable energy goals. Community members referenced existing examples (ex. Ventura County Government Center) and expressed strong interest in expanding this dual benefit infrastructure.
- **Provide Water-Based Cooling Amenities** - Explore opportunities for community pools, splash pads, or water based recreation spaces that allow residents to safely enjoy outdoor spaces during extreme heat while remaining cool and hydrated.

Programs & Cultural Gaps:

- **Expand Multilingual Climate Education Programs** - Develop climate preparedness programs in Spanish and English that address heat safety, drought response, flood preparation, and wildfire evacuation. Participants emphasized that education must be linguistically accessible and culturally welcoming to ensure broad community participation.

- **Deliver Education Through Schools for Families and Youth** - Use schools as hubs for climate education by offering family centered workshops, student led learning opportunities, and take home informational materials. Schools were identified as trusted spaces that effectively connect government agencies with households, particularly Spanish-speaking and immigrant families.
- **Offer Interactive and Youth-Friendly Learning Opportunities** - Create engaging, hands-on educational programs such as workshops, demonstrations, guided walks, and youth led activities. Youth participants noted that climate information can feel overwhelming or overly technical and expressed a preference for interactive formats.
- **Provide Community Preparedness Workshops** - Host neighborhood based workshops focused on evacuation protocols, emergency kits, air quality safety, sandbag use, and flood preparation. These workshops should occur before peak hazard seasons and include clear guidance tailored to West Ventura conditions.
- **Strengthen Community Communication Networks** - Support the development of community led communication systems (such as WhatsApp groups, text alerts, or phone trees) to complement official emergency alerts. Participants emphasized that neighbor-to-neighbor communication can be critical during emergencies.
- **Increase Awareness of Local Environmental Resources** - Develop outreach and education programs that highlight local green spaces, watershed resources, and resilience initiatives. Increasing awareness helps residents better understand, access, and care for local ecosystems connected to the Ventura River Watershed.

Access & Infrastructure:

- **Improve Emergency Alert and Warning Systems** - Strengthen emergency notification systems through timely alerts, loud alarms or sirens, Amber Alerts, and real time digital updates. Communication should be coordinated across agencies and available in multiple languages to ensure broad reach.
- **Enhance Evacuation Route Planning and Education** - Provide clear, accessible information on evacuation routes and protocols through mailers, digital platforms, signage, and community workshops. Participants expressed a strong need for transparency and education around evacuation planning, particularly for hillside and high risk neighborhoods.
- **Address Traffic Flow During Emergencies** - Develop and communicate coordinated traffic management plans for evacuations to reduce congestion, confusion, and safety risks. Residents want clarity on how police, fire, and city agencies will work together during large scale events.
- **Expand Emergency Sheltering and Temporary Housing Options** - Increase the availability of emergency shelters and temporary housing support for residents displaced

during disasters. Many families cannot afford hotels or extended stays, highlighting the need for accessible, community based shelter solutions.

- **Upgrade Flood and Drainage Infrastructure** - Prioritize cleaning and maintaining existing drains, culverts and pipes, and invest in infrastructure upgrades at known flood prone locations. Both adults and youth identified flooding and drainage failures as ongoing safety concerns.
- **Ensure Equitable Access to Resilience Resources** - Design resilience infrastructure and programs to prioritize West Ventura neighborhoods, ensuring that resources such as cooling centers, water access, education, and emergency services are conveniently located and accessible to those most impacted by climate hazards.
- Develop a **Westside community resilience hub** that combines learning, preparedness, and support services in one accessible location.

STAFF

Kristian Núñez
Senior Policy Advocate

Jose Rodriguez
Community Organizer

Cameron Yee
Operations and Research Director

Lucia Marquez
Associate Policy Director

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www.causenow.org ● (805) 658-0810
56 E. Main St. Suite 200 - Ventura, CA 93001

Appendix I

CSU Network Assessment Report

The following appendix provides additional information and detail about the network assessment that was completed for the Ventura River Watershed Resilience Plan.

Survey and Data Analysis Methodology

To collect data for the existing watershed network assessment, survey questions were developed by the research team in consultation with the VRWRP project managers. Questions were developed in part based on survey questions used for similar projects, including the Los Angeles River Stewardship Mapping & Assessment Project (STEW-MAP) and the WaterTalks Ventura County Needs Assessment Report. Questions were also reviewed by members of the Watershed Resilience Project Advisory Group Committee (Advisory Group) for clarity and to ensure that sufficient data would be collected for the network assessment analysis and to support future network engagement opportunities. The text of the final survey questions is available at the end of this appendix. After consultation with staff from the CSU Northridge Institutional Review Board (IRB), it was determined that the survey did not meet the definition of "human subjects research" under federal guidelines as survey participants were acting as professional representatives of their organizations and providing information about organizational capacities, collaboration, and/or their professional opinions. As such, the survey was not subject to IRB review.

Qualtrics, a web-based tool that supports survey research, evaluations, and other data collection activities, was used to develop and distribute an online survey with the finalized survey questions. This tool was selected due to its relatively intuitive user interface that supports a variety of question types and integrated functionality for sending and tracking survey invitations and reminders. Prior to distribution, the survey tool underwent internal and external testing and validation to ensure that the tool was void of technical errors and other barriers to participant use and data collection. To solicit structured, substantive feedback, participants were provided specific questions related to distribution method, survey completion time, survey content, and usability.

The VRWRP project managers developed a list of contacts at key organizations (based on Ventura River Watershed Council membership and other known community partners) to receive personal links to the survey through the Qualtrics survey platform. Personal unique survey links were used for several reasons: (1) a personalized link can only be used once, which ensures that organizations cannot submit multiple responses; (2) survey responses can be tracked, which allows for targeted reminder messages to be sent for responses that have not been completed; and (3) a personalized link automatically saves the respondents' data as they progress through the survey, allowing them to return and finish the survey on any device.

Individual survey links were sent to the contact list on May 9, 2025, and invited participants were given until May 30, 2025, to complete the survey. During the open survey period, reminders were distributed in bulk through Qualtrics at periodic intervals, and the VRWRP project managers also conducted direct outreach to key partners. After the May 30 deadline passed, further outreach was conducted to organizations that had started the survey but did not finish it. These organizations were provided with a deadline extension of June 20, 2025.

Once the survey was closed, the research team completed the process of cleaning and formatting the data in preparation for spatial, statistical, and social network analyses. For the social network analysis, this included standardizing organization names from write-in responses, removing self-referential choices (i.e., identifying their own organization as a collaborator, information provider, or funder), and organizing the data into the formats required for the Gephi software package and Kumu platform. To create the organizational profiles and to summarize the findings from the survey, respondents were

categorized into one of ten sectors (Water: 12 organizations, Land Management and Conservation of Resources: 10 organizations, Community/Education: 6 organizations, Ecosystem/Habitat: 6 organizations, Wildfire: 6 organizations, Recreation: 3 organizations, Agriculture: 3 organizations, Energy: 2 organizations, Municipal: 2 organizations, and Native/Tribal: 2 organizations). For the spatial analysis, the team conducted follow-up outreach with multiple organizations to acquire geospatial data files and/or verify or refine the spatial accuracy of their reported operational areas. Written responses to questions such as "not in our scope" were removed from the analysis. If respondents were unsure if they had a climate action resilience plan, the team determined whether they had plans based on a limited internet search and adjusted the response accordingly.

Ventura River Watershed Resilience Project (WRP) Community Partner Survey

Background

The Ventura River Watershed Council is conducting this survey as part of the Watershed Resilience Program, a statewide initiative aimed at strengthening watershed-based responses to climate change through inclusive community collaboration. Your input will help us better understand the existing network of community partners, assess opportunities for collaboration, and highlight the most pressing climate concerns facing our watershed. Broad participation is essential, and your responses will help shape the Watershed Resilience Plan and strengthen the role of the Watershed Council as a hub for coordination and action.

Survey Information

This survey should take approximately 20-30 minutes to complete. You do not have to complete the survey in a single session. Your responses will be automatically saved when you close the browser tab/window. You can finish the survey later by clicking on the original survey link. The survey will then open at the last question you answered.

Section 1 of the survey includes questions about your organization and where you work. Section 2 includes questions about your existing collaborations, including which groups you work with and how you work with them. Section 3 includes questions about how your organization views climate challenges and watershed resiliency.

Your Participation

Your participation in this survey is completely voluntary. Your contact information will not be made public in any way; it will only be used if we have questions about the information you provide in the survey.

Only one survey per organization should be submitted. We encourage collaboration within your organization to ensure that your responses reflect the organization as a whole and not just the individual views of the person completing the survey. To facilitate

collaboration, you can forward your unique survey link to another individual in your organization and/or access a copy of the survey questions here.

Your participation is vital to this project and greatly appreciated!

* *Denotes required question*

Section 1: Organization and Contact Information

Q1: *Organization Name _____

Q2: Organization Website _____

Please include the full website address. For example "www.google.com"

Q3: *Your Name _____

Q4: *Your Position in the Organization _____

Q5: *Email _____

Q6: Phone _____

Q7: *What type of organization do you represent? Please select one.

- Academic/research institution
- Community-based organization
- Elected official
- Federal government
- Local government (city, county, regional agency)
- Nonprofit/non-governmental organization
- Private sector/consulting firm
- Public utility (privately owned or publicly owned)
- State government
- Tribal organization
- Other (please specify):_____

Q8: *What is your organization's mission/purpose? Please briefly describe.

_____
_____
_____
_____

Q9: *What is your organization's primary focus? Please select one.

- Agriculture
- Community/Education
- Ecosystems/Habitat
- Energy
- Flood management

- Groundwater
- Land management
- Recreation
- Water quality
- Water supply
- Wildfire preparedness and management
- Other (please specify):_____

Q10: *Where does your organization primarily work within the Ventura River Watershed? Please refer to this map of the watershed. Please select one.

- Entire watershed
- Defined jurisdiction/area/boundary
- Project/site specific location(s)
- Broadly across multiple watersheds, including the Ventura River Watershed
- Other (please specify):_____

Q11: *Does your organization have GIS or spatial data (shapefile or similar) showing the areas where you work?

- Yes
- No

If Q11 = Yes

Q12: Please upload the GIS or spatial data file.

If you do not have the file readily accessible, leave this question blank and we will contact you later to obtain the data.

If Q11 = No

Q13: *Please describe the specific locations, neighborhoods, or jurisdictional boundaries where your organization primarily works within the Ventura River Watershed.

_____
_____
_____

Q14: If you have an image or document (e.g., JPG, PDF, Word) that shows where your organization primarily works, please upload the file.

Section 2: Existing Networks and Collaboration

In this section, "collaboration" means intentionally working with other groups toward shared goals or mutual benefits, including funding, joint projects, resource sharing, or regular information exchange.

Q15: *Is your organization currently part of any regional networks or coalitions that are active in the Ventura River Watershed?

Examples include the Association of Water Agencies of Ventura County, Central Coast Climate Collaborative, Ventura County Wildfire Collaborative, etc.

- Yes
- No

If Q15 = Yes

Q16: *Which regional networks or coalitions in the Ventura River Watershed is your organization involved in?

Please select all that apply. If a network or coalition is not listed, please select “Other” and include the name(s).

- Association of Water Agencies of Ventura County
- Beach Erosion Authority for Clean Oceans and Nourishment (BEACON)
- Central Coast Climate Collaborative
- Land Resilience Partnership
- Matilija Dam Ecosystem Restoration Project
- South Coast Habitat Restoration
- Southern Steelhead Coalition
- Ventura County Agricultural Irrigated Lands Group (VCAILG)
- Ventura County Climate Emergency Council
- Ventura County Climate Hub - 350
- Ventura County Regional Climate Collaborative
- Ventura County Wildfire Collaborative
- Ventura River Watershed Council
- Watersheds Coalition of Ventura County (WCVC)
- Westside Community Council
- Other (please specify):_____

Q17: *Which groups does your organization collaborate with in the Ventura River Watershed?

Please select from the groups listed. If a group is not listed, please select "Other" and include the name.

In the next question, you will be asked to specify how and how often you collaborate with these groups.

Category	Group
Agricultural	University of California Cooperative Extension
	Ventura County Dept of Agriculture
	Ventura County Farm Bureau
	Ventura County Resource Conservation District
Business	Ojai Valley Inn
	Patagonia Action Works
	Taylor Ranch
	Ventura County Coalition of Labor, Agriculture and Business (CoLAB)
Cities	City of Ojai
	City of Ventura Community Development/Planning
	City of Ventura Public Works
County of Ventura	Office of Emergency Services (OES) - Ventura County Sheriff's Office
	Ventura County Executive Office - Sustainability Division
	Ventura County Public Works Agency - Watershed Protection
	Ventura County Resource Management Agency - General Plan Section
	Ventura County Supervisor for District 1
	Ventura County Fire Department
Elected Officials - State	Assembly District 38, Asm. Steve Bennett
	Senate District 21, Sen. Monique Limón
Federal	Bureau of Land Management, US Dept of the Interior
	National Marine Fisheries Service (NOAA Fisheries)
	Natural Resources Conservation Service (NRCS), US Dept of Agriculture
	US Army Corps of Engineers
	US Bureau of Reclamation
	US Fish and Wildlife Service
	US Forest Service
Groundwater Sustainability Agencies	Mound Basin Groundwater Sustainability Agency
	Ojai Basin Groundwater Management Agency
	Upper Ventura River Groundwater Agency
Non-governmental	California Trout
	Central Coast Alliance United for A Sustainable Economy (CAUSE)
	Climate First: Replacing Oil & Gas (CFROG)
	Concerned Resource and Environmental Workers (C.R.E.W.)
	Friends of the Ventura River
	Localizing California Waters

Category	Group
	MERITO Foundation
	Ojai Valley Fire Safe Council
	Ojai Valley Green Coalition
	Ojai Valley Land Conservancy
	Once Upon a Watershed
	Santa Barbara Channelkeeper
	Surfrider Foundation
	Teranga Ranch
	Trout Unlimited
	Trust for Public Land
	Ventura Land Trust
	Ventura Regional Fire Safe Council
Public School Districts/Universities	California State University, Channel Islands (CSUCI)
	Ojai Unified School District
	University of California, Santa Barbara (UCSB)
	Ventura County Community College District
	Ventura Unified School District
Sanitary Districts	Ojai Valley Sanitary District
State	CA Conservation Corps
	CA Department of Forestry and Fire Protection (CAL FIRE)
	CA Dept of Conservation
	CA Dept of Fish and Wildlife
	CA Dept of Water Resources
	CA Governor's Office of Land Use and Climate Innovation (LCI)
	CA State Coastal Conservancy
	CA State Parks
	CA Wildlife Conservation Board
	Los Angeles Regional Water Quality Control Board (LARWQCB)
	State Water Resources Control Board (SWRCB)
Tribal	Barbareño/Ventureño Band of Mission Indians
	Chumash Elder Julie Tumamait-Stenslie
	Native Coast Action Network
	Wishtoyo Chumash Foundation
Water Utilities	Casitas Municipal Water District
	Casitas Mutual Water Company
	Meiner’s Oaks Water District
	Senior Canyon Mutual Water Company
	Ventura River Water District
	City of Ventura – Ventura Water
Other(s)	

Carry Forward Selected Choices from Q17

Q18: *How and how often do you collaborate with these groups?

For each group listed, please select the collaboration option and frequency that best applies.

[Groups from Q17]	How do you collaborate? Please select all that apply.			How often do you collaborate? Please select one. Select from Regularly (e.g., weekly, monthly, quarterly), Annually, or Occasionally (i.e., less than once a year)
	Routine collaboration on watershed-related projects or programs	Knowledge, data, or expertise on watershed related issues	Funding, materials, work share, or work trade for watershed related projects or programs	
				▼ Regularly ... Occasionally
				▼ Regularly ... Occasionally
				▼ Regularly ... Occasionally
				▼ Regularly ... Occasionally

Q19: *How would you describe the effectiveness of your organization's current collaborations? Please select one.

- Very Effective
- Somewhat Effective
- Neutral
- Somewhat Ineffective
- Very Ineffective

Q20: *How often do your organization's collaborative efforts result in tangible outcomes that address the needs of your community (e.g., implemented projects, policy changes, funding secured, multi-benefit projects)? Please select one.

- Very frequently (most collaborations lead to tangible outcomes)
- Occasionally (some collaborations lead to tangible outcomes)
- Rarely (few collaborations result in tangible outcomes)
- Never (collaborations rarely produce tangible results)

Q21a: *What does your organization see as the main barriers to successful collaboration on watershed-related projects or programs? Please select the top three.

- Data sharing/accessibility
- Lack of coordination between agencies/groups
- Limited funding/resources
- Limited staff/technical capacity

- Policy/regulatory challenges
- Public awareness/engagement
- Other (please specify):_____

Carry Forward Selected Choices from Q21a

Q21b: *How would you rank the selected barriers to collaboration? Please click and drag each barrier to box 1, 2, or 3 (1 being the greatest barrier).

	1	2	3
[Choice from Q21a]	O	O	O
[Choice from Q21a]	O	O	O
[Choice from Q21a]	O	O	O

Q22: Are there additional partners or types of collaborations that would strengthen your work or the existing watershed network?

Please list specific partners and/or briefly describe collaboration types.

_____
_____
_____

Section 3: Climate Challenges and Watershed Resilience Vision

California guidelines for developing watershed resilience plans emphasize the need for watershed-based solutions for sustainably managing and developing water resources for current and future generations that includes addressing current and projected climate impacts.

Q23: *What does "watershed resiliency" mean to your organization?

Please provide 3-5 keywords or brief phrases. Separate keywords or phrases using a comma.

_____
_____
_____

Q24: *Has your organization developed a climate resilience vision or plan?

- Yes
- No
- In development
- Unsure
- Other (please specify):_____

Q25: *What are the most urgent climate hazards affecting water resources in the Ventura River Watershed as identified by your organization? Please select up to three.

- Changing patterns in marine fog
- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding (more rainfall and more variability)
- Increased temperature and frequency of temperature extremes (extreme heat)
- More frequent and intense wildfires
- Sea-level rise
- Other (please specify):_____

Q26: *What are the most urgent challenges facing the Ventura River Watershed in terms of water and climate resilience as identified by your organization? Please select up to five.

- Access to cultural resources
- Access to recreational resources
- Changes in soil quality and aridity
- Disproportionate impacts on disadvantaged or underserved communities
- Disproportionate impacts on tribal communities
- Flooding and erosion
- Groundwater depletion

- Land use changes
- Loss of biodiversity and habitat degradation
- Regulatory or policy gaps
- Surface water shortages
- Water quality degradation
- Wildfire impacts on water systems
- Other (please specify):_____

Q27: *What approaches or strategies does your organization prioritize to support climate adaptation and resilience in the Ventura River Watershed, considering your organization's objectives, goals, and capacity? Please select up to three.

- Community engagement and education
- Data collection and monitoring
- Economic and funding strategies for resilience projects
- Infrastructure improvements (e.g., stormwater capture, flood control upgrades)
- Nature-based solutions (e.g., riparian restoration, wetland enhancement)
- Policy changes (e.g., new water conservation regulations, groundwater management)
- Other (please specify):_____

Q28: *What are the main challenges your organization encounters when implementing climate adaptation projects? Please select up to three.

- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources
- Lack of reliable climate and hydrological data and monitoring tools
- Limited technical capacity or expertise
- Regulatory or policy constraints
- Other (please specify):_____

Final Thoughts

Q29: Is there anything else you would like to share about your organization's role in the watershed, ideas for improving resilience planning, or other comments you'd like to add?

_____
_____
_____

Community Partner Profiles

Barbareño/Ventureño Band of Mission Indians

www.bvbmi.com

Type: Tribal organization

Focus and Sector: Community/Education, Native/Tribal

Service Area: Entire watershed

Mission: *Serving our tribal members.*

Regional Network/Coalition Partners: Matilija Dam Ecosystem Restoration Project

Collaborative Partners: California State Coastal Conservancy|California State University, Channel Islands (CSUCI)|City of Ventura Community Development Department|Friends of the Ventura River|Surfrider Foundation|Trust for Public Land|Ventura County Watershed Protection District|Ventura County Resource Conservation District|Ventura Land Trust

Effectiveness of Collaboration: Neutral

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Limited staff/technical capacity **2.** Limited funding/resources **3.** Lack of coordination between agencies/groups

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *Plan for existing water (no state water) and be responsible. Remove obstacles to ecological systems (dams etc.) No development in flood plain.*

Has a climate resilience vision or plan: In development

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased temperature and frequency of temperature extremes
- Legacy development

Most urgent climate challenges:

- Disproportionate impacts on disadvantaged or underserved communities
- Disproportionate impacts on tribal communities
- Loss of biodiversity and habitat degradation
- Water quality degradation

Priority climate resilience strategies:

- Community engagement and education
- Nature-based solutions

Main implementation challenges:

- Lack of funding or financial resources
- Limited technical capacity or expertise
- Regulatory or policy constraints

Other Comments: N/A

Beach Erosion Authority for Clean Oceans and Nourishment (BEACON)

www.beacon.ca.gov

Type: Local government | **Focus and Sector:** Other/multiple, Land management | **Service Area:** Multiple watersheds

Mission: *BEACON is a Joint Powers Agency representing the regional coastal interests of Santa Barbara and Ventura Counties and that of the coastal cities of Goleta, Santa Barbara, Carpinteria, Ventura, Oxnard, and Port Hueneme. The mission of BEACON is to reduce shoreline erosion and coastal storm damages, protect sensitive environmental resources, increase natural sediment supply to the coast, preserve and enhance beaches, improve water quality along the shoreline, and optimize the beneficial use of material dredged from ports, harbors, and other opportunistic sediment sources.*

Regional Network/Coalition Partners: Central Coast Climate Collaborative|Matilija Dam Ecosystem Restoration Project|Southern California Sand Collaborative

Collaborative Partners: Barbareño/Ventureño Band of Mission Indians|CA State Parks|California Assembly District 38, Asm. Steve Bennett|California Department of Fish and Wildlife|California State Coastal Conservancy|California State Senate District 21, Sen. Monique Limón|City of Ventura Community Development Department|City of Ventura Public Works Department|Santa Barbara Channelkeeper|Surfrider Foundation|U.S. Army Corps of Engineers|U.S. Fish and Wildlife Service|Ventura County Parks Department|Ventura County Sustainability Division|Ventura County Watershed Protection District

Effectiveness of Collaboration: Very Effective **Frequency of Tangible Outcomes:** Occasionally

Collaboration Barriers: 1. Limited funding/resources **2.** Public awareness/engagement **3.** Data sharing/accessibility

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *Watershed resiliency is critical to the natural transport of sediment to the coast which is critical to the protection of the California coastline.*

Has a climate resilience vision or plan: No

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- Sea-level rise

Most urgent climate challenges:

- Access to recreational resources
- Flooding and erosion
- Reduction in sediment to coast

Priority climate resilience strategies:

- Community engagement and education
- Data collection and monitoring

Main implementation challenges:

- Lack of funding or financial resources
- Regulatory or policy constraints

- Economic and funding strategies for resilience projects

Other Comments: N/A

California Conservation Corps

www.ccc.ca.gov

Type: State government

Focus and Sector: Wildfire preparedness and management, Wildfire

Service Area: Entire watershed

Mission: *To protect and enhance California's natural resources and communities while empowering and developing young adults through hard work and education.*

Regional Network/Coalition Partners: N/A

Collaborative Partners: CA State Parks | California Assembly District 38, Asm. Steve Bennett | California Department of Conservation | California Department of Fish and Wildlife | California Department of Forestry and Fire Protection (CAL FIRE)|California Department of Water Resources | California State Senate District 21, Sen. Monique Limón | California Trout | Casitas Municipal Water District | City of Ojai | Localizing California Waters | National Marine Fisheries Service (NOAA Fisheries)|Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture | Ojai Valley Land Conservancy | Once Upon a Watershed | Taylor Ranch | Trout Unlimited | U.S. Fish and Wildlife Service | U.S. Forest Service | University of California, Santa Barbara (UCSB)|Ventura County Resource Conservation District | Ventura County Watershed Protection District | Ventura Land Trust

Effectiveness of Collaboration: Neutral

Frequency of Tangible Outcomes: Very frequently

Collaboration Barriers: 1. Lack of coordination between agencies **2.** Public awareness/engagement **3.** Limited funding/resources

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *adaptability, forecasting, essential*

Has a climate resilience vision or plan: Yes, within the California Natural Resources Agency plan https://resources.ca.gov/Initiatives/Building-Climate-Resilience

Most urgent climate hazards:

- Increased precipitation extremes and flooding
- Increased temperature and frequency of temperature extremes
- More frequent and intense wildfires

Most urgent climate challenges:

- Flooding and erosion
- Loss of biodiversity and habitat degradation
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Data collection and monitoring
- Nature-based solutions

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources

Other Comments: N/A

California Department of Conservation, Division of Land Resource Protection

www.conservation.ca.gov/dlrp

Type: State government

Focus and Sector: Agriculture, Agriculture

Service Area: Project/site specific location(s)

Mission: *The Division of Land Resource Protection (DLRP), within the Department of Conservation, serves as the state's leader in conserving California's irreplaceable agricultural lands. DLRP provides information, and technical and financial assistance to partners to protect California's agricultural land and promote sustainable growth.*

Regional Network/Coalition Partners: N/A

Collaborative Partners: University of California Cooperative Extension | Ventura County Department of Agriculture/Weights & Measures | Ventura County Resource Conservation District

Effectiveness of Collaboration: Very Effective

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Limited funding/resources **2.** Policy/regulatory challenges **3.** Data sharing/accessibility

Thoughts on Additional Partners to Strengthen Work: *Increased collaboration between agencies would help to ensure larger, area-wide projects move forward and are provided ongoing support and funding. Too often we see starts and stops and organizations on the ground needing to piece together funding and projects creating inefficiencies and hindering the goals of larger scale planning and restoration documents.*

Meaning of Watershed Resiliency: *A strong watershed that is both supportive of habitat and human uses in spite of natural and human generated impacts. It conserves water and preserves water quality for use by agriculture and communities through the rehabilitation of wildlife and natural landscape.*

Has a climate resilience vision or plan: Yes https://resources.ca.gov/Initiatives/Building-Climate-Resilience

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- More frequent and intense wildfires

Most urgent climate challenges:

- Changes in soil quality and aridity
- Disproportionate impacts on disadvantaged or underserved communities
- Groundwater depletion
- Loss of biodiversity and habitat degradation
- Water quality degradation

Priority climate resilience strategies:

- Community engagement and education
- Nature-based solutions
- Policy changes

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources

Other Comments: *DLRP (particularly through Prop 68 Working Lands and Riparian Restoration grants) would like to see greater coordination between local RCD's and agencies to implement watershed scale planning. Our team funds implementation and planning projects to the RCD and also has a Planning Grant with the County, however, there is little overlap at this point between these projects and their goals. This may be circumstantial as both organizations have multiple projects being worked on at the same time as those funded by our team, but there does not appear to be much mention or consideration of the other when discussing the separate projects. We also see a need for funding to be continuous and an effort for ongoing collaboration between agencies/stakeholders where smaller agencies (such as RCD's) are conducting a lot of the on the ground work to preserve the watershed.*

California Department of Conservation, Geologic Energy Management Division

www.conservation.ca.gov/calgem

Type: State government

Focus and Sector: Energy, Energy

Service Area: Other, no current projects in watershed

Mission: *With a team of scientists and other dedicated professionals, the Department of Conservation (DOC) administers a variety of programs vital to California's public safety, environment and economy. The services DOC provides are designed to balance today's needs with tomorrow's obligations by fostering the wise use and conservation of energy, land and mineral resources.*

Regional Network/Coalition Partners: N/A

Collaborative Partners: California Department of Water Resources | City of Ventura Community Development Department | Climate First: Replacing Oil & Gas (CFROG)|Ventura County Watershed Protection District

Effectiveness of Collaboration: Neutral **Frequency of Tangible Outcomes:** Occasionally

Collaboration Barriers: 1. Public awareness/engagement **2.** Policy/regulatory challenges **3.** Limited staff/technical capacity

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *protect, maintain, awareness*

Has a climate resilience vision or plan: Yes https://resources.ca.gov/Initiatives/Building-Climate-Resilience

Most urgent climate hazards:

- N/A

Most urgent climate challenges:

- Flooding and erosion

Priority climate resilience strategies:

- N/A

Main implementation challenges:

- Regulatory or policy constraints

Other Comments: N/A

California Department of Water Resources

www.water.ca.gov

Type: State government **Focus and Sector:** Water supply, Water **Service Area:** Multiple watersheds

Mission: *To sustainably manage California's water resources for the benefit of its citizens and environment.*

Regional Network/Coalition Partners: Watershed Progressive for Land Resilience Partnership

Collaborative Partners: Mound Basin Groundwater Sustainability Agency | Ojai Basin Groundwater Management Agency | Upper Ventura River Groundwater Agency | Ventura County Resource Conservation District

Effectiveness of Collaboration: Very Effective **Frequency of Tangible Outcomes:** Very frequently

Collaboration Barriers: 1. Limited funding/resources **2.** Public awareness/engagement **3.** Policy/regulatory challenges

Thoughts on Additional Partners to Strengthen Work: *Better funding opportunities and expertise from the federal government.*

Meaning of Watershed Resiliency: *multi-benefit, security, ecosystem, sustainable*

Has a climate resilience vision or plan: Yes https://water.ca.gov/Programs/All-Programs/Climate-Change-Program/Climate-Action-Plan

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- More frequent and intense wildfires

Most urgent climate challenges:

- Loss of biodiversity and habitat degradation
- Water quality degradation
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Economic and funding strategies for resilience projects
- Infrastructure improvements
- Nature-based solutions

Main implementation challenges:

- Lack of funding or financial resources

Other Comments: N/A

California State University, Channel Islands (CSUCI)

www.csuci.edu

Type: Academic/research institution **Focus and Sector:** Community/Education, Community/Education **Service Area:** Entire watershed

Mission: *To educate the next generation and to conduct research for the betterment of our community.*

Regional Network/Coalition Partners: Beach Erosion Authority for Clean Oceans and Nourishment (BEACON)|Central Coast Climate Collaborative | Matilija Dam Ecosystem Restoration Project | South Coast Habitat Restoration | Southern Steelhead Coalition

Collaborative Partners: Barbareño/Ventureño Band of Mission Indians | Bureau of Land Management, U.S. Department of the Interior | CA State Parks | California Assembly District 38, Asm. Steve Bennett | California Department of Fish and Wildlife | California Department of Forestry and Fire Protection (CAL FIRE)|California Department of Water Resources | California State Coastal Conservancy | California State Senate District 21, Sen. Monique Limón | Climate First: Replacing Oil & Gas (CFROG)|National Marine Fisheries Service (NOAA Fisheries)|Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture | Office of Emergency Services (OES) - Ventura County Sheriff's Office |Santa Barbara Channelkeeper |State Water Resources Control Board (SWRCB)|Surfrider Foundation |Trust for Public Land |U.S. Army Corps of Engineers |U.S. Fish and Wildlife Service |U.S. Forest Service |University of California Cooperative Extension |Ventura County Community College District |Ventura County Department of Agriculture/Weights & Measures |Ventura County Fire Department |Ventura County Resource Conservation District |Ventura Land Trust |Wishtoyo Chumash Foundation

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Very frequently

Collaboration Barriers: 1. Limited funding/resources **2.** Limited staff/technical capacity **3.** Lack of coordination between agencies/groups

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *Perpetual water, robust food systems, free from drought-related restrictions*

Has a climate resilience vision or plan: Yes https://www.csuci.edu/fs/sustainability/plans-and-policies/climate-action-plan.htm

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- Increased temperature and frequency of temperature extremes

Most urgent climate challenges:

- Groundwater depletion
- Land use changes
- Loss of biodiversity and habitat degradation
- Surface water shortages

Priority climate resilience strategies:

- Community engagement and education
- Nature-based solutions
- Policy changes

Main implementation challenges:

- Lack of funding or financial resources
- Lack of reliable climate and hydrological data and monitoring tools
- Regulatory or policy constraints

Other Comments: N/A

California Trout (CalTrout)

www.caltrout.org

Type: Nonprofit/non-governmental organization

Focus and Sector: Ecosystems/Habitat, Ecosystems/Habitat

Service Area: Entire watershed

Mission: *CalTrout works to revitalize waters for resilient wild fish and a better California. Science supports that abundant wild fish indicate healthy waters and that healthy waters benefit all Californians.*

Regional Network/Coalition Partners: Matilija Dam Ecosystem Restoration Project|Southern Steelhead Coalition|Ventura River Watershed Council|Watersheds Coalition of Ventura County (WCVC)|Southern Steelhead Fish Passage Advisory Committee (FishPAC)

Collaborative Partners: CA Wildlife Conservation Board|California Assembly District 38, Asm. Steve Bennett|California Department of Fish and Wildlife|California State Coastal Conservancy|California State Senate District 21, Sen. Monique Limón|Central Coast Alliance United for A Sustainable Economy (CAUSE)|Chumash Elder Julie Tumamait-Stenslie|City of Ojai|City of Ventura Community Development Department|City of Ventura Public Works Department|Concerned Resource and Environmental Workers (C.R.E.W.)|Los Angeles Regional Water Quality Control Board (LARWQCB)|MERITO Foundation|National Marine Fisheries Service (NOAA Fisheries)|Native Coast Action Network|Ojai Valley Fire Safe Council|Ojai Valley Land Conservancy|Once Upon a Watershed|Santa Barbara Channelkeeper|State Water Resources Control Board (SWRCB)|Surfrider Foundation|U.S. Army Corps of Engineers|U.S. Bureau of Reclamation|U.S. Fish and Wildlife Service|U.S. Forest Service|Ventura County Resource Conservation District|Ventura County Supervisor for District 1|Ventura County Watershed Protection District|Wishtoyo Chumash Foundation

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Limited funding/resources **2.** Limited staff/technical capacity **3.** Policy/regulatory challenges

Thoughts on Additional Partners to Strengthen Work: *CalTrout would like to find ways to get more staff, resources and funding for the RCD to lead and implement nature-based watershed restoration projects on private property.*

Meaning of Watershed Resiliency: *river, aquatic, function, integrity, structure, scale*
Has a climate resilience vision or plan: No

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- Water use practices based on climate conditions that no longer exist

Most urgent climate challenges:

- Flooding and erosion
- Groundwater depletion
- Loss of biodiversity and habitat degradation
- Surface water shortages
- Water quality degradation

Priority climate resilience strategies:

- Community engagement and education
- Nature-based solutions
- Policy changes

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Limited technical capacity or expertise
- Resistance to change

Other Comments: *Significant amounts of State and Federal funding are brought into Ventura County and its local watersheds by non-profit organizations that lead nature-based restoration projects with climate resiliency benefits. For example, CalTrout, OVLC and the Ojai Fire Safe Council have secured millions in competitive grants from funding agencies to restore fish passage, enhance riparian habitat, and improve floodplain connectivity in key areas. These projects not only support endangered species recovery but also reduce flood risk, recharge groundwater, and improve water quality—delivering clear ecological and community benefits. Despite this success, Ventura County and its cities lack consistent internal funding mechanisms to modernize aging infrastructure in ways that align with these nature-based, multi-benefit approaches. Local investments are needed to match and leverage incoming state and federal dollars, and to ensure that public works projects incorporate natural infrastructure—such as bioswales, floodplain reconnection, and green stormwater systems—instead of defaulting to outdated gray infrastructure. Establishing reliable local funding would ensure communities can proactively address climate threats while maximizing co-benefits for water, habitat, and public health. Establishing a funding mechanism, if even hyper local to the Ventura River, will ensure that local communities are able to pursue the goals and objectives established by those that live in the watershed.*

Casitas Municipal Water District

www.casitaswater.org

Type: Public utility **Focus and Sector:** Water supply, Water **Service Area:** Defined jurisdiction/area/boundary

Mission: *The ongoing mission of the CMWD is to provide its service area with safe and reliable locally and regionally developed water and recreational opportunities in an environmentally and economically responsible manner.*

Regional Network/Coalition Partners: Association of Water Agencies of Ventura County|Matilija Dam Ecosystem Restoration Project|Ventura River Watershed Council|Watersheds Coalition of Ventura County (WCVC)

Collaborative Partners: California Assembly District 38, Asm. Steve Bennett|California Department of Fish and Wildlife|California Department of Water Resources|California State Senate District 21, Sen. Monique Limón|City of Ojai|City of Ventura Public Works Department|Los Angeles Regional Water Quality Control Board (LARWQCB)|Meiners Oaks Water District|National Marine Fisheries Service (NOAA Fisheries)|Office of Emergency Services (OES) - Ventura County Sheriff's Office|Ojai Basin Groundwater Management Agency|Ojai Valley Chamber of Commerce|Ojai Valley Land Conservancy|State Water Resources Control Board (SWRCB)|U.S. Bureau of Reclamation|U.S. Fish and Wildlife Service|Upper Ventura River Groundwater Agency|Ventura Chamber of Commerce|Ventura County Watershed Protection District|Ventura River Water District|City of Ventura – Ventura Water

Effectiveness of Collaboration: Somewhat Effective **Frequency of Tangible Outcomes:** Occasionally

Collaboration Barriers: 1. Policy/regulatory challenges **2.** Limited funding/resources

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *Adaptation of systems and infrastructure. Ease of ability to make modifications due to events of disturbance. Sustainable water management.*
Has a climate resilience vision or plan: Other, CMWD utilizes the Projected Changes in Ventura County Climate prepared by Desert Research Institute in 2019 (https://watershedscoalition.org/climate-resilience/); the CMWD Water Efficiency & Allocation Program (WEAP) revised March 22, 2023; and the adopted Urban Water Management Plan (https://www.casitaswater.org/casitas-water-security).

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding

Most urgent climate challenges:

- Flooding and erosion
- Surface water shortages

- Increased temperature and frequency of temperature extremes

Priority climate resilience strategies:

- Economic and funding strategies for resilience projects
- Infrastructure improvements
- Policy changes

Main implementation challenges:

- Lack of funding or financial resources
- Regulatory or policy constraints

Other Comments: N/A

Casitas Mutual Water Company

Type: Public utility **Focus and Sector:** Water supply, Water **Service Area:** Defined jurisdiction/area/boundary

Mission: *Deliver potable water to 85 shareholding properties.*

Regional Network/Coalition Partners: N/A

Collaborative Partners: California Department of Water Resources|Casitas Municipal Water District|Ojai Valley Sanitary District|State Water Resources Control Board (SWRCB)|Upper Ventura River Groundwater Agency|Ventura County Fire Department|Ventura River Water District

Effectiveness of Collaboration: Somewhat Effective **Frequency of Tangible Outcomes:** Rarely

Collaboration Barriers: 1. Limited funding/resources **2.** lack of recorded information **3.** Limited staff/technical capacity

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *Never considered "watershed resiliency."*

Has a climate resilience vision or plan: No

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- More frequent and intense wildfires

Most urgent climate challenges:

- Surface water shortages
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Economic and funding strategies for resilience projects
- Infrastructure improvements

Main implementation challenges:

- Lack of funding or financial resources
- Limited technical capacity or expertise
- Regulatory or policy constraints

Other Comments: N/A

Central Coast Alliance United for A Sustainable Economy (CAUSE)

www.causenow.org

Type: Community-based organization

Focus and Sector: Community/Education, Community/Education

Service Area: Defined jurisdiction/area/boundary

Mission: *CAUSE is a base-building organization committed to social, economic and environmental justice for working class and immigrant communities on California's Central Coast. We build grassroots power through community organizing, leadership development, coalition building, civic engagement, policy research, and non-partisan/non-lobbying advocacy.*

Regional Network/Coalition Partners: Westside Clean Air Coalition

Collaborative Partners: Climate First: Replacing Oil & Gas (CFROG)|Ventura Land Trust|Wishtoyo Chumash Foundation

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Accessible data and processes that involve community **2.** Limited staff/technical capacity

3. Lack of coordination between agencies/groups

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *Community stewardship developed by good public access to the watershed, contributing to groundwater recharge and minimizing runoff, ag uses help protect watershed not harm it, flood protection for communities, safe drinking water*

Has a climate resilience vision or plan: In development

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- More frequent and intense wildfires

Most urgent climate challenges:

- Access to cultural resources
- Access to recreational resources
- Disproportionate impacts on disadvantaged or underserved communities
- Water quality degradation
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Community engagement and education
- Economic and funding strategies for resilience projects

Main implementation challenges:

- Lack of funding or financial resources
- Limited technical capacity or expertise

Other Comments: *I would say this is not a high priority issue for CAUSE.*

City of Ventura Community Development Department

www.cityofventura.ca.gov

Type: Local government **Focus and Sector:** Municipal government, Municipal **Service Area:** Defined jurisdiction/area/boundary

Mission: *Committed to the safe and vital development, prosperity, and sustainability of the City of Ventura.*

Regional Network/Coalition Partners: N/A

Collaborative Partners: Barbareño/Ventureño Band of Mission Indians|Chumash Elder Julie Tumamait-Stenslie|City of Ventura Public Works Department|Farm Bureau of Ventura County|Patagonia|Taylor Ranch|Ventura County Coalition of Labor, Agriculture and Business (CoLAB)|Ventura County Community College District|Ventura County Department of Agriculture/Weights & Measures|Ventura County Planning Division|Ventura County Resource Conservation District|Ventura County Supervisor for District 1|Ventura Land Trust|Ventura Unified School District|City of Ventura – Ventura Water

Effectiveness of Collaboration: Neutral **Frequency of Tangible Outcomes:** Occasionally

Collaboration Barriers: 1. Policy/regulatory challenges **2.** Limited funding/resources **3.** Lack of coordination between agencies/groups

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *successful and sustainable ecosystems*

Has a climate resilience vision or plan: Yes
https://static1.squarespace.com/static/5f34bf7ddc1cd21c88c0c407/t/67b678fe43ffbe11ab86585d/1740011804052/VenturaCARP_FinalDraft_2025_0219.pdf

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased temperature and frequency of temperature extremes
- More frequent and intense wildfires

Most urgent climate challenges:

- Access to recreational resources
- Disproportionate impacts on disadvantaged or underserved communities
- Groundwater depletion
- Land use changes
- Water quality degradation

Priority climate resilience strategies:

- Community engagement and education
- Data collection and monitoring
- Infrastructure improvements

Main implementation challenges:

- Lack of funding or financial resources
- Limited technical capacity or expertise
- Regulatory or policy constraints

Other Comments: N/A

City of Ventura Public Works Department

www.cityofventura.ca.gov/2387/Public-Works

Type: Local government **Focus and Sector:** Other/Multiple, Municipal **Service Area:** Defined jurisdiction/area/boundary

Mission: *City of Ventura's mission is "We are dedicated to serving and safeguarding our historic coastal community by inspiring innovation, sustainability, and collaboration." The Public Works' mission is "Serving our Community together – To provide innovative solutions for Ventura's infrastructure and our environment – they're counting on us."*

Regional Network/Coalition Partners: Association of Water Agencies of Ventura County|Beach Erosion Authority for Clean Oceans and Nourishment (BEACON)|Ventura County Agricultural Irrigated Lands Group (VCAILG)|Ventura County Wildfire Collaborative|Ventura River Watershed Council|Watersheds Coalition of Ventura County (WCVC)|Westside Community Council|Ventura River Algae TMDL MOA/Group|Ventura River Trash TMDL MOA/Group

Collaborative Partners: CA State Parks|California Department of Fish and Wildlife|California Department of Forestry and Fire Protection (CAL FIRE)|California State Coastal Conservancy|Central Coast Alliance United for A Sustainable Economy (CAUSE)|City of Ojai|City of Ventura Community Development Department|Downtown Ventura Partners|Farm Bureau of Ventura County|Los Angeles Regional Water Quality Control Board (LARWQCB)|MERITO Foundation|Office of Emergency Services (OES) - Ventura County Sheriff's Office|Ojai Valley Sanitary District|Patagonia|Santa Barbara Channelkeeper|State Water Resources Control Board (SWRCB)|Surfrider Foundation|U.S. Army Corps of Engineers|Ventura County Fire Department|Ventura County Supervisor for District 1|Ventura County Watershed Protection District|Ventura Land Trust|Ventura Regional Fire Safe Council|Ventura Unified School District|City of Ventura – Ventura Water|Westside Community Development Corporation

Effectiveness of Collaboration: Very Effective **Frequency of Tangible Outcomes:** Occasionally

Collaboration Barriers: 1. Limited funding/resources **2.** Limited staff/technical capacity **3.** Public awareness/engagement

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *Reduce flooding risk and property loss, environmental stewardship (water quality, ecosystem services, waste reduction, renewable energies/climate action), infrastructure resilience (roads, bridges, sewer, storm sewer, etc.), fire safe communities*

Has a climate resilience vision or plan: Yes
https://static1.squarespace.com/static/5f34bf7ddc1cd21c88c0c407/t/67b678fe43ffbe11ab86585d/1740011804052/VenturaCARP_FinalDraft_2025_0219.pdf

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- Increased temperature and frequency of temperature extremes

Most urgent climate challenges:

- Flooding and erosion
- Groundwater depletion
- Surface water shortages
- Water quality degradation
- increase fire risk to community

Priority climate resilience strategies:

- Infrastructure improvements
- Policy changes
- Climate Action and Resiliency Plan execution

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources
- Staff and timing constraints

Other Comments: N/A

City of Ventura – Ventura Water

www.cityofventura.ca.gov/2268/Ventura-Water

Type: Local government

Focus and Sector: Water supply, Water

Service Area: Defined jurisdiction/area/boundary

Mission: *provide safe and reliable water supply to the citizens and the City of Ventura (and service area).*

Regional Network/Coalition Partners: Association of Water Agencies of Ventura County|Ventura River Watershed Council|Watersheds Coalition of Ventura County (WCVC)

Collaborative Partners: Barbareño/Ventureño Band of Mission Indians|California Department of Fish and Wildlife|California Department of Water Resources|Casitas Municipal Water District|Chumash Elder Julie Tumamait-Stenslie|City of Ventura Public Works Department|MERITO Foundation|Meiners Oaks Water District|Mound Basin Groundwater Sustainability Agency|Ojai Valley Sanitary District|State Water Resources Control Board (SWRCB)|Taylor Ranch|Upper Ventura River Groundwater Agency|Ventura County Resource Conservation District|Ventura County Watershed Protection District|Ventura River Water District|Ventura Unified School District

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Lack of coordination between agencies/groups **2.** Policy/regulatory challenges **3.** Limited funding/resources

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *ability to meet water supply needs and ecosystem needs*

Has a climate resilience vision or plan: Yes
https://www.cityofventura.ca.gov/DocumentCenter/View/44949/2025-Comprehensive-Water-Resources-Report

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- Increased temperature and frequency of temperature extremes

Most urgent climate challenges:

- Flooding and erosion
- Groundwater depletion
- Surface water shortages
- Water quality degradation

Priority climate resilience strategies:

- Economic and funding strategies for resilience projects
- Infrastructure improvements
- Policy changes

Main implementation challenges:

- Lack of funding or financial resources
- Lack of reliable climate and hydrological data and monitoring tools
- Limited technical capacity or expertise

Other Comments: N/A

Concerned Resource and Environmental Workers (C.R.E.W.)

www.crewojai.org

Type: Nonprofit/non-governmental organization

Focus and Sector: Wildfire preparedness and management, Wildfire

Service Area: Entire watershed

Mission: *The C.R.E.W. provides employment and leadership training to teens and young adults through hands-on environmental work. Since 1991, C.R.E.W. members work year-round to maintain trails, restore habitats, and reduce the risk of wildfire, while building skills and developing relationships that last a lifetime.*

Regional Network/Coalition Partners: Matilija Dam Ecosystem Restoration Project|Ventura County Wildfire Collaborative|Ventura River Watershed Council|Watersheds Coalition of Ventura County (WCVC)|Monarch and Pollinator Regional Advisory Committee|Ventura County Weed Management Area

Collaborative Partners: Barbareño/Ventureño Band of Mission Indians|CA Wildlife Conservation Board|California Assembly District 38, Asm. Steve Bennett|California Conservation Corps|California Department of Forestry and Fire Protection (CAL FIRE)|California State Coastal Conservancy|California State University, Channel Islands (CSUCI)|Casitas Municipal Water District|Central Coast Alliance United for A Sustainable Economy (CAUSE)|Chumash Elder Julie Tumamait-Stenslie|City of

Ojai|Friends of the Ventura River|MERITO Foundation|Ojai Unified School District|Ojai Valley Fire Safe Council|Ojai Valley Green Coalition|Ojai Valley Inn|Ojai Valley Land Conservancy|Ojai Valley Sanitary District|Once Upon a Watershed|Patagonia|Senior Canyon Mutual Water Company|Surfrider Foundation|U.S. Forest Service|University of California Cooperative Extension|Ventura County Fire Department|Ventura County Resource Conservation District|Ventura County Supervisor for District 1|Ventura County Watershed Protection District|Ventura Land Trust|Ventura Regional Fire Safe Council|Ventura River Water District|Ventura Unified School District

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Very frequently

Collaboration Barriers: 1. Limited funding/resources **2.** Policy/regulatory challenges **3.** Limited staff/technical capacity

Thoughts on Additional Partners to Strengthen Work: *USFS– they need our help to maintain trails but apparently have no funding.*

Meaning of Watershed Resiliency: *sustainable water use standards and practices, protection of water ways & habitats, climate adaptability*

Has a climate resilience vision or plan: In development, and need help.

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- More frequent and intense wildfires

Most urgent climate challenges:

- Access to recreational resources
- Disproportionate impacts on disadvantaged or underserved communities
- Loss of biodiversity and habitat degradation
- Regulatory or policy gaps
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Community engagement and education
- Economic and funding strategies for resilience projects
- Nature-based solutions

Main implementation challenges:

- Lack of funding or financial resources
- Regulatory or policy constraints

Other Comments: N/A

Farm Bureau of Ventura County

www.farmbureauvc.com

Type: Nonprofit/non-governmental organization

Focus and Sector: Agriculture, Agriculture

Service Area: Entire watershed

Mission: *To advocate for Ventura County agriculture.*

Regional Network/Coalition Partners: Association of Water Agencies of Ventura County|Ventura County Agricultural Irrigated Lands Group (VCAILG)|Ventura River Watershed Council|Watersheds Coalition of Ventura County (WCVC)

Collaborative Partners: California Assembly District 38, Asm. Steve Bennett|California State Senate District 21, Sen. Monique Limón|California State University, Channel Islands (CSUCI)|Casitas Municipal Water District|Central Coast Alliance United for A Sustainable Economy (CAUSE)|City of Ojai|City of Ventura|Mound Basin Groundwater Sustainability Agency|Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture|Ojai Basin Groundwater Management Agency|Ojai Valley Fire Safe Council|Ojai Valley Land Conservancy|Ojai Valley Sanitary District|Santa Barbara Channelkeeper|State Water Resources Control Board (SWRCB)|Surfrider Foundation|Taylor Ranch|University of California Cooperative Extension|Upper Ventura River Groundwater Agency|Ventura County Coalition of Labor, Agriculture and Business (CoLAB)|Ventura County Community College District|Ventura County Planning Division|Ventura County Resource Conservation District|Ventura County Supervisor for District 1|Ventura County Sustainability Division|Ventura County Watershed Protection District|Ventura Land Trust|Ventura Regional Fire Safe Council|City of Ventura – Ventura Water

Effectiveness of Collaboration: Very Effective

Frequency of Tangible Outcomes: Very frequently

Collaboration Barriers: 1. Limited staff/technical capacity **2.** Limited funding/resources **3.** Lack of coordination between agencies/groups

Thoughts on Additional Partners to Strengthen Work: *While I'm sure that there are additional collaborations that would further our work, nothing specific is coming to mind.*

Meaning of Watershed Resiliency: Sustainability of agriculture, clean and reliable water supply, soil health, climate adaptation, land stewardship

Has a climate resilience vision or plan: No

Most urgent climate hazards:

- Increased precipitation extremes and flooding
- Increased temperature and frequency of temperature extremes

Most urgent climate challenges:

- Flooding and erosion
- Groundwater depletion
- Land use changes
- Regulatory or policy gaps

- More frequent and intense wildfires
- Surface water shortages

Priority climate resilience strategies:

- Community engagement and education
- Data collection and monitoring
- Policy changes

Main implementation challenges:

- Lack of funding or financial resources
- Limited technical capacity or expertise
- Regulatory or policy constraints

Other Comments: N/A

Friends of the Ventura River

www.friendsofventurariver.org

Type: Community-based organization

Focus and Sector: Ecosystems/Habitat, Ecosystems/Habitat

Service Area: Defined jurisdiction/area/boundary

Mission: *We strive to reclaim the Ventura River by creating the Ventura River Parkway to reconnect the people to the river through a continuous network of parks, trails, and natural areas along the 16 miles of river from the estuary in Ventura north through Ojai.*

Regional Network/Coalition Partners: N/A

Collaborative Partners: City of Ventura Parks and Recreation Department|Patagonia|Surfrider Foundation|Trust for Public Land|Ventura Land Trust

Effectiveness of Collaboration: Very Effective

Frequency of Tangible Outcomes: Very frequently

Collaboration Barriers: 1. Limited funding/resources **2.** Lack of coordination between agencies/groups **3.** Public awareness/engagement

Thoughts on Additional Partners to Strengthen Work: *Sometimes there are so many agencies that need to be involved in decisions Army Corp, Caltrans, City, County, private owners... In this example it would be to open the Ventura River levee from above Main Street to Stanley or to get pedestrian and/or wildlife overpasses over State Route 33.*

Meaning of Watershed Resiliency: *More shade trees, no arrundo giant reed, funding help for individuals in small communities along the Ventura River get on to sewer from septic systems, no oil drilling or incompatible industrial uses in the riverbed and floodplains, good stewardship by different communities (cities, homeowners, ranchers, farmers...) to prevent polluted runoff from getting into the river. Help people living in the riverbed get access to appropriate housing.*

Has a climate resilience vision or plan: In development

Most urgent climate hazards:

- Changing patterns in marine fog
- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding

Most urgent climate challenges:

- Access to recreational resources
- Disproportionate impacts on disadvantaged or underserved communities
- Flooding and erosion
- Groundwater depletion
- Loss of biodiversity and habitat degradation

Priority climate resilience strategies:

- Community engagement and education
- Infrastructure improvements
- Nature-based solutions

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources
- Limited technical capacity or expertise

Other Comments: *Thank you to everyone who works to help save important resources for future human and wildlife generations.*

Los Angeles Regional Water Quality Control Board (LARWQCB)

www.waterboards.ca.gov/losangeles

Type: State government **Focus and Sector:** Water quality, Water **Service Area:** Entire watershed

Mission: *To preserve, enhance, and restore the quality of California's water resources and drinking water for the protection of the environment, public health, and all beneficial uses, and to ensure proper water resource allocation and efficient use, for the benefit of present and future generations.*

Regional Network/Coalition Partners: N/A

Collaborative Partners: California Department of Water Resources|City of Ventura Public Works Department|Farm Bureau of Ventura County|Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture|Ojai Valley Sanitary District|State Water Resources Control Board (SWRCB)|Surfrider Foundation|Taylor Ranch|U.S. Army Corps of Engineers|University of California Cooperative Extension|Ventura County Resource Conservation District

Effectiveness of Collaboration: Somewhat Effective **Frequency of Tangible Outcomes:** Occasionally

Collaboration Barriers: 1. Limited funding/resources **2.** Policy/regulatory challenges **3.** Public awareness/engagement

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *Improving water quality for all*

Has a climate resilience vision or plan: Yes https://www.waterboards.ca.gov/climate/

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- More frequent and intense wildfires
- Increased pollutant loading

Most urgent climate challenges:

- Disproportionate impacts on disadvantaged or underserved communities
- Land use changes
- Regulatory or policy gaps
- Water quality degradation
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Data collection and monitoring
- Economic and funding strategies for resilience projects
- Infrastructure improvements

Main implementation challenges:

- Lack of funding or financial resources
- Lack of reliable climate and hydrological data and monitoring tools
- Limited technical capacity or expertise

Other Comments: N/A

Meiners Oaks Water District

www.meinersoakswater.org

Type: Public utility **Focus and Sector:** Water supply, Water **Service Area:** Defined jurisdiction/area/boundary

Mission: *The mission of Meiners Oaks Water District and its staff is to produce and deliver a reliable and sustainable supply of water to meet the needs of the residents and properties and the community within its boundaries.*

Regional Network/Coalition Partners: Association of Water Agencies of Ventura County|Matilija Dam Ecosystem Restoration Project|Ventura River Watershed Council|CA Water/Wastewater Agency Response Network (CalWARN)

Collaborative Partners: California Assembly District 38, Asm. Steve Bennett|California Department of Water Resources|Casitas Municipal Water District|Casitas Mutual Water Company|Office of Emergency Services (OES) - Ventura County Sheriff's Office|Ojai Unified School District|Ojai Valley Land Conservancy|Ojai Valley Sanitary District|Senior Canyon Mutual Water Company|State Water

Resources Control Board (SWRCB)|Upper Ventura River Groundwater Agency|Ventura County Fire Department|Ventura County Planning Division|Ventura County Resource Conservation District|Ventura River Water District|City of Ventura – Ventura Water

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Limited funding/resources **2.** Data sharing/accessibility **3.** Limited staff/technical capacity

Thoughts on Additional Partners to Strengthen Work: *State funding for infrastructure projects*

Meaning of Watershed Resiliency: adaptability of the water system to address unexpected conditions.

Has a climate resilience vision or plan: Other, Drought Contingency Plan

https://meinersoakswater.com/board-of-directors/policies-procedures-resolutions-ordinances/

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- More frequent and intense wildfires

Most urgent climate challenges:

- Flooding and erosion
- Groundwater depletion
- Regulatory or policy gaps
- Water quality degradation
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Data collection and monitoring
- Infrastructure improvements
- Policy changes

Main implementation challenges:

- Lack of funding or financial resources

Other Comments: *MOWD reduced its total water consumption by 38% over the past 10 years.*

MERITO Foundation

www.meritofoundation.org

Type: Nonprofit/non-governmental organization

Focus and Sector: Other/multiple, Land management

Service Area: Multiple watersheds

Mission: *MERITO stands for Multicultural Education for Resource Issues Threatening Oceans. MERITO Foundation's vision is a healthy ocean cared for by diverse coastal communities who live in an environmentally responsible manner, regardless of race, native language, sexual orientation, economic status, or ethnic background. Our mission is to protect the ocean by providing multicultural youth and*

their communities with transformative experiences in environmental monitoring, habitat restoration, outdoor recreation, environmental advocacy, and green entrepreneurship. These experiences are supported by robust ocean, climate, energy, and environmental education.

Regional Network/Coalition Partners: Beach Erosion Authority for Clean Oceans and Nourishment (BEACON)|Ventura River Watershed Council|Ventura River Action Network (V-RAN)

Collaborative Partners: CA State Parks|California Assembly District 38, Asm. Steve Bennett|California Conservation Corps|California Department of Fish and Wildlife|California State Coastal Conservancy|California State University, Channel Islands (CSUCI)|California Trout|Casitas Municipal Water District|Chumash Elder Julie Tumamait-Stenslie|City of Ventura Public Works Department|Climate First: Replacing Oil & Gas (CFROG)|Concerned Resource and Environmental Workers (C.R.E.W.)|Ojai Valley Land Conservancy|Ojai Valley Sanitary District|Once Upon a Watershed|Patagonia|Santa Barbara Channelkeeper|Surfrider Foundation|U.S. Fish and Wildlife Service|University of California, Santa Barbara (UCSB)|Ventura Land Trust|Ventura Unified School District|City of Ventura – Ventura Water|Wishtoyo Chumash Foundation

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Very frequently

Collaboration Barriers: 1. Limited funding/resources **2.** Data sharing/accessibility **3.** Lack of coordination between agencies/groups

Thoughts on Additional Partners to Strengthen Work: *We think the V-RAN program would benefit existing watershed protection efforts by engaging communities that are not currently involved and assisting in environmental monitoring of the Ventura River. An example is the V-RAN StoryMap: https://storymaps.arcgis.com/stories/4d93e82e5977448996aa64ba1e3d18a2*

Meaning of Watershed Resiliency: *Healthy ecosystems, Hydrologic balance, Community & Governance Capacity, and Adaptable infrastructure are all needed to adapt to a changing climate. The ocean is the ultimate watershed.*

Has a climate resilience vision or plan: Other: We collaborate with OVLC, but they lead the effort with a team of professionals including engineers, landscape architects, and project managers.

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- More frequent and intense wildfires
- Increased precipitation extremes and flooding
- Increased temperature and frequency of temperature extremes
- Sea-level rise
- Changing patterns in marine fog

Most urgent climate challenges:

- Disproportionate impacts on disadvantaged or underserved communities
- Flooding and erosion
- Groundwater depletion
- Loss of biodiversity and habitat degradation
- Water quality degradation

Priority climate resilience strategies:

- Community engagement and education
- Data collection and monitoring
- Nature-based solutions

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources
- Lack of reliable climate and hydrological data and monitoring tools

Other Comments: *I think many organizations are working on the Ventura River, but they are not necessarily working together effectively, and most are not involving non-Caucasian or youth populations.*

Native Coast Action Network

www.nativecoast.org

Type: Nonprofit/non-governmental organization

Focus and Sector: Other/multiple, Tribal

Service Area: Multiple watersheds

Mission: *Building ecological and cultural capacity in Coastal Indigenous/Tribal communities.*

Regional Network/Coalition Partners: Central Coast Climate Collaborative

Collaborative Partners: California Trout|Ventura County Resource Conservation District|Wishtoyo Chumash Foundation

Effectiveness of Collaboration: Very Effective

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Limited funding/resources **2.** Limited staff/technical capacity **3.** Public awareness/engagement

Thoughts on Additional Partners to Strengthen Work: *Conservation Districts, regional agencies*

Meaning of Watershed Resiliency: *strong, healthy, clean water*

Has a climate resilience vision or plan: No

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding

Most urgent climate challenges:

- Access to cultural resources
- Disproportionate impacts on tribal communities

- More frequent and intense wildfires

- Groundwater depletion
- Loss of biodiversity and habitat degradation
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Community engagement and education
- Economic and funding strategies for resilience projects
- Nature-based solutions

Main implementation challenges:

- Lack of funding or financial resources
- Limited technical capacity or expertise
- Regulatory or policy constraints

Other Comments: N/A

Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture

www.nrcs.usda.gov/state-offices/california

Type: Federal government

Focus and Sector: Other/Multiple, Land Management

Service Area: Multiple watersheds

Mission: *"Helping people help the land.'" "NRCS provides America's farmers and ranchers with financial and technical assistance to voluntarily put conservation on the ground, not only helping the environment but agricultural operations, too"*

Regional Network/Coalition Partners: N/A

Collaborative Partners: Ventura County Resource Conservation District|Ventura County Watershed Protection District

Effectiveness of Collaboration: Very Effective

Frequency of Tangible Outcomes: Very frequently

Collaboration Barriers: N/A

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *Healthy soils, healthy plant communities*

Has a climate resilience vision or plan: No

Most urgent climate hazards:

- Soil, water, plant, animal and air quality resource concerns

Most urgent climate challenges:

- Flooding and erosion
- Groundwater depletion

- Surface water shortages
- Water quality degradation

Priority climate resilience strategies:

- Developing conservation plans with farmers, ranchers and forestland stewards

Main implementation challenges:

- Ensuring agricultural producers and forestland managers are aware of programs and technical services available

Other Comments: N/A

Ojai Valley Fire Safe Council

www.firesafeojai.org

Type: Community-based organization

Focus and Sector: Wildfire preparedness and management, Wildfire

Service Area: Entire watershed

Mission: *To develop and implement a wildfire risk mitigation strategy that enables the Ojai Valley Community to better prepare for, respond during, and recover more quickly from a catastrophic wildfire event.*

Regional Network/Coalition Partners: Ventura County Wildfire Collaborative|Ventura River Watershed Council

Collaborative Partners: American Red Cross|CA Congressional District 24, Rep. Salud Carbajal|California Assembly District 38, Asm. Steve Bennett|California State Coastal Conservancy|California State Senate District 21, Sen. Monique Limón|California Trout|Casitas Municipal Water District|Chumash Elder Julie Tumamait-Stenslie|City of Ojai|Concerned Resource and Environmental Workers (C.R.E.W.)|HELP of Ojai|Office of Emergency Services (OES) - Ventura County Sheriff's Office|Ojai Unified School District|Ojai Valley Green Coalition|Ojai Valley Land Conservancy|Senior Canyon Mutual Water Company|U.S. Bureau of Reclamation|U.S. Forest Service|University of California Cooperative Extension|Ventura County Fire Department|Ventura County Planning Division|Ventura County Resource Conservation District|Ventura County Supervisor for District 1|Ventura County Sustainability Division|Ventura County Watershed Protection District|Ventura Land Trust|Ventura Regional Fire Safe Council

Effectiveness of Collaboration: Very Effective

Frequency of Tangible Outcomes: Very frequently

Collaboration Barriers: 1. Limited staff/technical capacity **2.** Lack of coordination between agencies/groups **3.** Limited funding/resources

Thoughts on Additional Partners to Strengthen Work: *Channel Islands State University*

Meaning of Watershed Resiliency: *Watershed resiliency means that the watershed has properly functioning large and small water cycles, and is maintaining those hydrological cycles at the highest level possible thereby being a watershed that is fully hydrated with healthy soil and plants. And, a healthy watershed is a wildfire resilient watershed.*

Has a climate resilience vision or plan: In development

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased temperature and frequency of temperature extremes
- More frequent and intense wildfires

Most urgent climate challenges:

- Changes in soil quality and aridity
- Groundwater depletion
- Land use changes
- Loss of biodiversity and habitat degradation
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Community engagement and education
- Economic and funding strategies for resilience projects
- Nature-based solutions

Main implementation challenges:

- Lack of funding or financial resources
- Regulatory or policy constraints
- The need for a paradigm shift that sees the important role of the biosphere in regulating the climate and cooling the planet.

Other Comments: *We are developing two "Community Resilience Centers" in the Ojai Valley. We are planning to develop the Centers as bioregional learning centers with the Ventura River Watershed as the designated bioregion.*

Ojai Valley Green Coalition

www.ojaivalleygreencoalition.org

Type: Nonprofit/non-governmental organization

Focus and Sector: Community/Education, Community/Education

Service Area: Entire watershed

Mission: *We partner with Ojai community members and organizations to build and strengthen life-sustaining and regenerative ways of being.*

Regional Network/Coalition Partners: N/A

Collaborative Partners: Chumash Elder Julie Tumamait-Stenslie|City of Ojai

Effectiveness of Collaboration: Very Effective

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Lack of coordination between agencies/groups **2.** Public awareness/engagement **3.** Limited staff/technical capacity

Thoughts on Additional Partners to Strengthen Work: *Collaborate with technical organizations as the local hub.: bringing folks together for awareness, education, workshops.*

Meaning of Watershed Resiliency: *nature based solutions: slow it , spread it, sink it, reforestation (including urban), regenerative agriculture*

Has a climate resilience vision or plan: No

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased temperature and frequency of temperature extremes
- More frequent and intense wildfires

Most urgent climate challenges:

- Changes in soil quality and aridity
- Groundwater depletion
- Loss of biodiversity and habitat degradation
- Regulatory or policy gaps
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Community engagement and education

Main implementation challenges:

- Lack of funding or financial resources

Other Comments: N/A

Ojai Valley Land Conservancy

www.ovlc.org

Type: Nonprofit/non-governmental organization

Focus and Sector: Land management, Land management

Service Area: Entire watershed

Mission: *The Ojai Valley Land Conservancy's mission is to protect and restore the natural landscapes of the Ojai Valley forever. Our vision is to lead the valley's response to climate change.*

Regional Network/Coalition Partners: Watershed Progressive for Land Resilience Partnership|Matilija Dam Ecosystem Restoration Project|Southern Steelhead Coalition|Ventura County Wildfire Collaborative|Ventura River Watershed Council|Ventura County Resilient Agricultural Lands Initiative (RALI)|Monarch and Pollinator Regional Advisory Committee|Ventura County Weed Management Area, Ventura County Tree Coalition|Ventura Watershed Instream Flow Enhancement and Water Resiliency Regional Framework

Collaborative Partners: Barbareño/Ventureño Band of Mission Indians|CA State Parks|CA Wildlife Conservation Board|California Assembly District 38, Asm. Steve Bennett|California Conservation Corps|California Department of Conservation|California Department of Fish and Wildlife|California Department of Forestry and Fire Protection (CAL FIRE)|California Department of Water Resources|California State Coastal Conservancy|California State Senate District 21, Sen. Monique Limón|California Trout|Casitas Municipal Water District|Chumash Elder Julie Tumamait-Stenslie|City of Ojai|City of Ventura Community Development Department|City of Ventura Public Works Department|Concerned Resource and Environmental Workers (C.R.E.W.)|Farm Bureau of Ventura County|Friends of the Ventura River|Localizing California Waters|Los Angeles Regional Water Quality Control Board (LARWQCB)|Los Padres ForestWatch|Ojai Trees|Community Environmental Council|MERITO Foundation|Meiners Oaks Water District|National Marine Fisheries Service (NOAA Fisheries)|Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture|Ojai Basin Groundwater Management Agency|Ojai Unified School District|Ojai Valley Fire Safe Council|Ojai Valley Green Coalition|Ojai Valley Inn|Ojai Valley Sanitary District|Ojai Valley School|Villanova Prep|Oak Grove School|Besant Hill School of Happy Valley|Once Upon a Watershed|Patagonia|Poco Farm|Mama Tree Farm|Ojai Valley Resource Cooperative|Mesa Farm|Meiners Oaks Community Garden|Santa Barbara Channelkeeper|Senior Canyon Mutual Water Company|State Water Resources Control Board (SWRCB)|Surfrider Foundation|The Nature Conservancy|California Council of Land Trusts|Trout Unlimited|Trust for Public Land|U.S. Army Corps of Engineers|U.S. Fish and Wildlife Service|U.S. Forest Service|University of California Cooperative Extension|University of California, Santa Barbara (UCSB)|Upper Ventura River Groundwater Agency|Ventura County Department of Agriculture/Weights & Measures|Ventura County Fire Department|Ventura County Parks Department|Ventura County Resource Conservation District|Ventura County Supervisor for District 1|Ventura County Sustainability Division|Ventura County Watershed Protection District|Ventura Land Trust|Ventura Regional Fire Safe Council|Ventura River Water District|City of Ventura – Ventura Water

Effectiveness of Collaboration: Very Effective **Frequency of Tangible Outcomes:** Very frequently

Collaboration Barriers: 1. Policy/regulatory challenges **2.** Data sharing/accessibility **3.** Limited staff/technical capacity

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *Watershed resilience means leveraging multi-benefit nature-based solutions to adaptively manage and build resilience for increasingly stochastic conditions of climate change (drought, flood, fire); looking critically at current management practices and opportunities for improvements and efficiencies (status quo isn't without risk); clean water, conserved open spaces, healthy habitats, engaged community; land conservation, habitat restoration, nature-based solutions*

Has a climate resilience vision or plan: Yes https://issuu.com/ovlc/docs/stategic_plan

Most urgent climate hazards: **Most urgent climate challenges:**

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- More frequent and intense wildfires
- Flooding and erosion
- Groundwater depletion
- Land use changes
- Loss of biodiversity and habitat degradation
- Regulatory or policy gaps

Priority climate resilience strategies:

- Community engagement and education
- Economic and funding strategies for resilience projects
- Nature-based solutions

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Lack of reliable climate and hydrological data and monitoring tools
- Regulatory or policy constraints

Other Comments: *OVLC owns and manages over 2,600 acres of open space (including 1/3 of the Ventura River), 27 miles of trails, 40 acres of active habitat restoration projects, a Native Plant Nursery that produces 10,000 plants annually, and recently launched Rewild Ojai to engage the community. We have about 20 employees and a dedicated volunteer base (over 7,100 volunteer hours logged last year). OVLC is leading the Ventura River Watershed Riparian Resilience Program to remove Arundo and restore the riparian areas of our watershed (RCD is lead agency; OVLC recently received $7 million from the CALFIRE Forest Health grant for the Program!).*

Ojai Valley Sanitary District

www.ojaisan.org

Type: Public utility **Focus and Sector:** Water quality, Water **Service Area:** Defined jurisdiction/area/boundary

Mission: *Reliably collect, convey and treat wastewater in the Ojai Valley to sustainably protect public health and the environment.*

Regional Network/Coalition Partners: Association of Water Agencies of Ventura County|Ventura River Watershed Council

Collaborative Partners: California Assembly District 38, Asm. Steve Bennett|California State Senate District 21, Sen. Monique Limón|Casitas Municipal Water District|City of Ojai|City of Ventura Community Development Department|City of Ventura Public Works Department|Los Angeles Regional Water Quality Control Board (LARWQCB)|Office of Emergency Services (OES) - Ventura County Sheriff's Office|Ojai Unified School District|State Water Resources Control Board (SWRCB)|Ventura County Community College District|Ventura County Fire Department|Ventura County Planning

Division|Ventura County Supervisor for District 1|Ventura County Sustainability Division|Ventura County Watershed Protection District|Ventura River Water District|Ventura Unified School District

Effectiveness of Collaboration: Neutral **Frequency of Tangible Outcomes:** Occasionally

Collaboration Barriers: 1. Public awareness/engagement **2.** Policy/regulatory challenges **3.** Limited staff/technical capacity

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *ability to withstand and recover from disturbances, while maintaining essential functions and characteristics*

Has a climate resilience vision or plan: In development

Most urgent climate hazards:

- Increased precipitation extremes and flooding
- More frequent and intense wildfires

Most urgent climate challenges:

- Flooding and erosion
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Data collection and monitoring
- Economic and funding strategies for resilience projects
- Infrastructure improvements

Main implementation challenges:

- Regulatory or policy constraints

Other Comments: N/A

Patagonia

www.patagonia.com

Type: Private sector/consulting firm **Focus and Sector:** Other/multiple, Recreation **Service Area:** Multiple watersheds

Mission: *We're in business to save our home planet.*

Regional Network/Coalition Partners: Matilija Dam Ecosystem Restoration Project

Collaborative Partners: California Trout|Environmental Defense Center|Friends of the Ventura River|Los Padres ForestWatch|Santa Barbara Channelkeeper|Surfrider Foundation

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Limited funding/resources **2.** Lack of coordination between agencies/groups **3.** Data sharing/accessibility

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *Ability to recover from environmental disturbances, long-term sustainability, overall ecosystem health*

Has a climate resilience vision or plan: Yes https://www.patagonia.com/climate-goals/

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased temperature and frequency of temperature extremes
- More frequent and intense wildfires

Most urgent climate challenges:

- Access to recreational resources
- Disproportionate impacts on tribal communities
- Loss of biodiversity and habitat degradation
- Surface water shortages
- Water quality degradation

Priority climate resilience strategies:

- Community engagement and education
- Nature-based solutions
- Policy changes

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources
- Limited technical capacity or expertise

Other Comments: N/A

Santa Barbara Channelkeeper

www.sbck.org

Type: Nonprofit/non-governmental organization

Focus and Sector: Water quality, Water

Service Area: Entire watershed

Mission: *Our mission is to protect and restore the Santa Barbara Channel and its watersheds through science-based advocacy, education, fieldwork enforcement, and community engagement.*

Regional Network/Coalition Partners: Southern Steelhead Coalition

Collaborative Partners: Barbareño/Venturеño Band of Mission Indians|California Department of Fish and Wildlife|California Trout (CalTrout)|National Marine Fisheries Service (NOAA Fisheries)|Ojai Valley Land Conservancy|Patagonia|Surfrider Foundation|U.S. Fish and Wildlife Service|Ventura Land Trust|Ventura Unified School District

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Public awareness/engagement **2.** Limited funding/resources **3.** Policy/regulatory challenges

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *Clean/abundant water protection, habitat restoration, community engagement, climate adaptation, ecological integrity*

Has a climate resilience vision or plan: In development

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- More frequent and intense wildfires
- Sea-level rise

Most urgent climate challenges:

- Groundwater depletion
- Loss of biodiversity and habitat degradation
- Regulatory or policy gaps
- Surface water shortages
- Water quality degradation

Priority climate resilience strategies:

- Data collection and monitoring
- Nature-based solutions
- Policy changes

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources
- Regulatory or policy constraints

Other Comments: N/A

South Coast Habitat Restoration

www.schabitatrestoration.org

Type: Nonprofit/non-governmental organization

Focus and Sector: Ecosystems/Habitat, Ecosystems/Habitat

Service Area: Project/site specific location(s)

Mission: *The mission of South Coast Habitat Restoration is to protect, conserve, and restore the various habitats and native biodiversity of the Santa Barbara and Ventura areas.*

Regional Network/Coalition Partners: Southern Steelhead Coalition|Ventura River Watershed Council

Collaborative Partners: CA State Parks|CA Wildlife Conservation Board|California Assembly District 38, Asm. Steve Bennett|California Conservation Corps|California Department of Fish and Wildlife|California State Coastal Conservancy|California State Senate District 21, Sen. Monique Limón|California Trout|Localizing California Waters|National Marine Fisheries Service (NOAA Fisheries)|Ojai Valley Land Conservancy|Patagonia|U.S. Army Corps of Engineers|U.S. Fish and Wildlife Service|U.S. Forest Service|University of California Cooperative Extension|Ventura County Resource Conservation District

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Limited funding/resources **2.** Limited staff/technical capacity

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *post fire recovery, post flood recovery, sustaining populations of endangered species*

Has a climate resilience vision or plan: No

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- More frequent and intense wildfires

Most urgent climate challenges:

- Flooding and erosion
- Loss of biodiversity and habitat degradation
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Economic and funding strategies for resilience projects

Main implementation challenges:

- Lack of funding or financial resources

- Infrastructure improvements
- Nature-based solutions

Other Comments: N/A

Southern Steelhead Coalition

www.southernsteelhead.org

Type: Nonprofit/non-governmental organization

Focus and Sector: Ecosystems/Habitat, Ecosystems/Habitat

Service Area: Multiple watersheds

Mission: *The Coalition's goal is to increase the pace, scale, and scope of watershed restoration projects leading to resilient Southern steelhead populations in high priority rivers of Southern California.*

Regional Network/Coalition Partners: Matilija Dam Ecosystem Restoration Project|Ventura River Watershed Council

Collaborative Partners: CA State Parks|California Assembly District 38, Asm. Steve Bennett|California Conservation Corps|California Department of Conservation|California Department of Fish and Wildlife|California State Coastal Conservancy|California State Senate District 21, Sen. Monique Limón|California State University, Channel Islands (CSUCI)|California Trout (CalTrout)|Chumash Elder Julie Tumamait-Stenslie|City of Ventura Public Works Department|Friends of the Ventura River|MERITO Foundation|National Marine Fisheries Service (NOAA Fisheries)|Native Coast Action Network|Patagonia|Santa Barbara Channelkeeper|Surfrider Foundation|U.S. Fish and Wildlife Service|U.S. Forest Service|University of California, Santa Barbara (UCSB)|Ventura County Resource Conservation District|Ventura County Watershed Protection District|Ventura Land Trust|Wishtoyo Chumash Foundation

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Limited staff/technical capacity **2.** Data sharing/accessibility **3.** Lack of coordination between agencies/groups

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *withstand or recover from disturbances, maintain ecosystem services after disturbances*

Has a climate resilience vision or plan: Yes

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- More frequent and intense wildfires

Most urgent climate challenges:

- Flooding and erosion
- Groundwater depletion
- Loss of biodiversity and habitat degradation
- Wildfire impacts on water systems
- Matilija Dam

Priority climate resilience strategies:

- Community engagement and education
- Data collection and monitoring
- Nature-based solutions

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources
- Regulatory or policy constraints

Other Comments: *Continuous collaboration with watershed partners*

Surfrider Foundation

ventura.surfrider.org

Type: Nonprofit/non-governmental organization

Focus and Sector: Community/Education, Community/Education

Service Area: Entire watershed

Mission: *The Surfrider Foundation is dedicated to the protection and enjoyment of the world's ocean, waves and beaches, for all people, through a powerful activist network.*

Regional Network/Coalition Partners: Beach Erosion Authority for Clean Oceans and Nourishment (BEACON)|Matilija Dam Ecosystem Restoration Project|Southern Steelhead Coalition|Ventura River Watershed Council|Westside Community Council

Collaborative Partners: Barbareño/Ventureño Band of Mission Indians|CA State Parks|CA Wildlife Conservation Board|California Assembly District 38, Asm. Steve Bennett|California Department of Fish and Wildlife|California State Coastal Conservancy|California State Senate District 21, Sen. Monique Limón|California State University, Channel Islands (CSUCI)|California Trout|Casitas Municipal Water District|Central Coast Alliance United for A Sustainable Economy (CAUSE)|Chumash Elder Julie Tumamait-Stenslie|City of Ventura Public Works Department|Concerned Resource and Environmental Workers (C.R.E.W.)|Friends of the Ventura River|Los Angeles Regional Water Quality Control Board (LARWQCB)|MERITO Foundation|National Marine Fisheries Service (NOAA Fisheries)|Natural

Resources Conservation Service (NRCS), U.S. Department of Agriculture|Ojai Valley Green Coalition|Ojai Valley Land Conservancy|Once Upon a Watershed|Santa Barbara Channelkeeper|State Water Resources Control Board (SWRCB)|U.S. Bureau of Reclamation|U.S. Fish and Wildlife Service|University of California, Santa Barbara (UCSB)|Upper Ventura River Groundwater Agency|Ventura County Community College District|Ventura County Watershed Protection District|Ventura Land Trust|City of Ventura – Ventura Water

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Lack of coordination between agencies/groups **2.** Data sharing/accessibility **3.** Limited staff/technical capacity

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *water security, sea level rise*
Has a climate resilience vision or plan: Yes https://www.surfrider.org/programs/climate-action

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased temperature and frequency of temperature extremes
- Sea-level rise

Most urgent climate challenges:

- Changes in soil quality and aridity
- Groundwater depletion
- Loss of biodiversity and habitat degradation
- Surface water shortages
- Water quality degradation

Priority climate resilience strategies:

- Community engagement and education
- Nature-based solutions
- Policy changes

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Regulatory or policy constraints
- “client science”

Other Comments: N/A

Teranga Ranch

www.terangaranch.org

Type: Nonprofit/non-governmental organization

Focus and Sector: Community/Education, Community/Education

Service Area: Multiple watersheds

Mission: *Teranga Ranch is a wildlife education organization that educates Californians about local wildlife and teaches them how to coexist. We go to schools and home owners association meetings. We*

hold community meetings when there is a perceived wildlife issue, like coyotes. We bring humane hazing devices to pass out and we discuss humane alternatives to poison, traps and guns. We teach community classes about local wildlife, we present workshops and we host Field Trips. We provide opportunities for anyone to get outside and involve themselves with wildlife, nature and Science.

Regional Network/Coalition Partners: N/A

Collaborative Partners: CA State Parks|California Department of Fish and Wildlife|Conejo Open Space Foundation|Sierra Club

Effectiveness of Collaboration: Very Effective **Frequency of Tangible Outcomes:** Occasionally

Collaboration Barriers: 1. Public awareness/engagement **2.** Policy/regulatory challenges **3.** Limited staff/technical capacity

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *nature-based solutions, traditional ecological knowledge, sustainability*

Has a climate resilience vision or plan: No

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- More frequent and intense wildfires

Most urgent climate challenges:

- Access to cultural resources
- Changes in soil quality and aridity
- Disproportionate impacts on disadvantaged or underserved communities
- Groundwater depletion
- Loss of biodiversity and habitat degradation

Priority climate resilience strategies:

- Community engagement and education
- Infrastructure improvements
- Nature-based solutions

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources
- Limited technical capacity or expertise

Other Comments: We are excited to learn more and to do more.

Trust for Public Land

www.tpl.org

Type: Nonprofit/non-governmental organization

Focus and Sector: Recreation, Recreation

Service Area: Project/site specific location(s)

Mission: *Connecting everyone to the outdoors. Quality parks and green spaces are fundamental to sustaining equitable, resilient communities. Access to nature and the outdoors—close to home, in the cities and communities where people live—is a matter of health, equity, and justice. That's why we work alongside communities across the country to create, protect, and steward the nature-rich places that are vital to human well-being.*

Regional Network/Coalition Partners: N/A

Collaborative Partners: Barbareño/Ventureño Band of Mission Indians|CA Wildlife Conservation Board|California Department of Fish and Wildlife|Ojai Valley Land Conservancy|Ventura Land Trust

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Very frequently

Collaboration Barriers: 1. Limited funding/resources **2.** Limited staff/technical capacity **3.** Lack of coordination between agencies/groups

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *climate resilience, sustainable water use, healthy ecosystems*

Has a climate resilience vision or plan: Yes https://www.tpl.org/our-mission/climate

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- More frequent and intense wildfires

Most urgent climate challenges:

- Access to cultural resources
- Access to recreational resources
- Disproportionate impacts on disadvantaged or underserved communities
- Land use changes
- Water quality degradation

Priority climate resilience strategies:

- Community engagement and education
- Nature-based solutions

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources

Other Comments: N/A

U.S. Fish and Wildlife Service

ventura.fws.gov

Type: Federal government

Focus and Sector: Ecosystems/Habitat, Ecosystems/Habitat

Service Area: Entire watershed

Mission: *Our mission is to work with others to conserve, protect and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people.*

Regional Network/Coalition Partners: N/A

Collaborative Partners: CA State Parks|California Department of Fish and Wildlife|California State Coastal Conservancy|California State University, Channel Islands (CSUCI)|California Trout (CalTrout)|Casitas Municipal Water District|City of Ventura Public Works Department|National Marine Fisheries Service (NOAA Fisheries)|Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture|Surfrider Foundation|Trout Unlimited|Trust for Public Land|U.S. Army Corps of Engineers|U.S. Bureau of Reclamation|U.S. Forest Service|University of California, Santa Barbara (UCSB)|Ventura County Planning Division|Ventura County Resource Conservation District|Ventura County Supervisor for District 1|Ventura County Watershed Protection District|Ventura Land Trust|City of Ventura – Ventura Water

Effectiveness of Collaboration: Very Effective

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Limited funding/resources **2.** Limited staff/technical capacity **3.** Policy/regulatory challenges

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *The ability to withstand and recover from disturbances, whether natural or human-caused, while maintaining its essential ecological functionality and structure.*

Has a climate resilience vision or plan: Yes https://www.fws.gov/initiative/climate-change/climate-change-action-program

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased temperature and frequency of temperature extremes
- More frequent and intense wildfires

Most urgent climate challenges:

- Groundwater depletion
- Land use changes
- Loss of biodiversity and habitat degradation
- Surface water shortages
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Community engagement and education
- Economic and funding strategies for resilience projects
- Nature-based solutions

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources

Other Comments: N/A

University of California Cooperative Extension

www.ucanr.edu/county-office/cooperative-extension-ventura-county

Type: Academic/research institution

Focus and Sector: Other/multiple, Land management

Service Area: Entire watershed

Mission: *Develop science-based information about agriculture, youth development, home economics and natural resources, and deliver that information to local audiences.*

Regional Network/Coalition Partners: Association of Water Agencies of Ventura County|Central Coast Climate Collaborative|Watershed Progressive for Land Resilience Partnership|Matilija Dam Ecosystem Restoration Project|South Coast Habitat Restoration|Southern Steelhead Coalition|Ventura County Agricultural Irrigated Lands Group (VCAILG)|Ventura County Climate Emergency Council|Ventura County Climate Hub - 350|Ventura County Regional Climate Collaborative|Ventura County Wildfire Collaborative|Ventura River Watershed Council|Watersheds Coalition of Ventura County (WCVC)

Collaborative Partners: Barbareño/Ventureño Band of Mission Indians|Bureau of Land Management, U.S. Department of the Interior|CA State Parks|CA Wildlife Conservation Board|California Assembly District 38, Asm. Steve Bennett|California Department of Fish and Wildlife|California Department of Forestry and Fire Protection (CAL FIRE)|California State University, Channel Islands (CSUCI)|Chumash Elder Julie Tumamait-Stenslie|City of Ojai|City of Ventura Community Development Department|City of Ventura Public Works Department|Concerned Resource and Environmental Workers (C.R.E.W.)|Farm Bureau of Ventura County|Los Angeles Regional Water Quality Control Board (LARWQCB)|Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture|Office of Emergency Services (OES) - Ventura County Sheriff's Office|Ojai Valley Fire Safe Council|Ojai Valley Land Conservancy|Once Upon a Watershed|State Water Resources Control Board (SWRCB)|Taylor Ranch|U.S. Fish and Wildlife Service|U.S. Forest Service|University of California, Santa Barbara (UCSB)|Ventura County Coalition of Labor, Agriculture and Business (CoLAB)|Ventura County Community College District|Ventura County Department of Agriculture/Weights & Measures|Ventura County Fire Department|Ventura County Planning Division|Ventura County Resource Conservation District|Ventura County Supervisor for District 1|Ventura County Sustainability Division|Ventura County Watershed Protection District|Ventura Land Trust|Ventura Regional Fire Safe Council|Wishtoyo Chumash Foundation

Effectiveness of Collaboration: Very Effective **Frequency of Tangible Outcomes:** Very frequently

Collaboration Barriers: 1. Limited funding/resources **2.** Public awareness/engagement **3.** Pace of change, mostly due to changes in climate & land use

Thoughts on Additional Partners to Strengthen Work: *Federal at this time due to combination of numerous federal entities in the watershed, last several years of staffing attrition culminating in recent severe cuts by current administration.*

Meaning of Watershed Resiliency: *Healthy ecosystem, informed public, prudent governance.*

Has a climate resilience vision or plan: Yes https://ucanr.edu/site/uc-anr-planning-and-accountability/strategic-vision

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- More frequent and intense wildfires
- Encroachment of pollutants into & overdraft of groundwater

Most urgent climate challenges:

- Flooding and erosion
- Groundwater depletion
- Land use changes
- Loss of biodiversity and habitat degradation
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Community engagement and education
- Data collection and monitoring
- Nature-based solutions

Main implementation challenges:

- Lack of funding or financial resources
- Lack of reliable climate and hydrological data and monitoring tools
- Limited technical capacity or expertise

Other Comments: *Our organization has interfaced with agriculture & natural resources issues since 1914. We were funded last year to initiate a climate science & resilience program in the county that we are confident will bolster our knowledge, services, collaboration, and outreach for the watershed.*

University of California, Santa Barbara (UCSB)

www.ucsb.edu

Type: Academic/research institution **Focus and Sector:** Ecosystems/Habitat, Ecosystems/Habitat **Service Area:** Entire watershed

Mission: *Higher education, research*

Regional Network/Coalition Partners: N/A

Collaborative Partners: Barbareño/Ventureño Band of Mission Indians|California Department of Fish and Wildlife|California Trout (CalTrout)|Chumash Elder Julie Tumamait-Stenslie|U.S. Fish and Wildlife Service|University of California Cooperative Extension|Ventura County Watershed Protection District

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Limited staff/technical capacity **2.** Lack of coordination between agencies/groups **3.** Policy/regulatory challenges

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *capacity to quickly recover, water quality, habitat connectivity, ecosystem function*

Has a climate resilience vision or plan: Yes https://www.sustainability.ucsb.edu/climate-action-plan

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- Increased temperature and frequency of temperature extremes

Most urgent climate challenges:

- Disproportionate impacts on disadvantaged or underserved communities
- Disproportionate impacts on tribal communities
- Flooding and erosion
- Land use changes
- Loss of biodiversity and habitat degradation

Priority climate resilience strategies:

- Data collection and monitoring
- Nature-based solutions

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Limited technical capacity or expertise
- Regulatory or policy constraints

Other Comments: N/A

Upper Ventura River Groundwater Agency

www.uvrgroundwater.org

Type: Groundwater Sustainability Agency

Focus and Sector: Groundwater, Water

Service Area: Defined jurisdiction/area/boundary

Mission: *Sustainable Groundwater Management pursuant to the Sustainable Groundwater Management Act*

Regional Network/Coalition Partners: Ventura River Watershed Council

Collaborative Partners: Casitas Municipal Water District|Casitas Mutual Water Company|Farm Bureau of Ventura County|Meiners Oaks Water District|Ojai Basin Groundwater Management Agency|State Water Resources Control Board (SWRCB)|Ventura County Watershed Protection District|Ventura River Water District|City of Ventura – Ventura Water

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Very frequently

Collaboration Barriers: 1. Adjudication **2.** Lack of coordination between agencies/groups **3.** Data sharing/accessibility

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *Sustainable groundwater management*

Has a climate resilience vision or plan: Other: SGMA requires that GSAs analyze and consider climate change in groundwater sustainability plans. https://uvrgroundwater.org/sgma-overview/

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought

Most urgent climate challenges:

- The groundwater sustainability plan found that climate change does not have a material impact on groundwater management.

Priority climate resilience strategies:

- Data collection and monitoring
- Policy changes

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources

Other Comments: N/A

Ventura County Department of Agriculture/Weights & Measures

awm.venturacounty.gov

Type: Local government

Focus and Sector: Agriculture, Agriculture

Service Area: Multiple watersheds

Mission: To protect and promote agriculture and equity in the marketplace, while ensuring the welfare of the public, the industry and the environment.

Regional Network/Coalition Partners: Association of Water Agencies of Ventura County|Ventura County Agricultural Irrigated Lands Group (VCAILG)|Ventura River Watershed Council|Ventura County Weed Management Area

Collaborative Partners: Bureau of Land Management, U.S. Department of the Interior|CA Governor's Office of Land Use and Climate Innovation (LCI)|California Assembly District 38, Asm. Steve Bennett|California Conservation Corps|California Department of Conservation|California Department of Fish and Wildlife|California Department of Forestry and Fire Protection (CAL FIRE)|California State Senate District 21, Sen. Monique Limón|Casitas Municipal Water District|Casitas Mutual Water Company|Central Coast Alliance United for A Sustainable Economy (CAUSE)|City of Ojai|Farm Bureau of Ventura County|Meiners Oaks Water District|Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture|Office of Emergency Services (OES) - Ventura County Sheriff's Office|Ojai Valley Land Conservancy|Senior Canyon Mutual Water Company|University of California Cooperative Extension|Ventura County Coalition of Labor, Agriculture and Business (CoLAB)|Ventura County Fire Department|Ventura County Planning Division|Ventura County Resource Conservation District|Ventura County Supervisor for District 1|Ventura County Sustainability Division|Ventura County Watershed Protection District|Ventura Land Trust|Ventura Regional Fire Safe Council|Ventura River Water District|City of Ventura – Ventura Water

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Rarely

Collaboration Barriers: 1. Limited funding/resources **2.** Policy/regulatory challenges **3.** Lack of coordination between agencies/groups

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *perennial availability, user-side responsibility, infrastructure expansion*

Has a climate resilience vision or plan: Yes, participated in development and implementation of Ventura County CAP https://ecap.venturacounty.gov/

Most urgent climate hazards:

Most urgent climate challenges:

- Groundwater depletion

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- Increased temperature and frequency of temperature extremes
- Land use changes
- Surface water shortages

Priority climate resilience strategies:

- Community engagement and education
- Data collection and monitoring
- Policy changes

Main implementation challenges:

- Lack of funding or financial resources
- Limited technical capacity or expertise
- Authority/responsibility constraints

Other Comments: N/A

Ventura County Fire Department

www.vcfd.org

Type: Local government

Focus and Sector: Wildfire preparedness and management, Wildfire

Service Area: Multiple watersheds

Mission: *The mission of the Ventura County Fire Department is to anticipate and respond to the dynamic public safety needs of a diverse community of about 840,000 people. This includes not only fire prevention, but also education, response, and communication. Our wide-ranging response area covers 848 square miles and includes all unincorporated areas along with the cities of Ojai, Port Hueneme, Moorpark, Camarillo, Santa Paula, Simi Valley, and Thousand Oaks.*

Regional Network/Coalition Partners: Ventura County Wildfire Collaborative

Collaborative Partners: City of Ojai|Ojai Valley Fire Safe Council|Ojai Valley Inn|Ojai Valley Land Conservancy|U.S. Forest Service|Ventura County Resource Conservation District|Ventura Land Trust|Ventura Regional Fire Safe Council

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Very frequently

Collaboration Barriers: 1. Public awareness/engagement **2.** Limited funding/resources **3.** Limited staff/technical capacity

Thoughts on Additional Partners to Strengthen Work: *land owners*

Meaning of Watershed Resiliency: *Reestablishment of traditional riparian areas that can act as a natural fuel break during wildland fires.*

Has a climate resilience vision or plan: No

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased temperature and frequency of temperature extremes
- More frequent and intense wildfires

Most urgent climate challenges:

- Loss of biodiversity and habitat degradation
- Wildfire impacts on water systems
- Arundo-donax

Priority climate resilience strategies:

- Nature-based solutions

Main implementation challenges:

- N/A

Other Comments: N/A

Ventura County Parks Department

www.ventura.org/parks-department

Type: Local government

Focus and Sector: Recreation, Recreation

Service Area: Project/site specific location(s)

Mission: *To enhance the quality of life for the residents and visitors of Ventura County through the equitable provision and promotion of quality recreational facilities and park lands. To improve physical and mental health through outdoor recreation while fostering partnerships to expand community activity opportunities.*

Regional Network/Coalition Partners: N/A

Collaborative Partners: Surfrider Foundation|Ventura Land Trust

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Very frequently

Collaboration Barriers: 1. Limited funding/resources **2.** Agreeable scope of delivery with funding and measured impacts to other interests. **3.** Limited staff/technical capacity

Thoughts on Additional Partners to Strengthen Work: *We coordinate with many agencies and partners within the water shed. Having common goals and funding is most important for executing anything*.

Meaning of Watershed Resiliency: *The watershed should be managed such that it is available for future generations.*

Has a climate resilience vision or plan: Yes https://ecap.venturacounty.gov/

Most urgent climate hazards:

- N/A

Most urgent climate challenges:

- N/A

Priority climate resilience strategies:

- Sustainable management of properties in the watershed.

Main implementation challenges:

- N/A

Other Comments: Look for continued mechanical weed treatment by VC Parks and we are hopeful to have an Arundo management pilot near Foster Park in the future.

Ventura County Planning Division

rma.venturacounty.gov/divisions/planning/

Type: Local government

Focus and Sector: Land management, Land management

Service Area: Multiple watersheds

Mission: *The chief responsibility of the Planning Division is to regulate the use of land and structures, zoning, subdivision regulations, signage, filming, growth management, and environmental protections within unincorporated areas of the county. Using these regulations and others, the Planning Division issues permits for uses and structures and enforces both permit conditions and maintains consistency with the County's Zoning Ordinances and General Plan.*

Regional Network/Coalition Partners: Ventura County Climate Emergency Council|Ventura River Watershed Council

Collaborative Partners: Barbareño/Ventureño Band of Mission Indians|CA Governor's Office of Land Use and Climate Innovation (LCI)|CA Wildlife Conservation Board|California Department of Fish and Wildlife|California Department of Forestry and Fire Protection (CAL FIRE)|California State Coastal Conservancy|Central Coast Alliance United for A Sustainable Economy (CAUSE)|Chumash Elder Julie Tumamait-Stenslie|City of Ojai|City of Ventura Community Development Department|Climate First: Replacing Oil & Gas (CFROG)|Farm Bureau of Ventura County|Los Angeles Regional Water Quality Control Board (LARWQCB)|Office of Emergency Services (OES) - Ventura County Sheriff's Office|Ojai Valley Land Conservancy|U.S. Army Corps of Engineers|U.S. Fish and Wildlife Service|University of California Cooperative Extension|Ventura County Coalition of Labor, Agriculture and Business (CoLAB)|Ventura County Department of Agriculture/Weights & Measures|Ventura County Fire Department|Ventura County Parks Department|Ventura County Supervisor for District 1|Ventura

County Sustainability Division|Ventura County Watershed Protection District|Ventura Regional Fire Safe Council

Effectiveness of Collaboration: Neutral

Frequency of Tangible Outcomes: Rarely

Collaboration Barriers: 1. Limited staff/technical capacity **2.** Lack of coordination between agencies/groups **3.** Policy/regulatory challenges

Thoughts on Additional Partners to Strengthen Work: *In my capacity as a County General Plan implementation person, the need for collaboration is somewhat limited and is mainly focused on General Plan program development and implementation.*

Meaning of Watershed Resiliency: *Balancing water use demands, Effective management of water quality and quantity for current and future uses, Protection of the physical watershed to minimize erosion, maximize use of watershed resources for wildlife and other biological resources*

Has a climate resilience vision or plan: Yes https://ecap.venturacounty.gov/

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased temperature and frequency of temperature extremes
- More frequent and intense wildfires

Most urgent climate challenges:

- Groundwater depletion
- Loss of biodiversity and habitat degradation
- Surface water shortages
- Water quality degradation
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Community engagement and education
- Nature-based solutions
- Policy changes

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Limited technical capacity or expertise
- Regulatory or policy constraints

Other Comments: N/A

Ventura County Resource Conservation District

www.vcrcd.org

Type: Nonprofit/non-governmental organization

Focus and Sector: Other/multiple, Land management

Service Area: Multiple watersheds

Mission: *Natural resource conservation*

Regional Network/Coalition Partners: Watershed Progressive for Land Resilience Partnership|Ventura County Agricultural Irrigated Lands Group (VCAILG)|Ventura County Wildfire Collaborative|Ventura River Watershed Council|Monarch and Pollinator Regional Advisory Committee

Collaborative Partners: Barbareño/Ventureño Band of Mission Indians|CA Governor's Office of Land Use and Climate Innovation (LCI)|CA State Parks|CA Wildlife Conservation Board|California Department of Conservation|California Department of Fish and Wildlife|California Department of Forestry and Fire Protection (CAL FIRE)|California Department of Water Resources|California State Coastal Conservancy|California State University, Channel Islands (CSUCI)|Chumash Elder Julie Tumamait-Stenslie|City of Ojai|City of Ventura Public Works Department|Farm Bureau of Ventura County|Los Angeles Regional Water Quality Control Board (LARWQCB)|MERITO Foundation|Meiners Oaks Water District|Native Coast Action Network|Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture|Ojai Basin Groundwater Management Agency|Ojai Unified School District|Ojai Valley Fire Safe Council|Ojai Valley Inn|Ojai Valley Land Conservancy|Senior Canyon Mutual Water Company|State Water Resources Control Board (SWRCB)|Taylor Ranch|U.S. Fish and Wildlife Service|University of California Cooperative Extension|University of California, Santa Barbara (UCSB)|Upper Ventura River Groundwater Agency|Ventura County Department of Agriculture/Weights & Measures|Ventura County Fire Department|Ventura County Supervisor for District 1|Ventura County Sustainability Division|Ventura County Watershed Protection District|Ventura Regional Fire Safe Council|Ventura River Water District|City of Ventura – Ventura Water

Effectiveness of Collaboration: Very Effective **Frequency of Tangible Outcomes:** Very frequently

Collaboration Barriers: 1. Limited funding/resources **2.** Limited staff/technical capacity **3.** timelines not aligned

Thoughts on Additional Partners to Strengthen Work: *Grass-root community collaboration and engagement*

Meaning of Watershed Resiliency: Watershed resilience reduces impact from climate hazards, can adopt additional conservation measures when needed, emphasizes use of local resources, environmental health is a goal

Has a climate resilience vision or plan: Yes, it's one of our organization's nine strategic priorities. https://vcrcd.org/resources/

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- More frequent and intense wildfires

Most urgent climate challenges:

- Changes in soil quality and aridity
- Flooding and erosion
- Loss of biodiversity and habitat degradation
- Surface water shortages
- Water quality degradation

Priority climate resilience strategies:

- Community engagement and education
- Economic and funding strategies for resilience projects
- Nature-based solutions

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources
- Limited technical capacity or expertise

Other Comments: N/A

Ventura County Sustainability Division

sustain.venturacounty.gov

Type: Local government **Focus and Sector:** Energy, Energy **Service Area:** Multiple watersheds

Mission: *The County Executive Office's Sustainability Division is dedicated to establishing Ventura County, its communities, and neighboring regions as leaders in developing and implementing sustainable initiatives that support sensible growth, healthy environment and economy, enhanced quality of life, inclusion and equity, and greater self-reliance for the region.*

Regional Network/Coalition Partners: Ventura County Climate Emergency Council

Collaborative Partners: CA Governor's Office of Land Use and Climate Innovation (LCI)|California Assembly District 38, Asm. Steve Bennett|California State Senate District 21, Sen. Monique Limón|California State University, Channel Islands (CSUCI)|Central Coast Alliance United for A Sustainable Economy (CAUSE)|City of Ojai|City of Ventura Community Development Department|City of Ventura Public Works Department|Climate First: Replacing Oil & Gas (CFROG)|Farm Bureau of Ventura County|MERITO Foundation|University of California Cooperative Extension|Ventura County Community College District|Ventura County Department of Agriculture/Weights & Measures|Ventura County Planning Division|Ventura County Resource Conservation District|Ventura County Supervisor for District 1|Ventura County Watershed Protection District|Ventura Land Trust|Ventura Unified School District

Effectiveness of Collaboration: Very Effective **Frequency of Tangible Outcomes:** Occasionally

Collaboration Barriers: 1. Limited funding/resources **2.** Limited staff/technical capacity **3.** Data sharing/accessibility

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *nature based solutions, clean water and healthy ecosystem*
Has a climate resilience vision or plan: Yes https://ecap.venturacounty.gov/

Most urgent climate hazards:

- Increased precipitation extremes and flooding
- Increased temperature and frequency of temperature extremes
- More frequent and intense wildfires

Most urgent climate challenges:

- Access to recreational resources
- Changes in soil quality and aridity
- Disproportionate impacts on disadvantaged or underserved communities
- Groundwater depletion
- Loss of biodiversity and habitat degradation

Priority climate resilience strategies:

- Community engagement and education
- Economic and funding strategies for resilience projects

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources
- Limited technical capacity or expertise

Other Comments: N/A

Ventura County Watershed Protection District

publicworks.venturacounty.gov/wp/

Type: Local government

Focus and Sector: Flood management, Water

Service Area: Entire watershed

Mission: *Provide public infrastructure to unincorporated county*

Regional Network/Coalition Partners: Association of Water Agencies of Ventura County|Matilija Dam Ecosystem Restoration Project|Ventura River Watershed Council|Watersheds Coalition of Ventura County (WCVC)

Collaborative Partners: CA State Parks|CA Wildlife Conservation Board|California Assembly District 38, Asm. Steve Bennett|California Department of Fish and Wildlife|California Department of Water Resources|California State Coastal Conservancy|Casitas Municipal Water District|Casitas Mutual Water Company|City of Ventura Public Works Department|Los Angeles Regional Water Quality Control Board (LARWQCB)|Meiners Oaks Water District|National Marine Fisheries Service (NOAA Fisheries)|Ojai Valley Land Conservancy|Senior Canyon Mutual Water Company|State Water Resources Control Board (SWRCB)|U.S. Army Corps of Engineers|U.S. Bureau of Reclamation|U.S. Fish and Wildlife Service|Ventura County Supervisor for District 1|Ventura River Water District|City of Ventura – Ventura Water

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Limited funding/resources **2.** Policy/regulatory challenges **3.** Permitting

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *Ability to obtain permits to perform required maintenance and capital projects*

Has a climate resilience vision or plan: Yes https://ecap.venturacounty.gov/

Most urgent climate hazards:

- Increased precipitation extremes and flooding

Most urgent climate challenges:

- Flooding and erosion
- Regulatory or policy gaps

Priority climate resilience strategies:

- Data collection and monitoring

Main implementation challenges:

- Lack of funding or financial resources
- Regulatory or policy constraints

Other Comments: N/A

Ventura County Wildfire Collaborative

www.vcrcd.org/vcwc

Type: Nonprofit/non-governmental organization

Focus and Sector: Wildfire preparedness and management, Wildfire

Service Area: Multiple watersheds

Mission: *Countywide initiative designed to ensure that Ventura County neighborhoods and communities located in and near the Wildland Urban Interface (WUI) are not only wildfire resilient but have the tools necessary to better prepare, withstand, respond to, and recover from devastating wildfires.*

Regional Network/Coalition Partners: N/A

Collaborative Partners: Barbareño/Ventureño Band of Mission Indians|CA Governor's Office of Emergency Services (Cal OES)|California Conservation Corps|California Department of Forestry and Fire Protection (CAL FIRE)|California State Coastal Conservancy|City of Ojai|City of Ventura Fire Department|Concerned Resource and Environmental Workers (C.R.E.W.)|Native Coast Action Network|Office of Emergency Services (OES) - Ventura County Sheriff's Office|Ojai Valley Fire Safe Council|Ojai Valley Land Conservancy|U.S. Forest Service|Ventura County Fire Department|Ventura County Resource Conservation District|Ventura Land Trust|Ventura Regional Fire Safe Council

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Very frequently

Collaboration Barriers: 1. Limited staff/technical capacity **2.** Lack of coordination between agencies/groups **3.** Public awareness/engagement

Thoughts on Additional Partners to Strengthen Work: *Expand collaboration with Forest Service to address wildfire concerns in the northern half of the county. Coordinate better with County Planning and Sustainability to address disparate goals (i.e. mulch for drought tolerance and pollinators can significantly increase wildfire risk depending on placement)*

Meaning of Watershed Resiliency: *Water is accessible and in sufficient quantities during wildfire events. Seasonally dry creekbeds are not filled with invasive, flashy fuels (arundo).*

Has a climate resilience vision or plan: No

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased temperature and frequency of temperature extremes
- More frequent and intense wildfires

Most urgent climate challenges:

- Disproportionate impacts on disadvantaged or underserved communities
- Groundwater depletion
- Land use changes
- Surface water shortages
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Economic and funding strategies for resilience projects
- Infrastructure improvements
- Nature-based solutions

Main implementation challenges:

- Lack of funding or financial resources
- Limited technical capacity or expertise

Other Comments: *We believe that long-term, it would behoove our wildfire collaborative to be more knowledgeable regarding watershed health and resources; not necessarily to take on watershed projects ourselves, but to ensure we are addressing wildfire holistically and can better direct organizational and resident concerns to the proper channels.*

Ventura Land Trust

www.venturalandtrust.org

Type: Nonprofit/non-governmental organization

Focus and Sector: Land management, Land management

Service Area: Multiple watersheds

Mission: *Working to preserve, enhance, and restore the native biodiversity and ecosystem values of wildlands in Ventura County for the benefit of current and future generations, and to responsibly facilitate public access, engagement, and ecological literacy within our community.*
Vision: *Building a robust baseline of natural resource and public access data and investing in long-term biological monitoring to inform strategic, science-based, adaptive conservation management of our wildland preserves, and to share our discoveries with our community in order to buoy ecological valuation and support for our organization's mission.*

Regional Network/Coalition Partners: Southern Steelhead Coalition|Ventura County Wildfire Collaborative|Ventura River Watershed Council

Collaborative Partners: Barbareño/Venturеño Band of Mission Indians|CA State Parks|California Department of Fish and Wildlife|Friends of the Ventura River|Ojai Valley Land Conservancy|U.S. Fish and Wildlife Service|Ventura County Resource Conservation District|Ventura County Supervisor for District 1

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Policy/regulatory challenges **2.** Limited funding/resources **3.** Lack of coordination between agencies/groups

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *ecological integrity, functional dynamicism, sustainable ecological and cultural adaptation, enhanced biodiversity*

Has a climate resilience vision or plan: No

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding More frequent and intense wildfires

Most urgent climate challenges:

- Flooding and erosion
- Groundwater depletion
- Land use changes
- Loss of biodiversity and habitat degradation
- Regulatory or policy gaps

Priority climate resilience strategies:

Main implementation challenges:

- Data collection and monitoring
- Economic and funding strategies for resilience projects
- Nature-based solutions
- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources
- Regulatory or policy constraints

Other Comments: *Sharing monitoring and project outcome data, connecting property owners along the river corridor to facilitate collaboration, streamlining regulatory hurdles and outlining a path to navigate permit approvals, incentivizing ecological management of floodplain properties (i.e. arundo), and increasing communications across stakeholders to exchange information would be highly valuable in improving resilience planning and implementation.*

Ventura Regional Fire Safe Council

www.venturafiresafe.org

Type: Nonprofit/non-governmental organization

Focus and Sector: Wildfire preparedness and management, Wildfire

Service Area: Multiple watersheds

Mission: *Ventura Regional Fire Safe Council is a grassroots, community-led organization that mobilizes residents to protect their homes, communities, and environments from catastrophic wildfire, through collaborative planning, programs, mitigation and education.*

Regional Network/Coalition Partners: Ventura County Wildfire Collaborative|Environmental Workforce Collaborative (led by Ventura County Community Foundation)|Ventura County Volunteer Organizations Active in Disaster (VC VOAD)

Collaborative Partners: California Assembly District 38, Asm. Steve Bennett|California Department of Conservation|California Department of Forestry and Fire Protection (CAL FIRE)|California State Coastal Conservancy|Office of Emergency Services (OES) - Ventura County Sheriff's Office|Ojai Unified School District|Ojai Valley Fire Safe Council|Patagonia|U.S. Forest Service|University of California Cooperative Extension|Ventura County Community College District|Ventura County Fire Department|Ventura County Resource Conservation District|Ventura County Supervisor for District 1|Ventura Land Trust

Effectiveness of Collaboration: Very Effective

Frequency of Tangible Outcomes: Very frequently

Collaboration Barriers: 1. Limited staff/technical capacity **2.** Limited funding/resources **3.** Data sharing/accessibility

Thoughts on Additional Partners to Strengthen Work: *collaboration with land conservancies and USFS to complete more wildfire resilience and forest health work*

Meaning of Watershed Resiliency: Water is accessible and in sufficient quantities during wildfire events. Seasonally dry creekbeds are not filled with invasive, flashy fuels (arundo). Drought is mitigated in both wildland and urban areas

Has a climate resilience vision or plan: No

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased temperature and frequency of temperature extremes
- More frequent and intense wildfires

Most urgent climate challenges:

- Disproportionate impacts on disadvantaged or underserved communities
- Groundwater depletion
- Land use changes
- Surface water shortages
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Community engagement and education
- Economic and funding strategies for resilience projects
- Infrastructure improvements

Main implementation challenges:

- Lack of funding or financial resources
- Limited technical capacity or expertise

Other Comments: *While it may not be within our scope or role to lead watershed or climate resilience projects, we recognize that wildfire mitigation is a critical, complementary effort and look forward to opportunities to collaborate.*

Ventura River Water District

www.vrwd.ca.gov

Type: Public utility

Focus and Sector: Water supply, Water

Service Area: Defined jurisdiction/area/boundary

Mission: *To provide good quality water that meets or exceeds State requirements in a cost effective and sustainable manner.*

Regional Network/Coalition Partners: Association of Water Agencies of Ventura County|Watersheds Coalition of Ventura County (WCVC)

Collaborative Partners: Barbareño/Ventureño Band of Mission Indians|California Assembly District 38, Asm. Steve Bennett|California Department of Fish and Wildlife|California Department of Water Resources|California State Senate District 21, Sen. Monique Limón|Casitas Municipal Water District|Casitas Mutual Water Company|City of Ojai|City of Ventura|Meiners Oaks Water District|Office of Emergency Services (OES) - Ventura County Sheriff's Office|Ojai Valley Sanitary

District|State Water Resources Control Board (SWRCB)|Surfrider Foundation|Taylor Ranch|Tico Mutual Water Company|U.S. Bureau of Reclamation|U.S. Fish and Wildlife Service|Upper Ventura River Groundwater Agency|Ventura County Fire Department|Ventura County Resource Conservation District|City of Ventura – Ventura Water

Effectiveness of Collaboration: Neutral

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Limited staff/technical capacity **2.** Limited funding/resources **3.** Data sharing/accessibility

Thoughts on Additional Partners to Strengthen Work: N/A

Meaning of Watershed Resiliency: *Adaptability, sustainability, ecosystem health*

Has a climate resilience vision or plan: Yes, but it is in a living document subject to change when new information is gained.

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- More frequent and intense wildfires

Most urgent climate challenges:

- Disproportionate impacts on disadvantaged or underserved communities
- Groundwater depletion
- Water quality degradation
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Infrastructure improvements
- Policy changes
- Green infrastructure

Main implementation challenges:

- Lack of funding or financial resources

Other Comments: N/A

Ventura River Watershed Council

www.venturawatershed.org

Type: Community-based organization

Focus and Sector: Other/multiple, Land management

Service Area: Entire watershed

Mission: *The mission of the Ventura River Watershed Council is to facilitate and support efforts by individuals, agencies, and organizations to maintain and improve the health and sustainability of the Ventura River Watershed for the benefit of the people and ecosystems that depend upon it.*

Regional Network/Coalition Partners: Southern Steelhead Coalition|Ventura County Wildfire Collaborative|Watersheds Coalition of Ventura County (WCVC)

Collaborative Partners: Barbareño/Ventureño Band of Mission Indians|CA State Parks|California Department of Fish and Wildlife|California State Coastal Conservancy|California State University, Channel Islands (CSUCI)|California Trout|Casitas Municipal Water District|Casitas Mutual Water Company|Central Coast Alliance United for A Sustainable Economy (CAUSE)|Chumash Elder Julie Tumamait-Stenslie|City of Ventura Community Development Department|City of Ventura Public Works Department|Concerned Resource and Environmental Workers (C.R.E.W.)|Farm Bureau of Ventura County|Friends of the Ventura River|Localizing California Waters|MERITO Foundation|Meiners Oaks Water District|Mound Basin Groundwater Sustainability Agency|National Marine Fisheries Service (NOAA Fisheries)|Native Coast Action Network|Ojai Basin Groundwater Management Agency|Ojai Valley Fire Safe Council|Ojai Valley Green Coalition|Ojai Valley Land Conservancy|Once Upon a Watershed|Santa Barbara Channelkeeper|State Water Resources Control Board (SWRCB)|Surfrider Foundation|U.S. Fish and Wildlife Service|University of California Cooperative Extension|University of California, Santa Barbara (UCSB)|Upper Ventura River Groundwater Agency|Ventura County Coalition of Labor, Agriculture and Business (CoLAB)|Ventura County Department of Agriculture/Weights & Measures|Ventura County Fire Department|Ventura County Parks Department|Ventura County Resource Conservation District|Ventura County Supervisor for District 1|Ventura County Sustainability Division|Ventura County Watershed Protection District|Ventura Land Trust|Ventura River Water District|City of Ventura – Ventura Water

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Public awareness/engagement **2.** Limited funding/resources **3.** Lack of coordination between agencies/groups

Thoughts on Additional Partners to Strengthen Work: *Ventura County Community Foundation*

Meaning of Watershed Resiliency: *adaptable, forward looking, an educated and engaged community*
Has a climate resilience vision or plan: In development

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- More frequent and intense wildfires

Most urgent climate challenges:

- Access to recreational resources
- Flooding and erosion
- Loss of biodiversity and habitat degradation
- Water quality degradation
- water supply is our other listed concern in our watershed plan document

Priority climate resilience strategies:

Main implementation challenges:

- Community engagement and education
- Economic and funding strategies for resilience projects
- Lack of funding or financial resources
- we don't apply for projects directly but rather serve as a network for partner organizations to share projects and discuss issues, our main focus is sharing information and spreading communication throughout watershed

Other Comments: *The partners we collaborate with the most are those that regularly attend our meetings, are engaged in our communications, and provide funding. While I work for the VCRCD I kept my answers confined to the partnerships I work with when I am serving as the watershed coordinator since other staff members at the VCRCD will complete this survey for the VCRCD.*

Watershed Progressive for Land Resilience Partnership

www.landresiliencepartnership.org

Type: Private sector/consulting firm

Focus and Sector: Other/multiple, Land management

Service Area: Entire watershed

Mission: *Connecting communities with their watersheds through integrated solutions for a healthy resilient future.*

Regional Network/Coalition Partners: South Coast Habitat Restoration|Southern Steelhead Coalition|Ventura River Watershed Council

Collaborative Partners: CA Governor's Office of Land Use and Climate Innovation (LCI)|CA State Parks|CA Wildlife Conservation Board|California Assembly District 38, Asm. Steve Bennett|California Conservation Corps|California Department of Conservation|California Department of Fish and Wildlife|California Department of Forestry and Fire Protection (CAL FIRE)|California Department of Water Resources|California State Coastal Conservancy|California State Senate District 21, Sen. Monique Limón|Casitas Municipal Water District|Chumash Elder Julie Tumamait-Stenslie|City of Ojai|City of Ventura Community Development Department|City of Ventura Public Works Department|Concerned Resource and Environmental Workers (C.R.E.W.)|Localizing California Waters|Los Angeles Regional Water Quality Control Board (LARWQCB)|MERITO Foundation|Meiners Oaks Water District|National Marine Fisheries Service (NOAA Fisheries)|Native Coast Action Network|Ojai Basin Groundwater Management Agency|Ojai Unified School District|Ojai Valley Fire Safe Council|Ojai Valley Green Coalition|Ojai Valley Inn|Ojai Valley Land Conservancy|Once Upon a Watershed|Patagonia|Santa Barbara Channelkeeper|Senior Canyon Mutual Water Company|State Water Resources Control Board (SWRCB)|Surfrider Foundation|Trout Unlimited|U.S. Fish and Wildlife Service|U.S. Forest Service|University of California, Santa Barbara (UCSB)|Ventura County Resource

Conservation District|Ventura County Supervisor for District 1|Ventura County Watershed Protection District|Ventura River Water District|Ventura Unified School District|City of Ventura – Ventura Water

Effectiveness of Collaboration: Somewhat Effective

Frequency of Tangible Outcomes: Very frequently

Collaboration Barriers: 1. Public awareness/engagement **2.** Burn out: Too many groups, not enough people to participate **3.** Data sharing/accessibility

Thoughts on Additional Partners to Strengthen Work: *Discussing and coordinating on data and approaches used, how to coordinate.*

Meaning of Watershed Resiliency: *Healthy watershed communities-it's the LCW tag line.*
Has a climate resilience vision or plan: Yes

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- Increased temperature and frequency of temperature extremes

Most urgent climate challenges:

- Changes in soil quality and aridity
- Disproportionate impacts on tribal communities
- Loss of biodiversity and habitat degradation
- Surface water shortages
- Water quality degradation

Priority climate resilience strategies:

- Community engagement and education
- Data collection and monitoring
- Nature-based solutions

Main implementation challenges:

- Lack of funding or financial resources
- Cost of living in Ventura County for local labor pool

Other Comments: *Land Resilience Partnership/Watershed Progressive has collected holistic assessments on over 355 parcels in the watershed, including ag, schools, municipal, commercial, light industrial, residential and in every case there is a 50-90% water reduction and water quality benefit at each property. Multiple benefits such as enhanced habitat, recreation, shade, groundwater recharge, drought resilience, fire resilience improvements, healthy soils, and reduced ghg's are available to every one of these parcels. And all the approaches, stemming from the VRIF Toolkit Catalogue are easy to implement, minimal permitting and doable.*

Watersheds Coalition of Ventura County

www.watershedscoalition.org

Type: Community-based organization **Focus and Sector:** Water supply, Water **Service Area:** Multiple watersheds

Mission: *WCVC facilitated regional cooperation in integrated regional water management planning. Calleguas MWD is the regional wholesale water agency for imported water in Ventura County serving primarily municipal water uses in the Calleguas Creek watershed.*

Regional Network/Coalition Partners: Association of Water Agencies of Ventura County

Collaborative Partners: California Assembly District 38, Asm. Steve Bennett|California Department of Water Resources|California State Senate District 21, Sen. Monique Limón|California State University, Channel Islands (CSUCI)|Casitas Municipal Water District|Los Angeles Regional Water Quality Control Board (LARWQCB)|State Water Resources Control Board (SWRCB)|U.S. Bureau of Reclamation|Ventura County Coalition of Labor, Agriculture and Business (CoLAB)|City of Ventura – Ventura Water

Effectiveness of Collaboration: Very Effective **Frequency of Tangible Outcomes:** Very frequently

Collaboration Barriers: 1. Policy/regulatory challenges **2.** Lack of coordination between agencies/groups **3.** Limited funding/resources

Thoughts on Additional Partners to Strengthen Work: *VCAILG (Farm Bureau), MS4 Permittees, (regional solutions to water quality issues that currently do not have a funding entity capable of delivering regional solutions)*

Meaning of Watershed Resiliency: *Maintaining water supply reliability given future uncertainties, emergent climate interactions, shifting institutional responses, and emergencies.*

Has a climate resilience vision or plan: Yes, climate resilience is part of our strategic plan and the context of our mission. https://watershedscoalition.org/2019-irwm-plans/

Most urgent climate hazards:

- Increased frequency, intensity, and duration of drought
- Increased precipitation extremes and flooding
- Increased temperature and frequency of temperature extremes

Most urgent climate challenges:

- Groundwater depletion
- Regulatory or policy gaps
- Surface water shortages
- Water quality degradation
- Wildfire impacts on water systems

Priority climate resilience strategies:

- Economic and funding strategies for resilience projects
- Infrastructure improvements
- Policy changes

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources
- Regulatory or policy constraints

Other Comments: *The response to climate change resiliency encompasses many scales of management. At the WCVC and for Calleguas, we have always stressed watershed specific approaches while looking for regional integration across watersheds as necessary and coordinated elements of a holistic resilience plan.*

Westside Community Council

www.westsidecommunitycouncil.org

Type: Community-based organization

Focus and Sector: Community/Education, Community/Education

Service Area: Defined jurisdiction/area/boundary

Mission: *Since May 1994 we have been actively working to create a better, safer neighborhood in which to live, work, and raise our families. We are an organized, nonpartisan group of people focused on improving the quality of life for all on the Westside. The purposes of this Corporation are to promote, support, and encourage community unity and sustainability.*

Regional Network/Coalition Partners: N/A

Collaborative Partners: Trust for Public Land

Effectiveness of Collaboration: Neutral

Frequency of Tangible Outcomes: Occasionally

Collaboration Barriers: 1. Public awareness/engagement **2.** Limited funding/resources **3.** Lack of coordination between agencies/groups

Thoughts on Additional Partners to Strengthen Work: *Anyone that can help inform the community at our meetings and allow us to provide feedback.*

Meaning of Watershed Resiliency: *Clean, affordable, sustainable, ecologically valuable*

Has a climate resilience vision or plan: Other: “Plan with principal but not wholly specific.”

Most urgent climate hazards:

Most urgent climate challenges:

- Access to recreational resources

- Increased temperature and frequency of temperature extremes

- Disproportionate impacts on disadvantaged or underserved communities
- Regulatory or policy gaps
- Water quality degradation

Priority climate resilience strategies:

- Community engagement and education
- Policy changes

Main implementation challenges:

- Difficulty engaging or coordinating with partners and communities
- Lack of funding or financial resources

Other Comments: N/A

Summary of the Key Partner Engagement Meetings

Resource Sector	Entity	Meeting Date	Climate Concerns/Threats	Resource Focus
County, Flood Management, Storm Water Quality	Ventura County Public Works Agency, Watershed Protection District	Aug 29, 2024	Flooding and erosion, limited flood management funding, community flood risks (e.g. Coyote creek neighborhood)	Flood Management, Water Quality
City, Water Agency	City of Ventura – Ventura Water (Water and Wastewater Department)	Aug 21, 2024	Wildfire damage to water infrastructure, flooding impacts on water infrastructure (particularly around Foster Park), increased uncertainty in drought/flood cycle effects on water availability, limited funding	Water Supply, Water Supply Infrastructure Resilience, Fire Safety/Resilience
Groundwater Sustainability Agency	Upper Ventura River GMA	Oct 14, 2024	Drought impacts on water supply and ecosystems/GDEs, flooding impacts on water infrastructure, Arundo proliferation	Groundwater
Groundwater Sustainability Agency	Ojai Basin GMA	Oct 14, 2024	Drought impacts on water supply, flooding impacts on water infrastructure, Arundo proliferation	Groundwater
Agricultural	Ventura County Farm Bureau	Oct 9, 2024	Water supply concern (drought and temperature increases) for agriculture, extreme heat impacts on crops	Agriculture, Groundwater
Land Conservancy	Ojai Valley Land Conservancy	Oct 2, 2024	Impacts of drought, flooding, and wildfire on open space and agricultural lands; biodiversity loss and invasive species (e.g. Arundo); adaptive management challenges due to increasingly variable climate; increased stewardship and operational/recreational access costs and challenges.	Habitat Restoration, Riparian Areas, Open Space, Community Stewardship, Water Supply
Land Conservancy	Ventura Land Trust	Oct 2, 2024	Impacts of flooding and wildfire on open space and ecosystems; water availability for species; climate-driven changes in agriculture/water quality, increased pressure on limited recreational access and increased operational costs of providing access and habitat restoration post floods/fires	Open Space, Ecosystem Services, Habitat Restoration, Recreation
Community Resilience	Ojai Fire Safe Council	Oct 14, 2024	Drought, wildfire, precipitation pattern shifts extending fire season	Ecosystem Services, Community Resilience
Water Agency	Casitas Municipal Water District	Nov 22, 2024*	Wildfire driven sedimentation impacts on water supply and wildfire driven loss of power. Sea level rise risks to coastal infrastructure and customers. High temperature driven increased irrigation demand and evaporation of surface water supply, and risk to field staff. Flood damage to infrastructure such as Robles Diversion & Fish Passage facility. Prolonged drought reduces water supply and revenue. Affordability concerns for disadvantaged communities.	Water Supply, Water Supply Infrastructure Resilience, Agriculture

Resource Sector	Entity	Meeting Date	Climate Concerns/Threats	Resource Focus
Small Water Systems	Ventura River Water District, Meiners Oaks Water District, Casitas Mutual Water Company	Nov 14, 2024	Flooding risks to water system infrastructure, particularly post-Matilija Dam removal and need to reassess post-dem floodplain changes. Drought impacts on groundwater and surface water availability for both supply and habitat. Financial challenges in implementing climate-resilient improvements. Need for improved fire flow and infrastructure in disadvantaged communities such as Casitas Springs.	Water Supply, Water Supply Infrastructure Resilience, Fire Safety

*Provided via email dated 11.22.2024

Note: The Ventura River Watershed Resilience Program team met with Ventura County Office of Sustainability and Ventura County Resource Management Agency Planning Division, however they are not listed in this table. We discussed engaging existing networks they are active in and potential opportunities to collaborate (e.g. Climate Emergency Council). The programs and policies that they are implementing (adaptation strategies) can be found in the General Plan and Climate Action Plan and will be considered during the adaptation strategy development phase. A future addition to the table may include the Climate Emergency Council.

Social Network Analysis

Definitions of Network Metrics

Degree

How many total connections does an organization have?

Highly connected organizations are "hubs" for diffusing information. However, they do not necessarily reach diverse portions of the network and the quantity of ties may indicate lack of strength. *Example: B has a degree of 4.*

Outdegree

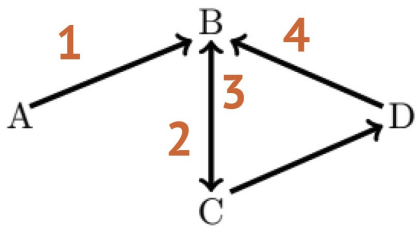
How many outgoing connections does an organization have?

In general, organizations with high outdegree can reach many others and spark the flow of information across a network (but may not be the most efficient at spreading the information). *Example: B has an outdegree of 1.*

Indegree

How many incoming connections does an organization have?

In general, organizations with high indegree are the leaders, looked to by others as a source of advice, expertise, or information. *Example: B has an indegree of 3.*



Example of a simplified network diagram.

Betweenness

The number of times an organization lies between two organizations that otherwise would not be connected

This bridging or brokering position is considered a measure of influence, and highlights quality of ties over quantity. However, many high betweenness scores within a network can indicate that large numbers of organizations are peripheral or receive information from limited sources.

Example: B is between A & C and A & D.

Results Summaries

Collaboration Network

- There are 890 total collaboration (indegree and outdegree) ties in the network.

- Indegree and betweenness tables (Table 1 and Table 2) show that the top leaders (indegree) are often, but not always, the most influential (betweenness) organizations for collaboration. More than half (8 out of 14) are ranked for both indegree and betweenness charts.
- 43 organizations are weakly or not at all connected to the collaboration network with zero or one total collaboration ties (indegree or outdegree) – Table 3.
- Figure 1 shows the full collaboration network with nodes based on indegree ranking.

Figure 1 Visual representation of the VRWRP Collaboration Network, with node sizes based on number of indegree ties

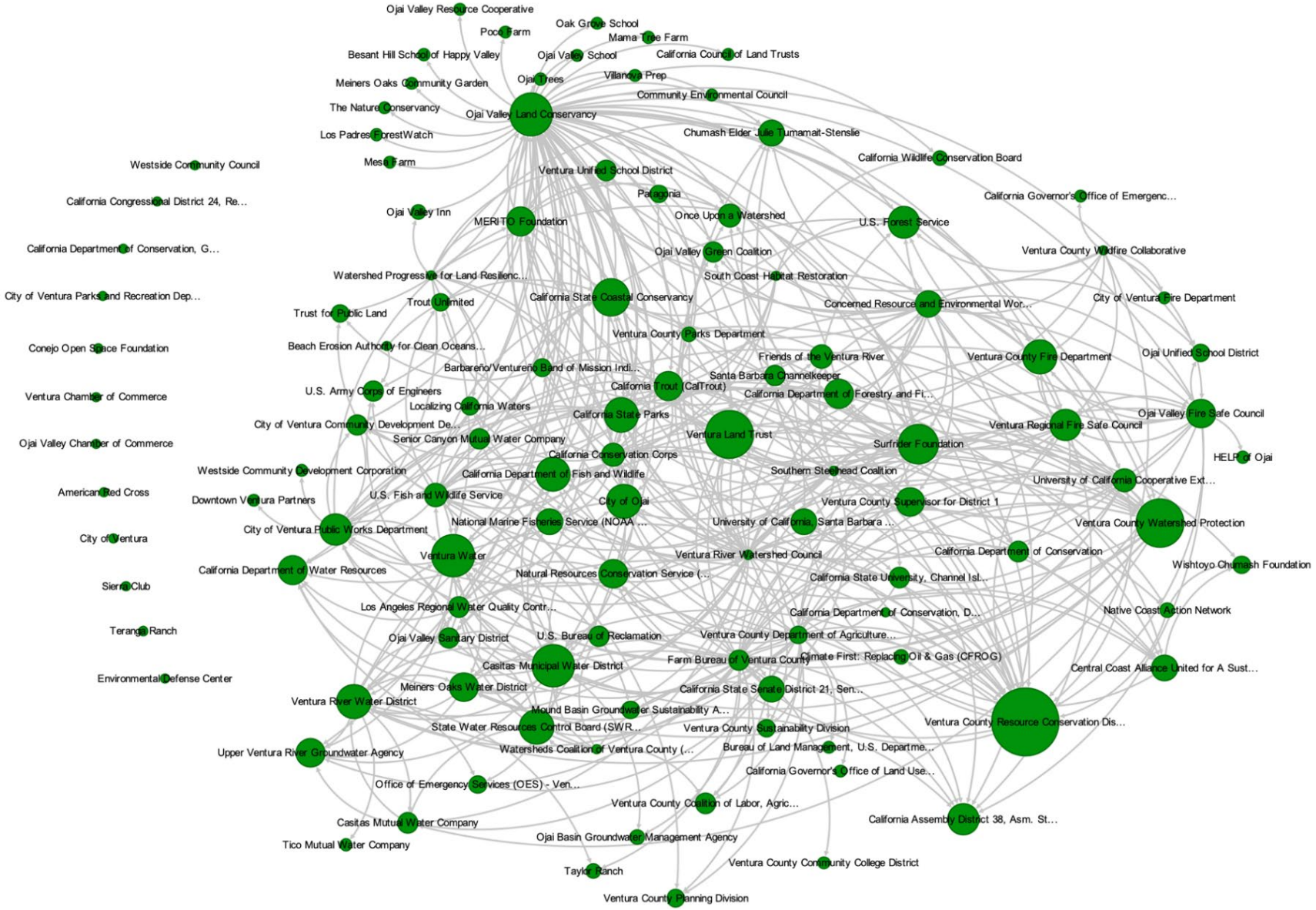


Table 1 VRWRP organizations with highest collaboration indegree scores (leadership). Italicized organizations are ranked for collaboration betweenness as well

Organization name	Indegree ties
Ventura County Resource Conservation District	21
Ventura Land Trust	14
Ventura County Watershed Protection District	14
Ojai Valley Land Conservancy	12
Casitas Municipal Water District	12
City of Ventura – Ventura Water	12
Surfrider Foundation	11
California State Coastal Conservancy	10
Ventura River Water District	9
Ventura County Fire Department	9
California Department of Fish and Wildlife	9
California State Parks	9
City of Ojai	9
State Water Resources Control Board (SWRCB)	9

Table 2 VRWRP organizations with highest collaboration betweenness scores (influence). Italicized organizations are ranked for collaboration indegree as well

Organization Name	Betweenness
Ojai Valley Land Conservancy	1516
Ventura County Resource Conservation District	655
Surfrider Foundation	441
Farm Bureau of Ventura County	372
City of Ventura Public Works Department	250
Casitas Municipal Water District	228
Ventura River Water District	210
Ventura County Department of Agriculture/Weights & Measures	166
Ventura Land Trust	147
Ojai Valley Fire Safe Council	140
City of Ventura – Ventura Water	131
Ventura County Watershed Protection District	130
Los Angeles Regional Water Quality Control Board (LARWQCB)	127
University of California Cooperative Extension	115

Table 3 VRWRP organizations with zero or one collaboration network ties

Organization Name	# Total Ties
American Red Cross	0
California Congressional District 24, Rep. Salud Carbajal	0
California Department of Conservation, Geologic Energy Management Division	0
City of Ventura	0
City of Ventura Parks and Recreation Department	0
Conejo Open Space Foundation	0
Environmental Defense Center	0
Ojai Valley Chamber of Commerce	0
Sierra Club	0
Teranga Ranch	0
Ventura Chamber of Commerce	0
Westside Community Council	0
Besant Hill School of Happy Valley	1
Bureau of Land Management, U.S. Department of the Interior	1
California Council of Land Trusts	1
California Department of Conservation, Division of Land Resource Protection	1
California Governor's Office of Land Use and Climate Innovation (LCI)	1
California Governor’s Office of Emergency Services (Cal OES)	1
City of Ventura Fire Department	1
Community Environmental Council	1
Downtown Ventura Partners	1
HELP of Ojai	1
Los Padres ForestWatch	1
Mama Tree Farm	1
Meiners Oaks Community Garden	1
Mesa Farm	1
Oak Grove School	1
Ojai Trees	1
Ojai Valley Resource Cooperative	1
Ojai Valley School	1
Poco Farm	1
The Nature Conservancy	1
Tico Mutual Water Company	1
Ventura County Community College District	1
Villanova Prep	1
Westside Community Development Corporation	1

Information Network

- There are 1,052 total information (indegree and outdegree) ties in the network.

- Indegree and betweenness tables (Table 4 and Table 5) show that the top leaders (indegree) are not always the most influential (betweenness) organizations for providing information. Only 4 of 12 top organizations are ranked on both charts.
- 32 organizations are weakly or not at all connected to the information network with zero or one information ties (indegree or outdegree) – Table 6.
- Figure 2 shows the full collaboration network with node size based on indegree ranking.

Figure 2 Visual representation of the VRWRP Information Network, with node sizes based on number of indegree ties

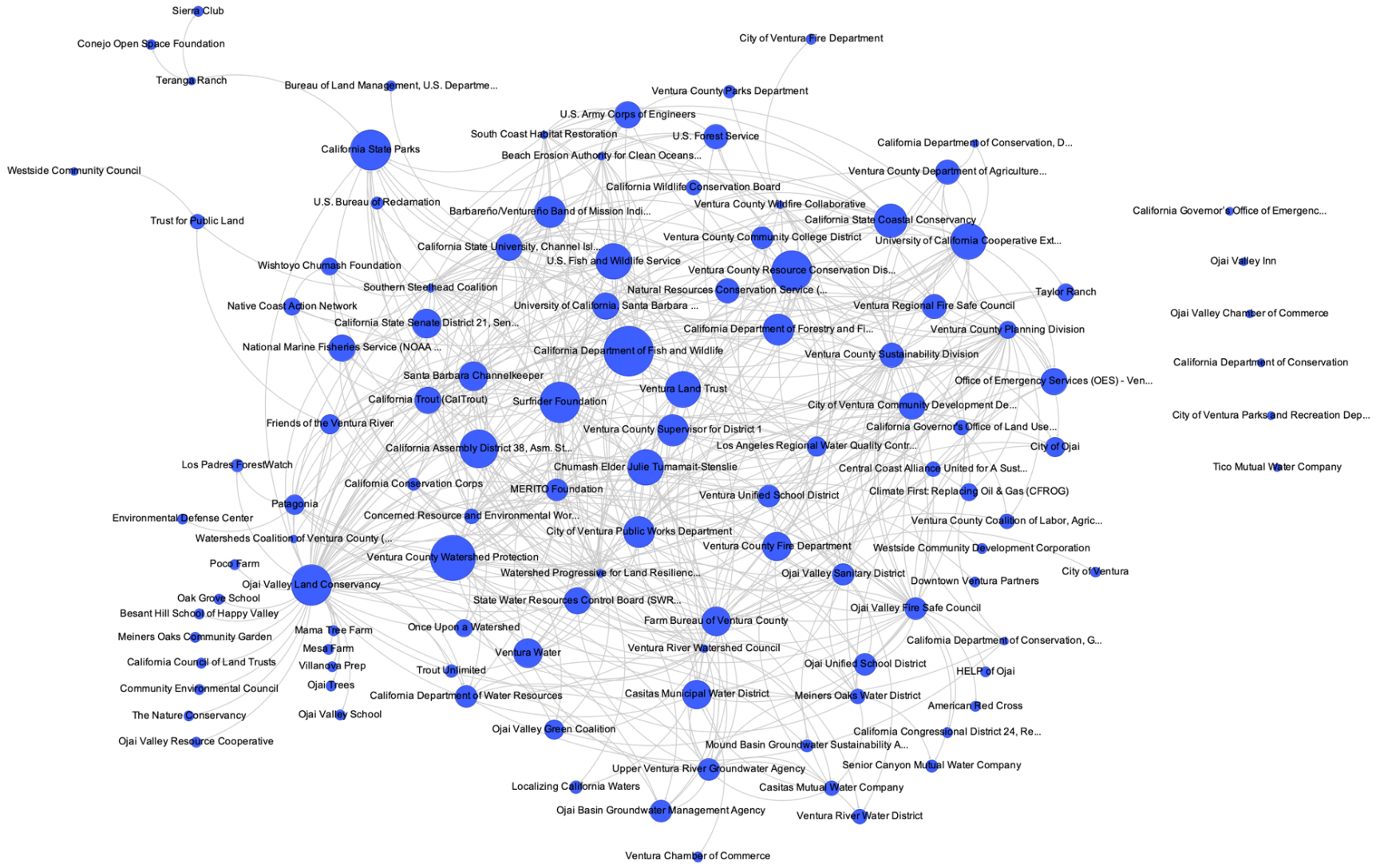


Table 4 VRWRP organizations with highest information indegree scores (leadership). Italicized organizations are ranked for information betweenness as well

Organization Name	Indegree ties
California Department of Fish and Wildlife	18
Ventura County Watershed Protection District	16
Ojai Valley Land Conservancy	14
Surfrider Foundation	14
Ventura County Resource Conservation District	14
California State Parks	14
University of California Cooperative Extension	13
California Assembly District 38, Asm. Steve Bennett	13
U.S. Fish and Wildlife Service	12
Ventura Land Trust	12
Chumash Elder Julie Tumamait-Stenslie	12
California State Coastal Conservancy	11

Table 5 VRWRP organizations with highest information betweenness scores (influence). Italicized organizations are ranked for information indegree as well

Organization Name	Betweenness
Ojai Valley Land Conservancy	1340
Surfrider Foundation	401
Ventura County Resource Conservation District	390
City of Ventura Public Works Department	326
California State University, Channel Islands (CSUCI)	259
Ojai Valley Fire Safe Council	242
Upper Ventura River Groundwater Agency	229
Ventura County Planning Division	220
Farm Bureau of Ventura County	213
University of California Cooperative Extension	212
California Trout (CalTrout)	183
Ventura County Sustainability Division	179

Table 6 VRWRP organizations with zero or one information network ties

Organization Name	# Total Ties
California Department of Conservation	0
California Governor's Office of Emergency Services (Cal OES)	0
City of Ventura Parks and Recreation Department	0
Ojai Valley Chamber of Commerce	0
Ojai Valley Inn	0
Tico Mutual Water Company	0
American Red Cross	1
Besant Hill School of Happy Valley	1
Bureau of Land Management, U.S. Department of the Interior	1
California Congressional District 24, Rep. Salud Carbajal	1
California Council of Land Trusts	1
City of Ventura	1
City of Ventura Fire Department	1
Community Environmental Council	1
Conejo Open Space Foundation	1
Downtown Ventura Partners	1
Environmental Defense Center	1
HELP of Ojai	1
Mama Tree Farm	1
Meiners Oaks Community Garden	1
Mesa Farm	1
Oak Grove School	1
Ojai Trees	1
Ojai Valley Resource Cooperative	1
Ojai Valley School	1
Poco Farm	1
Sierra Club	1
The Nature Conservancy	1
Ventura Chamber of Commerce	1
Villanova Prep	1
Westside Community Council	1
Westside Community Development Corporation	1

Funding Network

- The funding network is the least connected network type: there are 690 total funding (indegree and outdegree) ties in the network.
- Indegree and betweenness tables (Table 7 and Table 8) show that the top funders (indegree) are not always the most influential (betweenness) organizations for providing funding.

- 40 organizations are weakly or not at all connected to the information network with zero or one information ties (indegree or outdegree) – Table 9.
- Figure 3 shows the full collaboration network with nodes based on indegree ranking.

Table 7 VRWRP organizations with highest funding indegree scores (leadership). Italicized organizations are ranked for funding betweenness as well

Organization Name	Indegree ties
California Department of Fish and Wildlife	14
California State Coastal Conservancy	14
Ventura County Resource Conservation District	13
California State Parks	10
California Wildlife Conservation Board	10
City of Ojai	10
Ojai Valley Land Conservancy	10
State Water Resources Control Board (SWRCB)	10
California Department of Water Resources	9
Los Angeles Regional Water Quality Control Board (LARWQCB)	8
U.S. Fish and Wildlife Service	8

Table 8 VRWRP organizations with highest funding betweenness scores (influence). Italicized organizations are ranked for funding indegree as well

Organization Name	Betweenness
Ventura County Resource Conservation District	974
Ojai Valley Land Conservancy	897
University of California Cooperative Extension	385
City of Ventura Public Works Department	367
Concerned Resource and Environmental Workers (C.R.E.W.)	295
Surfrider Foundation	283
Ventura County Watershed Protection District	258
MERITO Foundation	234
California Department of Water Resources	229
Patagonia	168
Los Angeles Regional Water Quality Control Board (LARWQCB)	133

Figure 3 Visual representation of the VRWRP Funding Network, with node sizes based on number of indegree ties

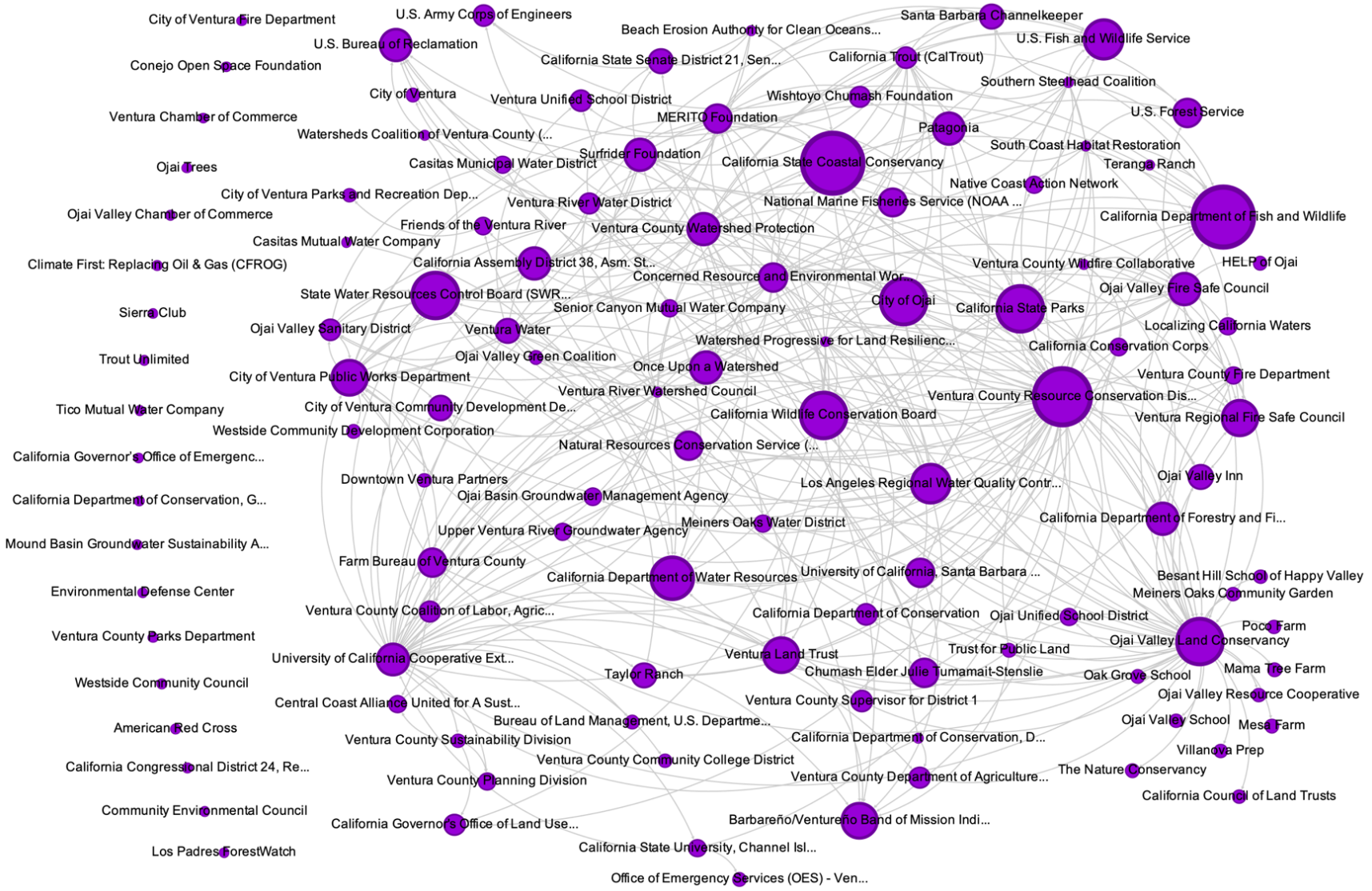


Table 9 VRWRP organizations with zero or one funding network ties

Organization Name	# Total Ties
American Red Cross	0
California Congressional District 24, Rep. Salud Carbajal	0
California Department of Conservation, Geologic Energy Management Division	0
California Governor's Office of Emergency Services (Cal OES)	0
City of Ventura Fire Department	0
Climate First: Replacing Oil & Gas (CFROG)	0
Community Environmental Council	0
Conejo Open Space Foundation	0
Environmental Defense Center	0
Los Padres ForestWatch	0
Mound Basin Groundwater Sustainability Agency	0
Ojai Trees	0
Ojai Valley Chamber of Commerce	0
Sierra Club	0
Tico Mutual Water Company	0
Trout Unlimited	0
Ventura Chamber of Commerce	0
Ventura County Parks Department	0
Westside Community Council	0
Besant Hill School of Happy Valley	1
Bureau of Land Management, U.S. Department of the Interior	1
California Council of Land Trusts	1
Casitas Mutual Water Company	1
City of Ventura	1
City of Ventura Parks and Recreation Department	1
Downtown Ventura Partners	1
HELP of Ojai	1
Mama Tree Farm	1
Meiners Oaks Community Garden	1
Mesa Farm	1
Oak Grove School	1
Office of Emergency Services (OES) - Ventura County Sheriff's Office	1
Ojai Valley Resource Cooperative	1
Ojai Valley School	1
Poco Farm	1
Teranga Ranch	1
The Nature Conservancy	1
Ventura County Community College District	1
Villanova Prep	1
Westside Community Development Corporation	1

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Appendix J

Data Gaps and Limitations

Data Gaps and Limitations

Evaluating climate hazards in the Ventura River Watershed is constrained by several data gaps and limitations. While historical records provide important context, future climate extremes are expected to exceed past conditions. Understanding these gaps helps clarify where additional monitoring, modeling, and Tribal and local knowledge are needed to support climate resilient decision-making.

- Limited and inconsistent historical records restrict understanding of the full range and severity of past floods, droughts, wildfires, coastal hazards, and marine fog dynamics. Many extreme events likely occurred before systematic monitoring began or were poorly documented.
- Sparse historical data on marine fog, coastal erosion, and sea-level change limit the ability to reconstruct long-term trends and fully evaluate how these factors shaped past ecological and hydrologic conditions—despite their relevance to future climate stressors.
- Incomplete wildfire records, especially before the mid-20th century, constrain understanding of past burn severity, fire frequency, post-fire flooding, and sedimentation patterns that are important for modern fuel-management and emergency-response planning.
- Gaps in groundwater–surface water interaction data existed historically, though this has improved substantially with recent monitoring networks established by the Upper Ventura River and Ojai Basin GSAs. Continued integration of real-time groundwater and streamflow data remains critical for evaluating drought impacts and groundwater-dependent ecosystem resilience. The State Water Resources Control Board was in the process of developing an integrated GW-SW model (GSFlow) at the time of the development of this plan and was not yet complete when this plan was finalized.
- Limited documentation of past damages and human impacts (including economic losses, public-health outcomes, and disproportionate impacts on underserved communities) makes it difficult to fully assess historical vulnerability or quantify long-term climate-related costs.
- Insufficient records on cultural-resource impacts, often due to confidentiality protections, mean that many climate-related threats to cultural sites, plants, and landscapes remain poorly documented.

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Appendix K

Hydrologic and Ecological Degradation

Hydrologic and Ecological Degradation

The watershed has experienced decades of hydrologic and ecological stress driven by infrastructure investments, land use practices, and regional water demands. These pressures have contributed to altering the natural flow regime, degraded water quality, and fragmented essential aquatic and riparian habitats, weakening the watershed's overall resilience to climate and ecological stressors. Key drivers of degradation include dam construction and sediment accumulation, human intervention, invasive species, periods of groundwater overdraft, surface water diversions, sprawling land use patterns, agricultural uses and runoff, and untreated urban and agricultural stormwater runoff. Modifications and human presence – such as the Ventura River Levee system, large, unhoused encampments, and bridge crossings – also impact hydrologic and ecological degradation in the watershed. The cumulative impacts of these changes have reduced ecological function, limited water availability, and triggered regulatory and legal actions aimed at restoring balance between water use and ecosystem health.

Hydrologic Modifications

Hydrologic conditions in the watershed have been heavily impacted by infrastructure such as dams, water diversions, new fire suppression strategies and wildfires, and groundwater pumping.

The Matilija Dam, constructed in 1947 initially for flood control and water storage, now traps millions of cubic yards of sediment, significantly reducing downstream sediment supply and habitat quality. This sediment deficit affects river morphology, habitat complexity, and native species, particularly the federally endangered Southern California steelhead, whose migration routes have been disrupted by blocked passage.

Surface water diversions and groundwater pumping for urban, agricultural, and industrial uses reduce baseflows during dry seasons. These disruptions can alter critical surface-groundwater interactions (UVRGA, 2022).

Historical fire management and increased anthropogenic ignitions have significantly altered the natural fire regime of the Ventura River watershed. These shifts in fire frequency facilitate high-intensity wildfires that strip vegetative cover and promote the development of hydrophobic soil layers, drastically increasing post-fire runoff and sediment yield (Safford and Van de Water 2014). For instance, following the Thomas Fire, fine sediment flux in the Ventura River increased by more than two orders of magnitude compared to pre-fire conditions, severely impacting downstream water quality and aquatic habitats (Jumps et al. 2022).

Although these modifications have reduced dry season baseflows and altered surface–groundwater interactions, the watershed's peak flood magnitudes are roughly similar to historical conditions. Unlike many regulated California river systems, the Ventura River mainstem does not contain a large on-stream storage reservoir capable of attenuating major storm flows. Lake Casitas is located on a tributary; the Robles Diversion has a maximum capacity of roughly 500 cfs and therefore does not meaningfully reduce high-magnitude flows; and Matilija Dam currently provides negligible storage. As a result, large flood peaks (on the order of thousands to tens of thousands of cubic feet per second) continue to occur much as they did under historical conditions. This distinction underscores that while human activities have substantially modified baseflow regimes, extreme flow events on the mainstem largely remain a function of natural storm dynamics.

Water Quality Impairments

Water quality conditions in the Ventura River watershed are shaped less by any single discharge and more by the interaction between continuous point source inputs and episodic but dominant non-point source loading, driven by seasonal hydrology. Point sources exert strong influence during low-flow periods, while non-point sources influence water quality conditions during storms; together they sustain chronic nutrient-related impairments, particularly in downstream reaches and the estuary. Cascading impacts to water quality can occur when drought periods persist and extreme precipitation years occur. This cycle drives acute pulses of pollutants into the system and as flows diminish and temperatures rise in the dry season or consecutive dry rainy seasons, ambient surface water quality is impacted.

The lower Ventura River is officially listed as impaired under Section 303(d) of the Clean Water Act due to excessive levels of nutrients (particularly nitrogen and phosphorus), algae blooms, elevated indicator bacteria levels, and trash. These water quality impairments are largely driven by aging septic systems, horse/livestock facilities and grazing, agricultural runoff, untreated urban stormwater from increased impervious surfaces and landscape areas, wastewater effluent, and reduced river flows. Unhoused encampments located along the lower Ventura River and throughout the Watershed also contribute to pollutant loads, particularly through human waste and trash accumulation. Water quality degradation negatively impacts aquatic ecosystems, human health, and recreational uses, highlighting the critical need for watershed-scale solutions (Los Angeles Regional Water Quality Control Board, 2022).

To address algae and eutrophic conditions in Ventura River, the Los Angeles Regional Water Quality Control Board (Los Angeles Water Board) adopted a Total Maximum Daily Load (TMDL) for algae, eutrophic conditions, and nutrients in the Ventura River and its tributaries in December 2012. The Algae TMDL, which sets a regulatory limit on these specific pollutants, identifies parties who will be responsible for monitoring and implementing the TMDL.

To support implementation of the Algae TMDL, the State Water Resources Control Board developed a hydrologic fate and transport model to simulate interactions between groundwater and surface water, and to estimate nutrient contributions from different sources, including wastewater discharges, septic systems, stormwater runoff, and agricultural operations. This model helps identify pollutant pathways and informs management strategies for reducing nutrient loads throughout the Ventura River Watershed.

To address trash impairments in the Ventura River Estuary, the Los Angeles Water Board adopted the Ventura River Estuary Trash TMDL (Resolution No. 2007-008), later revised in 2019 (Resolution No. R19-005). The Trash TMDL requires responsible jurisdictions, including the City of Ventura, County of Ventura, agricultural dischargers, Ventura County Fairgrounds, and Caltrans, to eliminate trash discharges to the estuary. Compliance pathways include installing full capture systems for stormwater, regular cleanups and monitoring of the estuary area to prevent unauthorized activities, implementing minimum frequency of assessment and collection program, along with regular reporting and monitoring. The TMDL responsible parties have been working collaboratively with the Ventura Land Trust on organizing volunteer clean ups and conducting frequent monitoring of the estuary area. The monitoring and cleanup efforts in the estuary have noted recurring trash accumulation from encampments located in and near riparian corridors, highlighting the need for coordinated social services, public health support, and housing solutions as part of long-term watershed protection. These measures are designed to achieve zero trash discharge and restore beneficial uses in the estuary, while addressing the needs of people who are unhoused.

Loss of Riparian and Aquatic Habitat

Extensive historic channelization, bank stabilization ("armoring" with concrete) to prevent erosion, and invasive species proliferation, such as the spread of giant reed "Arundo" have severely degraded riparian corridors and wetland ecosystems. These alterations disconnect the river from its floodplain, increase groundwater uptake by high-demand invasive species like Arundo, which contributes to reduced groundwater recharge potential, diminish habitat diversity, and exacerbate bank erosion during floods. Fragmented wildlife corridors also compromise habitat connectivity, adversely affecting species dependent on continuous riparian ecosystems, including endangered wildlife such as the Southern California steelhead (Cowan et al. 2021).

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Appendix L

Water Resource Systems

Water Resource Systems

The following appendix provides additional background on the water resource systems established and evaluated through the Ventura River Watershed Resilience Plan.

Water Supply

Water supply sources include surface water, groundwater, and recycled water. Water supply component features are identified in Table 1 along with the entities that oversee their management. Note that features that are located outside of the watershed boundary but influence the water systems within it (such as the Ventura Water Reclamation Facility) are included in this table.

Table 1 Summary of Water Supply System Features in the Ventura River Watershed

Type	Feature	Management Entity
Surface Water		
Reservoirs	Lake Casitas	Casitas Municipal Water District
	Matilija Reservoir	Ventura County Watershed Protection District
	Senior Canyon Dam	Senior Canyon Mutual Water Company
Diversions and Water Conveyance Infrastructure	Foster Park Subsurface Dam	City of Ventura – Ventura Water
	Foster Park Diversion*	City of Ventura – Ventura Water
	Robles Canal	Casitas Municipal Water District
	Robles Diversion & Fish Passage Facility	Casitas Municipal Water District
	Surface Water Diversions	Water agencies, agricultural entities, and individuals (domestic surface water diversions)
Groundwater		
Groundwater Wells	Foster Park Wells	Ventura Water
	Meiners Oaks County Water District Wells	Meiners Oaks County Water District
	Ventura River County Water District Wells	Ventura River County Water District
	Ojai Water System Wells	Casitas Municipal Water District (previously owned by Golden State Water Company prior to 2017 acquisition)
	Additional Groundwater Wells	Mutual Water companies, privately-owned agricultural wells; privately-owned domestic wells
Recharge	San Antonio Creek Spreading Grounds*	Ventura County Watershed Protection District
	Irrigation**	Agricultural
Water Treatment		
Water Treatment Facilities	Avenue Water Treatment Plant	City of Ventura – Ventura Water
	Marion Walker Pressure Filtration Plant	Casitas Municipal Water District
	San Antonio Manganese Filtration Treatment Plant	Casitas Municipal Water District
Wastewater/Recycled Water Facilities, Infrastructure	Ventura Water Reclamation Facility	City of Ventura – Ventura Water
	VenturaWaterPure Advanced Water Purification Facility***	City of Ventura – Ventura Water
	Ojai Valley Sanitary District Wastewater Treatment Plant	Ojai Valley Sanitary District
	Thatcher School	Thatcher School

Type	Feature	Management Entity
	Ojai Valley School Upper Campus	Ojai Valley School
	Residential graywater and rain barrel systems	Privately-owned
Imported Water		
Future Imported Water Infrastructure	State Water Interconnection Project***	City of Ventura – Ventura Water, Calleguas Municipal Water District
	Ventura-Santa Barbara Counties Intertie Project***	Casitas Municipal Water District, Carpinteria Valley Water District

* Not currently operable.

** Recharge from irrigation is incidental and not managed.

*** Future infrastructure that is not yet operable.

Surface Water

Surface water constitutes approximately 54 percent of the average annual water use within the Ventura River Watershed. While a portion of this surface water is derived directly from the Ventura River and its tributaries through diversions and subsurface intakes, the primary regional supply is provided by Lake Casitas, which serves as the principal reservoir for the Casitas Municipal Water District (CMWD). This surface water dependency is complemented by groundwater extractions from the four primary basins—the Lower Ventura River, Upper Ventura River, Ojai Valley, and Upper Ojai—to meet agricultural, municipal, and industrial demands (CMWD, 2021). Lake Casitas, an off-stream reservoir constructed by the U.S. Bureau of Reclamation in 1959, was formed with an earthfill dam across Coyote Creek. It is filled by runoff diverted from the Ventura River at the Robles Diversion and Fish Passage Facility via the Robles Canal, as well as from Coyote Creek and Santa Ana Creek, both of which flow directly into the reservoir. Approximately 45 percent of the water in the reservoir is sourced from Ventura River, and 55 percent is sourced from Coyote Creek and Santa Ana Creek, though these ratios fluctuate seasonally based on precipitation and Robles Dam facility operations. The estimated maximum capacity of Lake Casitas was reduced from its original capacity of 254,000 acre-feet (AF) to 237,761 AF due to sedimentation – a 6 percent loss (16,239 AF) since it's construction in 1958 (Casitas MWD 2020). If current trends continue as they are expected to, capacity could decline to 220,000 AF by 2100.

Casitas Dam, the Robles Diversion Facility (upgraded in 2005 by Casitas MWD to include a fish passage facility), and Robles Canal comprise the Ventura River Project, authorized by Congress in 1956. Lake Casitas and its supporting infrastructure are operated and maintained by Casitas MWD. The Robles Diversion and Fish Passage Facility is located northwest of Lake Casitas, about 2.3 miles downstream from Matilija Dam and includes a diversion dam, fish ladder, intake screens, and control gates. Water is diverted into Lake Casitas at up to 500 cubic feet per second and managed under a Biological Opinion issued by NMFS in 2003 to protect endangered steelhead. Lake Casitas also supports a wide range of recreation, including boating, camping, and fishing, and plays a central role in regional water security and outdoor access.

Water is conveyed from Lake Casitas to the Marion Walker Pressure Filtration Plant and conveyance system. The Casitas MWD conveyance system includes 34 miles of pipeline, five pumping stations, and six balancing reservoirs (Walter, 2015). The Casitas Dam spillway has operated ten times since its construction – most recently in 2026. The largest release occurred in 1998, when 35,000 AF spilled over the dam during the strong 1997-1998 El Niño event (Casitas MWD, 2025).

Matilija Dam, which formed the Matilija Reservoir on the Ventura River upstream from the Robles Diversion and Fish Passage Facility, was constructed in 1947. It was designed to hold 7,000 AF of water,

but due to extreme sediment buildup, it now holds less than 500 AF. Historically, Matilija Dam and Reservoir supplied irrigation water to the western Ojai Valley via the Matilija Conduit pipeline and provided flood protection downstream. However, due to the sediment build up and concrete corrosion of the dam itself, the dam is considered non-functional and is a safety concern. The Matilija Dam Ecosystem Restoration Project (MDERP) is a public-private partnership, led by the Ventura County Public Works Agency, to remove the obsolete Matilija Dam and includes a series of projects to restore habitat and modify downstream flood protection and water supply infrastructure. Included as part of the MDERP are modifications to the Robles Diversion and Fish Passage Facility.

Senior Canyon Reservoir, managed by Senior Canyon Mutual Water Company, is a small but important feature in the San Antonio Creek subwatershed. Water from four deep wells owned and operated by Senior Canyon Mutual Water Company is conveyed to a reservoir for storage. The reservoir holds about 80 AF of water and is designated for agricultural use.

As noted previously, City of Ventura – Ventura Water operates a Ventura River subsurface diversion in the Foster Park Area. In the Foster Park area, groundwater is near the surface and contributes to surface flows, and are considered interconnected (Upper Ventura River Groundwater Agency [UVRGA], 2022), and the City's water produced from the area is considered by the Department of Drinking Water as groundwater under the influence of surface water (City of Ventura, 2025). The subsurface dam and diversion structure were built across the river and the mouth of Coyote Creek to increase water detention in the early 1900s. The dam is 975 feet long and works in combination with subsurface collector pipes. According to the City's 2025 Comprehensive Water Resources report, the City's current reliable water supply capacity from the Foster Park area for planning purposes is 4,200 AF per year, but the number may be reduced by regulatory and environmental constraints. The subsurface intake is currently out of service, and repairs are in design. In 2018, and as amended in 2019, Ventura Water began operating under a Settlement Agreement to reduce its pumping and diversion of water from the river when flows drop during dry times to help protect species that depend on the river. The City of Ventura is currently operating, as stipulated in a 2025 Interim Order, with additional pumping reductions at low river flow levels. Ventura Water historically also had a surface diversion in the Foster Park area of the Ventura River. However, due to changes in river course and potential regulatory constraints, no direct surface water diversions have occurred since 2000.

Groundwater

Nearly half (46 percent) of the average annual water use in the Ventura River Watershed is extracted from groundwater basins by urban water suppliers, agricultural water suppliers, growers, and other private businesses and landowners, including domestic well users. Due to the porous nature of the alluvium in the region, surface water and groundwater are closely linked in this watershed (Ventura River Watershed Hydrology Model, 2009).

The Upper Ventura River Groundwater Basin (UVRGB) is the primary hydrogeologic unit for groundwater production in the watershed. Major municipal and industrial (M&I) extractions are concentrated among three principal water purveyors: the City of Ventura – Ventura Water with approximately 3,500 connections, the Ventura River Water District serving an estimated 6,100 residents via 2,190 connections, and the Meiners Oaks Water District with 1,260 connections. Additionally, the basin supports decentralized groundwater production from several mutual water companies, including North Fork Springs (serving 10 people via 11 connections), Rancho Matilija (serving 8 agricultural users), and Tico (serving 77 people via 38 connections), which satisfy smaller clusters of domestic and agricultural demand (UVRGA, 2022).

The **Ojai Valley Basin** supplies the second greatest quantity of groundwater in the Watershed; the Ojai Water System (now operated by Casitas MWD after it was acquired from Golden State Water in 2017) relies upon it as a water supply. The Ojai Water System is estimated to account for up to 35 percent of the water pumped in the Ojai ValleyGroundwater Basin and serves roughly 2,900 people (Ventura River Watershed Hydrology Model, 2009; Walter, 2015). Senior Canyon Mutual Water Company pumps water from the Ojai Valley Basin to store in Senior Canyon Reservoir. Senior Canyon Mutual Water Company serves an estimated 800 people via 247 domestic connections, as well as agricultural users. Other pumpers include Gridley Road Water Group (serving an estimated 44 people via 20 connections), Hermitage Mutual Water Company (serving an estimated 35 people via 22 connections), Siete Robles Mutual Water Company (serving an estimated 24 people via 98 connections), and Sisar Mutual Water Company (serving an estimated 325 people via 103 connections). There are also agricultural and domestic wells in all four groundwater basins within the watershed which are privately owned and operated.

The other two groundwater basins in the watershed, the **Lower Ventura River Basin** and the **Upper Ojai Valley Basin**, are smaller in both areal extent and storage capacity, and they are not currently managed under active Groundwater Sustainability Plans due to their "very low priority" classification under the Sustainable Groundwater Management Act. While groundwater pumping from these basins is relatively limited compared to the Upper Ventura and Ojai Valley Basins, they still serve important local uses that are discussed at greater length in subsequent sections.

Treated Wastewater

The two principal wastewater treatment facilities that service the watershed are: Ojai Valley Wastewater Treatment Plant and the Ventura Water Reclamation Facility. Two smaller wastewater treatment plants provide local treatment at private schools in Ojai Valley, both of which disperse its treated effluent underground, potentially supporting groundwater recharge in the area (Walter, 2015).

The Ojai Valley Sanitary District (OVSD) serves 20,000 residents of the City of Ojai and surrounding area and treats the majority of wastewater produced in the watershed via the Ojai Valley Wastewater Treatment Plant. The treatment plant was built in 1963 as a 1.4 million gallons per day (MGD) plant and expanded in 1965 to 3.0 MGD. All water from the OVSD Treatment Plant is discharged into the Ventura River at a permitted discharge flow rate of three MGD, where it supports endangered Southern California Steelhead habitat and migration by helping meet instream flow requirements (NPDES permit CA 005396). There is interest in reusing treated wastewater for irrigation or groundwater recharge, but environmental concerns regarding adequate water supply for the endangered Steelhead would need to be addressed.

The Ventura Water Reclamation Facility is a tertiary treatment facility that treats eight to nine MGD for about 98 percent of City of Ventura residents (both within and outside of the watershed boundaries). The facility is located within the Santa Clara River watershed. Treated wastewater from the Ventura Water Reclamation Facility is currently used for landscape irrigation within the City of Ventura or discharged into the Santa Clara River Estuary.

Future Water Supply

The Ventura River Watershed is exploring several future water supply options to enhance reliability and meet growing demands. These include imported water, recycled water, and desalination.

Casitas Municipal Water District and City of Ventura – Ventura Water hold entitlements to the California State Water Project (SWP) (5,000 and 10,000 acre-feet per year, respectively) but currently lack infrastructure to deliver this water into the watershed. Projects are underway to build interconnections

using existing facilities owned by other agencies, enabling water transfers through Calleguas Municipal Water District and Carpinteria Valley Water District. Ventura Water's seven-mile pipeline is expected to be operational by 2027, while Casitas MWD plans to start construction of a 6,100-foot pipeline and booster stations in 2025.

The City of Ventura – Ventura Water is also constructing the VenturaWaterPure advanced purification facility to treat tertiary effluent for potable reuse and groundwater recharge. It will be located outside of the Ventura River Watershed, but will contribute water supply to City of Ventura customers which will help the City reduce its use of Ventura River supplies under low flow conditions. Expected to produce at least 4,000 acre-feet annually after 2030, this program may supply up to 20% of the city's water demand, reducing reliance on local watershed sources.

Desalination remains in the exploratory phase. While the City of Ventura – Ventura Water continues to evaluate it as a potential future supply, high costs and environmental concerns mean it is not considered a near-term solution, and no active projects are currently underway.

Flood Management

Overview

The watershed is susceptible to fluvial, alluvial, pluvial, and coastal flooding as well as the related effects of erosion and sediment transport during high flow events.

- **Fluvial flooding** occurs when water levels exceed stream and riverbanks, sending flow out onto adjacent floodplains or low-lying areas.
- **Alluvial flooding** occurs on the surface of an alluvial fan, a landform at the base of a valley where floodwater spreads out and decreases in speed.
- **Pluvial flooding** happens when the ground is saturated or drainage systems are full, and excess water collects over the land surface.
- **Coastal flooding** occurs when water inundates dry or low-lying land due to rising tides or storm surges.

Flood management has historically focused on fluvial flooding, for which a moderate to major flood event occurs roughly every 5 years in the Watershed. Alluvial flooding has affected communities in the Ojai Valley repeatedly, often in combination with fluvial and pluvial flood events. Regional efforts and associated infrastructure have been put in place to manage flooding. However, communities face significant impacts from flooding on a consistent basis, having been developed near and within federal floodplains throughout the watershed (see Figure 1). FEMA-designated Special Flood Hazard Areas (SFHAs) guide land use planning and development restrictions to minimize future flooding, with oversight from various flood management entities. In many areas, the flood management system alleviates flooding from moderate events but does not provide sufficient protection in severe flooding events. See Figure 2, which illustrates the overlap between FEMA-designated SFHAs and the Governor's Office of Land Use and Climate Innovation's Vulnerable Communities Platform-identified communities in the watershed, suggesting that certain populations with specific social indicators (such as food and housing insecurity or low-income) face heightened exposure to flood risk, underscoring the importance of considering equity in future flood management efforts.

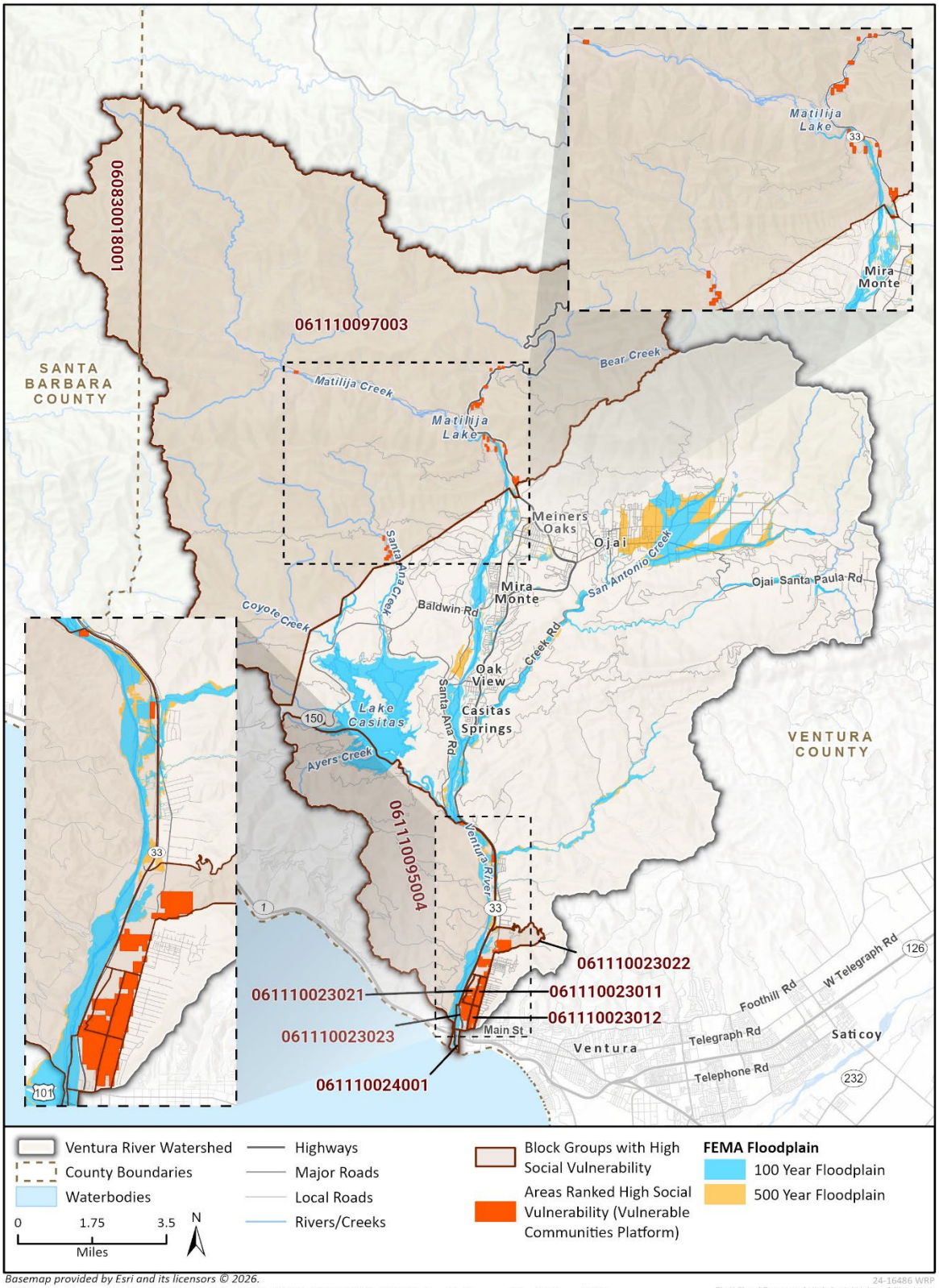
Figure 1 Flood Hazard Zones in the Ventura River Watershed



Basemap provided by Esri and its licensors © 2025.
Additional data provided by CPAD, 2024; NHD, 2024; NWI, 2025; Ventura County Watershed Protection Data, 2025; FEMA, 2025.

24-16486 WRP
Fig X Flood Zones and System Components

Figure 2 Flood Hazard Zones and VCP-Identified Communities in the Ventura River Watershed



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Additional data provided by CPAD, 2025; NHD, 2024; US EPA, 2022; FEMA, 2025; Vulnerable Communities Platform, 2026.

24-16486 WRP
Fig X Flood Zones and High Social Vulnerability Areas

Watershed Flood Management Entities

Flood management is carried out by several agencies, with support and collaboration from the Ventura River Watershed Council (VRWC); a collaborative forum supporting integrated flood management, watershed restoration, and multi-agency coordination. Although VRWC does not operate flood infrastructure directly, its role in facilitating planning efforts across jurisdictional boundaries remains important. The primary entities involved in flood management, infrastructure maintenance, and emergency response coordination for the watershed are summarized below:

- **Ventura County Watershed Protection District (VCWPD)** is the lead agency responsible for regional flood management. VCWPD designs, operates, and maintains the Ventura River Levee, debris basins such as the Stewart Canyon and San Antonio Creek facilities, and spreading grounds that contribute to peak flow reduction. VCWPD also leads watershed planning efforts, supports flood alert systems, and collaborates with other jurisdictions on major projects such as the Matilija Dam Ecosystem Restoration (VCWPD, 2022).
- **Ventura County Office of Emergency Services (VCOES)** coordinates flood emergency preparedness, response, and recovery efforts across the county. VCOES administers the Multi-Jurisdictional Hazard Mitigation Plan, facilitates public communication during flood events, and works with VCWPD and municipal governments during emergency response operations (VCOES, 2022).
- **Municipal governments, including the County of Ventura, City of Ventura and the City of Ojai,** manage local drainage systems, enforce floodplain management standards, and participate in the National Flood Insurance Program. The County implements flood hazard mitigation strategies in unincorporated communities, such as Mira Monte and Casitas Springs (VCWPD, 2022).

In addition to the primary flood management agencies, several other entities play supporting roles with collective goals of improving watershed resilience. Casitas MWD manages Lake Casitas, which influences regional hydrology and affects flow regulation in the upper watershed. The County of Ventura Public Works Agency (VCPWA) is also in the final stages of design and implementation of the Matilija Dam Ecosystem Restoration Project (MDERP), which includes Ventura River levee improvements; critical downstream infrastructure projects that will mitigate flood risks post dam removal. State and federal agencies, including the California Department of Water Resources (DWR), the U.S. Geological Survey (USGS), and FEMA, provide technical assistance, regulatory oversight, data services, and grant funding that support local flood management and hazard mitigation efforts (VCWPD, 2022). For example, USGS operates stream gaging stations, including the one at Foster Park, which provide critical real-time data for flood forecasting and water resource management (U.S. Geological Survey, n.d.).

System Infrastructure

In addition to levees, the sections below describe four debris basins owned and operated by the VCWPD that support sediment and debris management in the watershed through collecting sediment from drainages before they enter the mainstem Ventura River. Typically placed at canyon mouths, debris basins capture the sediment, gravel, boulders, and vegetation that are washed out of canyons during storms. The basins capture the material and allow the water to flow into downstream drainage channels. Removing sediment and debris helps prevent blockage of channels and associated flooding.

For this VRWRP, the discussion of flood management is organized by three geographic regions:

- **Upper Ventura Watershed – Matilija and Coyote Creeks** (encompassing the Matilija Creek, North Fork Matilija Creek, Coyote Creek, and Upper Ventura River regions)

- **Upper Ventura Watershed – San Antonio Creek** (a significant tributary to the Ventura River in the Ojai Valley area)
- **Lower Ventura** (the watershed downstream of the confluence with San Antonio Creek, including coastal areas)

Upper Ventura – Matilija and Coyote Creeks

This region is characterized by steep mountainous terrain, high sediment loads, and intense runoff during storm events, particularly following wildfires. Flood management here focuses on preserving natural hydrologic processes while addressing localized hazards.

Natural drainage channels, including Coyote Creek, North Fork Matilija Creek, and Santa Ana Creek, remain largely undeveloped and play a vital role in floodplain function and runoff conveyance. Matilija Dam, once providing flood control and water supply, has lost much of its function due to sediment buildup and aging infrastructure and is planned for removal to restore sediment flow and improve downstream flood resilience.

Key flood management infrastructure includes the McDonald Canyon Detention Basin and the Live Oak Creek Dam and Diversion Channel, which serve as detention and debris basins. The Live Oak Acres Levee offers localized flood protection, with ongoing efforts to upgrade levees to meet FEMA standards as part of the Matilija Dam Ecosystem Restoration Project (MDERP). Lake Casitas, primarily a water supply reservoir, also influences downstream hydrology by modulating seasonal flows on Coyote Creek, indirectly affecting flood behavior.

Overall, the area relies heavily on non-structural flood management approaches such as erosion control at road crossings, post-wildfire debris monitoring, and preservation of natural floodplain functions. The relatively undeveloped landscape allows natural drainage and sediment processes to continue largely uninterrupted. Key flood management features within this area are summarized in Table 2.

Table 2 Upper Ventura – Matilija and Coyote Creeks Flood Management Features

Category	Feature	Management Entity
Reservoir	[1,2]Matilija Dam	VCWPD (federal partners)
Reservoir	[1]Lake Casitas	CWMD, Reclamation
Levee	[1]Live Oak Acres Levee	VCWPD
Diversion Structure and Debris Basin	Live Oak Creek Dam and Diversion Channel	VCWPD
Detention Basin and Debris Basin	McDonald Canyon Detention Basin	VCWPD
Floodplain	[1]FEMA Special Flood Hazard Areas (SFHAs)	VCWPD / FEMA / City of Ojai / County Planning
Natural Management	[2]Natural channels and tributaries (Coyote Creek, North Fork Matilija Creek, Santa Ana Creek)	N/A

Source: [1]VCWPD, 2022; [2]Walter, 2015 Watershed Management Plan

Upper Ventura - San Antonio Creek

San Antonio Creek is the primary drainage for the Ojai Valley, collecting runoff from the valley floor and steep tributaries of the Topatopa Mountains. Flood hazards arise from rapid tributary inflows, mobile alluvial fans, and historical urban and agricultural development in flood-prone areas (VCWPD, 2022).

Flood management combines structural and non-structural approaches. Historically, the San Antonio Creek Spreading Grounds supported peak flow attenuation and groundwater recharge but is no longer operational. Restored natural floodplain functions, such as those at the Ojai Meadows Preserve, help absorb stormwater and reduce flood impacts.

Urbanized areas in Ojai and Mira Monte rely on storm drains and culverts managed by local cities and the Watershed Protection District. Despite these systems, sheet flooding and debris flows from tributary fans remain concerns, especially along the Mira Monte and East Ojai alluvial fans, which are vulnerable to channel migration and overbank flooding.

Key infrastructure includes the Stewart Canyon Debris Basin (the largest in the Ventura Basin), which provides critical flood protection to Ojai residents. An emergency debris basin built after the 1985 Wheeler Fire served its purpose but is now damaged and non-functional.

Given San Antonio Creek's significant contribution to peak flows in the Ventura River mainstem, effective flood management here is vital to protect downstream communities and infrastructure near the coast. Key flood management features within the San Antonio Creek are summarized in Table 3.

Table 3 Upper Ventura - San Antonio Creek Flood Management Features

Category	Feature	Management Entity
Spreading Ground	[1]San Antonio Creek Spreading Grounds (no longer operable)	VCWPD / Casitas Municipal Water District
Debris Basin	[1]Stewart Canyon Debris Basin	VCWPD
Wetland	[2]Ojai Meadows Preserve	Ojai Valley Land Conservancy
Stormwater System	[1]Urban storm drains and culverts (Ojai, unincorporated areas)	Cities of Ojai and Ventura / VCWPD
Floodplain	[1]FEMA Special Flood Hazard Areas (SFHAs)	VCWPD / FEMA / City of Ojai / County Planning
Floodplain	[1]Mira Monte and East Ojai Alluvial Fans	County of Ventura

Source: [1]VCWPD, 2022; [2]Walter, 2015 Watershed Management Plan

Lower Ventura

Flood management strategies within the lower reaches of the Ventura River Watershed prioritize the resilience of urbanized areas, critical infrastructure, and sensitive coastal ecosystems as the fluvial system terminates at the Pacific Ocean. The segment extending from Foster Park to the river estuary is characterized by a complex hazard profile that integrates riverine discharge with maritime drivers, including accelerated coastal erosion, eustatic sea level rise, and backwater effects during extreme meteorological events (County of Ventura, 2019).

Two levee segments maintained by VCWPD provide localized flood protection:

- **Casitas Springs Levee**, along the east bank near the unincorporated community of Casitas Springs, is about one mile long but currently does not meet FEMA standards.
- **Ventura River Levee-1 (VR-1)** protects areas along the mainstem in the City of San Buenaventura, extending approximately 2.65 miles from the ocean upstream toward Canada de San Joaquin. It shields residential neighborhoods, commercial districts, the Ojai Valley Sanitary District's wastewater treatment plant, and the City of Ventura's water filtration plant. VR-1 also lacks modern FEMA certification. Efforts are underway to upgrade both levees to meet FEMA requirements as part of MDERP.

Additional flood infrastructure includes the Fresno Canyon Debris Trap (built 2005), which discharges into a drain flowing through the Casitas Springs Levee into the Ventura River, and the Dent Debris Basin, a smaller basin east of Ventura, which releases floodwaters into Dent Drain and then into the lower Ventura River via the Ventura Levee.

Natural features also contribute significantly to flood management. The Ventura River Estuary, jointly managed by VCWPD, the City of Ventura, and the California Coastal Conservancy, acts as a vital flood buffer by absorbing overbank flows during large storms. It also supports sediment transport and nutrient exchange between the river and coastal ecosystems. Table 4 summarizes key flood management features within the Lower Ventura River. Though not included in this table, there are also other efforts being conducted or recently completed to reduce flood risk, including a major sediment removal project in the Coyote Creek led by the County of Ventura – WPD.

Table 4 Lower Ventura Flood Management Features

Category	Feature	Management Entity
Levee	Ventura River Levee	VCWPD
Wetland	Ventura River Estuary	VCWPD / City of Ventura / Coastal Conservancy
Levee	[1]Casitas Springs Levee	VCWPD
Debris Basin	Dent Debris Basin	VCWPD
Debris Basin	Fresno Canyon Debris Trap	VCWPD
Floodplain	[1]FEMA Special Flood Hazard Areas (SFHAs)	VCWPD / FEMA / City of Ventura / County Planning
Coastal Resilience Project	Surfer's Point Managed Shoreline Retreat	City of Ventura / Surfrider Foundation / Coastal Conservancy

Source: VCWPD, 2022

Historical Flooding Events

Historically, the Ventura River has experienced several major floods with regional impacts on communities. The largest recorded flood occurred in February 1978, when measured flows reached approximately 63,600 cubic feet per second (cfs) at the Foster Park Bridge, equivalent to an estimated 70-year recurrence interval flood event. Earlier floods in 1938, 1943, and 1969 caused widespread damage to homes, transportation facilities, utilities, and agricultural lands. The January–February 1969 floods resulted in watershed-wide damages driven by severe erosion, sediment deposition, and debris flows. In part, damages caused by the 1969 flood were high due to the storm's long duration (FEMA 2024).

San Antonio Creek (the primary tributary to the Ventura River) is the primary watercourse flowing through the City of Ojai and has a long history of flooding, documented since the mid-1800s. The most severe recorded event occurred on January 25, 1969, when peak flows reached approximately 16,200 cfs (less than 50-year flood event), the highest discharge measured at the USGS gauging station near Casitas Springs. Multiple other significant floods occurred during the mid-20th century, particularly between 1952 and 1966 (FEMA 2024).

To explore these historical floods in more detail, including interactive maps, photographs, and first-hand accounts, readers can view the Ventura River Flood History StoryMap. This online resource provides a visual, place-based overview of major flood events that have shaped the watershed's hydrology and community resilience: https://storymaps.arcgis.com/stories/f50cbb2654f449578d10d924a525b5a3.

Table 5 Historical Flooding of the Ventura River from County of Ventura – WPD

Date	Peak Flow (cfs)	% Annual Exceedance Probability	Flood Category
February 1978	63,600	1.5 %	Major
January 1969	58,000	2.2 %	Major
February 1992	45,800	5.2 %	Major
January 1995	43,700	6.0 %	Major
January 2005	41,000	7.3 %	Major
February 1969	40,000	7.8 %	Major
March 1938	39,200	8.2 %	Moderate
February 1998	38,800	8.5 %	Moderate
February 1980	37,900	9.0 %	Moderate
January 1943	35,000	11.0 %	Moderate
January 2023	34,700	11.3 %	Moderate
January 1952	29,500	16.1 %	Moderate
January 2005	29,400	16.2 %	Moderate
March 1983	27,000	19.1 %	Moderate
March 1952	24,600	22.5 %	Moderate
January 1934	23,000	25.2 %	Moderate
February 1986	22,100	26.8 %	Moderate
December 2005	20,600	29.7 %	Moderate
February 1944	20,000	30.9 %	Moderate
March 2011	19,100	32.9 %	Flood
March 2001	19,100	32.9 %	Flood
February 2005	18,800	33.6 %	Flood
April 1958	18,700	33.8 %	Flood
February 1945	17,000	38.1 %	Action
January 1969	16,600	39.1 %	Action
February 1973	15,700	41.6 %	Action
March 1941	15,200	43.1 %	Action

Groundwater Management

Groundwater Management Overview

Subbasin Background

Upper Ojai Valley Groundwater Basin (DWR Basin No. 4-001)

The Upper Ojai Valley Groundwater Basin is located in the northeastern portion of the Ventura River Watershed and is isolated from the other three groundwater basins in the watershed. Land uses within the basin include undeveloped land, agriculture, and rural residential. Groundwater is the primary water source within the Upper Ojai Valley Groundwater Basin; however, the total groundwater use is relatively lower compared to other basins in the watershed. The primary uses of groundwater in the area include

agriculture (i.e., citrus and avocados) and private residential well owners in and around Upper Ojai. The Sisar Mutual Water Company is the only municipality that relies on groundwater in the basin.

The Upper Ojai Valley Basin is a fairly deep, bowl-shaped basin and is the smallest of the watershed's groundwater basins in areal extent and storage capacity (5,681 AF).The groundwater depth ranges from about 45 to 60 feet below the ground surface and recharge occurs primarily through local precipitation and runoff from surrounding hillsides (Walter, 2015 Watershed Management Plan). Due to the relatively low groundwater use and regulatory management in the basin, there is limited hydrologic data available on basin conditions.

There is no GSA managing the groundwater resources of the Upper Ojai Valley Basin due to its very-low-priority designation by the DWR under SGMA. However, the County has some authority over the basin as it administers well permits. Local communities rely heavily on groundwater and lack alternative supplies, so the basin may still be vulnerable to climate variability and long-term drought impacts.

Ojai Valley Groundwater Basin (DWR Basin No. 4-002)

The Ojai Valley Groundwater Basin is located in the northeastern portion of the Ventura River Watershed, encompassing the urbanized Ojai Valley area. Major landowners and municipal jurisdictions within the basin consist primarily of unincorporated lands within the County of Ventura, the City of Ojai, and public land owned and managed by the U.S. Forest Service. The basin underlies agricultural areas, residential development, and natural open space, and the key groundwater users of this basin include Casitas MWD, Ojai Valley Sanitary District, Ojai Water Conservation District, Ventura County Watershed Protection District, and private users (OBGMA, 2022).

The Ojai Valley Groundwater Basin is a relatively deep, bowl-shaped basin. Its recharge primarily occurs from local precipitation and intermittent streamflow. The groundwater levels are generally stable but may face pressure during extended droughts. Water quality is generally good, though there are localized concerns in some areas, such as the presence of nitrates (OBGMA, 2022).

The basin is managed by the OBGMA, legislatively formed in 1991, due to the basin's high-priority designation by the DWR under SGMA. In 2022, OBGMA developed the GSP for the Ojai Valley Groundwater Basin with the goal to enable interested parties to sustainably manage groundwater and surface water resources and to comply with the requirements of SGMA.

Upper Ventura River Groundwater Basin (DWR Basin No. 4-003.01)

The Upper Ventura River Valley Basin (UVRV Basin) represents the most significant hydrogeologic reservoir within the watershed, extending from the northern boundary at Camino Cielo to the southern terminus at the Casitas Vista Bridge. This unconfined alluvial aquifer underlies a mosaic of agricultural, residential, and natural land uses, serving as the primary source of groundwater production among the four regional basins. Major extractions are conducted by the City of Ventura, Casitas Municipal Water District, Ventura River Water District, and Meiners Oaks Water District, alongside numerous private pumpers (Upper Ventura River Groundwater Agency [UVRGA] 2022).

The Upper Ventura River Groundwater Basin features significant surface water-groundwater interaction, particularly near sections of the Ventura River that flow year-round, due to the high groundwater table which is often as shallow as 0-5 feet below ground surface. Due to the shallow depth of water, groundwater pumping in the basin influences baseflow conditions of the Ventura River and its tributaries; some of the reaches impacted by the alteration in baseflow are critical habitat for endangered species, such as Southern California steelhead, and downstream ecosystems. The shallow groundwater table results in a higher risk of contamination from above-ground sources (University of Arizona, 2011), which may impact water quality for critical habitat and anthropogenic uses.

The basin is managed by the Upper Ventura River Groundwater Agency (UVRGA). UVRGA was identified as the basin's GSA in 2017 due to the basin's medium-priority designation by the DWR under SGMA. In 2022, UVRGA developed the Upper Ventura River Valley Basin GSP with the goal to sustainably manage the basin's resources for the benefit of current and future users, establishing long-term reliability no later than 20 years from GSP adoption (UVRGA, 2022).

Lower Ventura River Groundwater Basin (DWR Basin No. 4-003.02)

The Lower Ventura River Groundwater Basin underlies the Ventura River from downstream of Foster Park to the Ventura River estuary, with deep layers extending offshore as submerged alluvial delta deposits. The basin underlies agricultural areas, residential development, and natural open space, and the key groundwater users of this basin include the City of Ventura, Casitas Municipal Water District, Ventura River Water District, and Meiners Oaks Water District.

The basin is narrow and shallow with limited storage capacity compared to the Upper Ventura River Groundwater Basin, and it ranks as the third largest basin in terms of storage capacity (8,743 AF). The water table can be found at depths as shallow as 3 to 13 feet below ground surface (Ventura County, 2019). Due to the shallow water table, the groundwater in the basin is more susceptible to contaminants percolating down from the surface (University of Arizona, 2011). Furthermore, surface water-groundwater interactions in the basin are critical, as groundwater contributes to surface flows in the Ventura River and Ventura River Estuary, particularly during low-flow conditions. These interactions support freshwater input to the Pacific Ocean and play a vital role in sustaining estuarine and nearshore habitats, including that of the Southern California steelhead (DWR, 2004).

Due to its very-low-priority designation by DWR under SGMA, there is no GSP in place that manages the resources of the Lower Ventura River Groundwater Basin. Although the basin has the lowest water supply withdrawals of the four basins in the watershed, thus making it relatively low-risk from a human water use perspective, it may still be sensitive to climate impacts – particularly those affecting ecosystems and upstream management decisions.

Groundwater Management Components

A groundwater budget is a tool used to understand and manage the balance of water in an aquifer system. Groundwater budgets are comprised of inflows, such as recharge and subsurface inflows, and outflows, such as discharge and subsurface outflows. The difference between inflows and outflows determines the change in storage of an aquifer. The interactions and infrastructure impacting the budget components of each basin within the Ventura River Watershed are summarized in Table 6 below.

Table 6 Summary of Ventura River Watershed Groundwater Basin Components

Basin	Inflows	Outflows
Upper Ojai Groundwater Basin	Precipitation Infiltration from creeks Irrigation return flows Underflow from fractured rock beneath the basin	Evapotranspiration Groundwater extraction
Ojai Valley Groundwater Basin	Precipitation Infiltration from creeks Recharge from San Antonio Creek Spreading Grounds Septic discharges Treated wastewater Irrigation return flows Underflow from upgradient alluvial channels	Evapotranspiration Groundwater discharges to streams Groundwater extraction Subsurface outflow
Upper Ventura River Groundwater Basin	Precipitation Infiltration from creeks and Ventura River Irrigation return flows Septic discharges Water distribution system losses	Evapotranspiration Discharge to Ventura River Groundwater extraction
Lower Ventura River Groundwater Basin	Precipitation Infiltration from creeks and Ventura River Treated wastewater Irrigation return flows Underflow from Upper Ventura River Groundwater Basin	Evapotranspiration Discharge to Pacific Ocean Groundwater extraction

Ecosystems

Headwaters, Wetland and Riparian Vegetation Communities

The headwaters of the Ventura River Watershed are characterized by a mosaic of chaparral, coastal sage scrub, oak woodland, and annual grassland communities. Riparian and palustrine systems within the drainage are dominated by mixed hardwood forests and scrub-shrub wetlands, including distinct stands of arroyo willow thickets and tidal estuarine habitats at the fluvial-marine interface (California Department of Fish and Wildlife [CDFW] 2018). The Ventura estuary, where the river meets the Pacific Ocean, supports a unique brackish-water ecosystem that provides critical nursery habitat for fish, feeding grounds for migratory birds, and nutrient cycling between marine and freshwater systems. Table 7 summarizes the vegetation communities and dominant plant species within the Ventura River Watershed along with their “Wetland Indicator Statuses”, which designates a plant’s probability of occurring in a wetland environment and helps describe where each community grows in the Watershed.

Table 7 Vegetation Communities within the Ventura River Watershed

Vegetation Community	Dominant Plant Species	Wetland Indicator Status
Mixed riparian hardwood	California sycamore, Fremont cottonwood, white alder , coast live oak, southern California black walnut, California bay laurel , arroyo willow), red willow	Facultative
Riparian scrub	scale broom, mule fat, mugwort, willow and cottonwood saplings	Facultative
Arroyo willow thickets	arroyo willow, red willow, narrowleaf willow	Facultative Wetland
Oak woodland and oak savanna	coast live oak, California bay laurel, toyon, elderberry	Facultative Upland
Riverine wetland	dotted water smartweed, water parsnip, cattails, bulrushes, rushes and submerged and floating aquatic plants, including duckweed and green algae in slow flowing channels	Facultative Wetland
Annual grassland	native grasses, non-native annual grasses and non-native herbs such as black mustard, tocalote and sweet fennel	Upland
Mixed chaparral	chamise, ceanothus, laurel sumac , scrub oak, manzanita	Upland
Sagebrush scrub	black sage, California sagebrush, white sage, California buckwheat, coyote brush, deerweed	Upland
Estuary	saltbush, pickleweed, salt marsh sand spurrey	Obligate Wetland
Wetland Indicator Status	**Definition**	
Facultative	Equally likely to occur in wetlands and non-wetlands (estimated probability 34% – 66%).	
Facultative Upland	Usually occurs in non-wetlands (estimated probability 67% – 99%), but occasionally found in wetlands (estimated probability 1% – 33%).	
Facultative Wetland	Usually occurs in wetlands (estimated probability 67% – 99%), but occasionally found in non-wetlands (estimated probability 1% – 33%).	
Obligate Wetland	Almost always occurs in wetlands under natural conditions (estimated probability > 99%).	
Upland	Almost always occurs in non-wetlands under natural conditions (estimated probability > 99%).	

The presence, type, and density of riparian vegetation is directly related to hydro-geomorphic factors. Where the riverbed slopes are steep and narrow, particularly along Matilija Creek, the North Fork of Matilija Creek, and upstream sections of San Antonio Creek near the Los Padres National Forest, high velocity storm water scours the streambed (Ventura County Public Works, 2004). Major storms can produce high volume sediment-laden flows that rapidly dislodge large areas of riparian vegetation and alter the stream channel. Where gradients are low and as the storm flows recede, alluvial material is deposited, as seen in the broad floodplains near Oak View and Casitas Springs along the mainstem Ventura River. Both of these flow types provide areas where pioneer, early seral vegetation can recolonize the riverbed. If the interval between stream-altering flows is several years, rapidly growing riparian vegetation can become mature and well established, providing dense riparian canopies. In addition to native vegetation communities, the spread of Arundo and other invasive plant species has had a substantial impact on the quality of riparian habitat within the watershed. Invasive species spread is primarily driven by aggressive growth habits, which allow it to outcompete native vegetation, consume large amounts of water, and alter river hydrology. Human activities, like land development, can also exacerbate growth.

Hydrology and Aquatic Resources

Natural processes play a critical role as an ecosystem component including the natural sediment regime and natural hydrological regime within the watershed. These physical factors are important components

of the riparian ecosystem and determine the type and quality of aquatic and riparian habitat present throughout the watershed. Flows within the Ventura River Watershed are highly dependent on rainfall and extensive sections of the main stem of the Ventura River are hydrologically intermittent. The Ventura River Watershed exhibits typically steep gradients and is dominated by a flashy precipitation regime, meaning that the river stage can rise and fall abruptly in response to a single rain event. The mountainous peaks in the upper reaches of the Ventura River Watershed, combined with the high level of tectonic activity in the region, result in large amounts of upland sediment supply to the streambed. In general, the highest sediment-producing parts of the watershed are those covered in shrubs and brush and located in the upper parts of the watershed where slopes are greater and annual rainfall is higher.

Matilija Creek, in its natural, undammed condition, resulted in a highly dynamic, relatively steep stream with the potential for large amounts of sediment (including sand, gravel, and cobbles) to be transported downstream during large floods. In a state of natural dynamic equilibrium, the river channel shape would shift from flood to flood, and the river would serve as a major supplier of beach sand along the Ventura coastline (U.S. Army Corps of Engineers, 2004). The installation of Matilija Dam dramatically altered this natural flood regime, trapping sediment and disrupting the natural flow of the river. This led to the degradation of aquatic and riparian habitats. With the planned removal of the dam, there will be significant ecological benefits, including the restoration of natural sediment transport, improved habitat for native species, and enhanced resilience of the watershed to climate variability and long-term drought impacts. In addition, marine habitats just offshore, although limited in extent within Watershed boundaries, play an important role in supporting coastal biodiversity and are influenced by upstream activities.

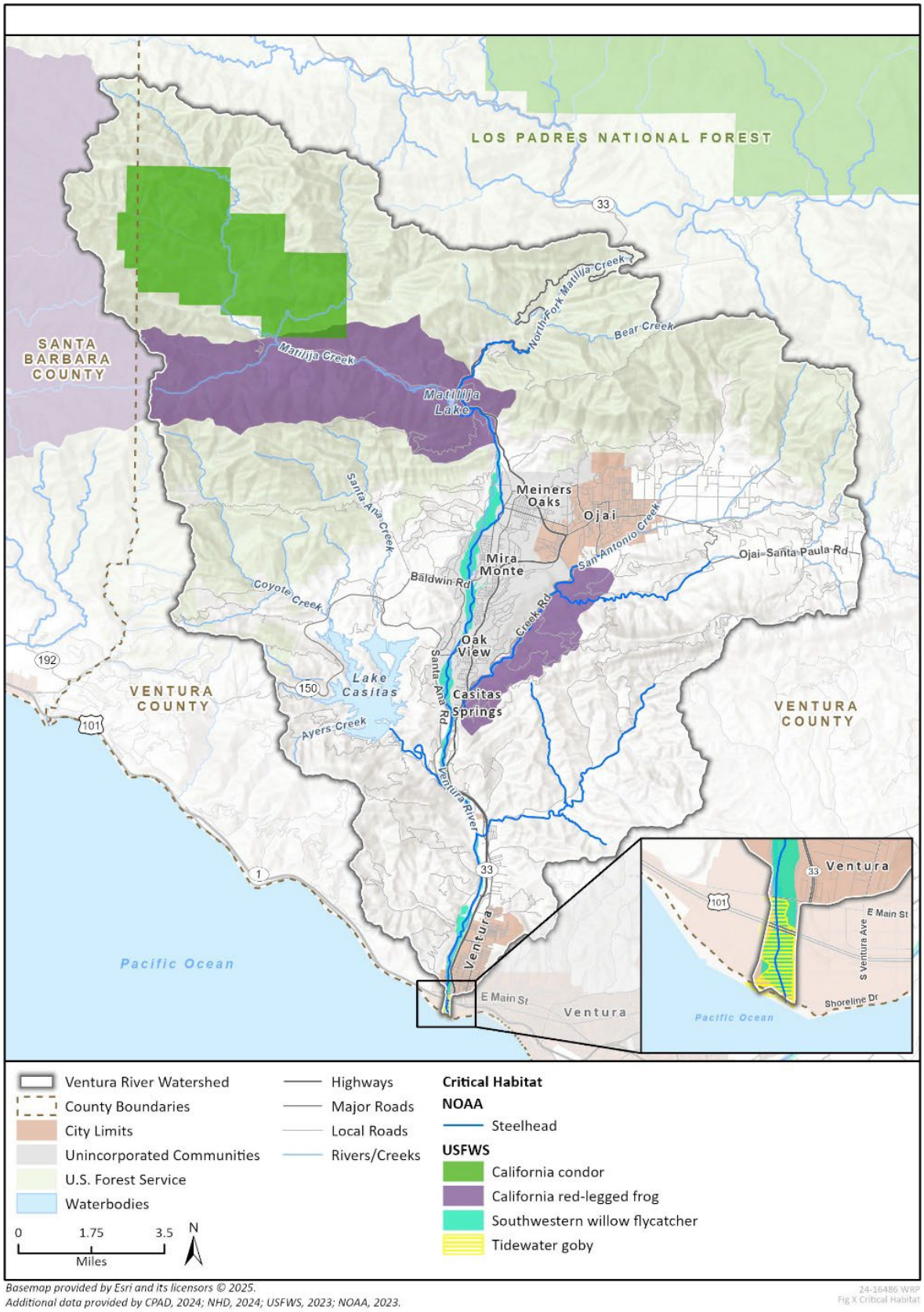
Special Status Plants and Wildlife and Designated Critical Habitat

The Ventura River Watershed is home to numerous special status, or legally protected, plant and animal species. Over 130 plant and animal species in the watershed are protected at either the federal, state, or local level, including 16 species listed as endangered, threatened, or fully protected at the state or federal level (Walter, 2015 Watershed Management Plan). Several special status plants species are known to occur in the watershed, including the Ojai fritillary which is only found in and around the Los Padres National Forest and has fewer than forty documented occurrences.

Over 80 special status wildlife species have some potential to occur in the watershed and include the federally and state endangered Southern California steelhead and federally threatened California red-legged frog. The federally threatened tidewater goby utilizes habitat within the Ventura River estuary and the southwestern pond turtle (proposed federally threatened and California Department of Fish and Wildlife Species of Special Concern) utilizes the aquatic habitat in the watershed. The mountain lion is considered a specially protected species in California following the passage of The California Wildlife Protection Act of 1990 and is currently a candidate species under the California Endangered Species Act. Riparian vegetation within the watershed provides habitat for many special status bird species, including the federally endangered least Bell's vireo and the federally endangered southwestern willow flycatcher. In addition to special status species, hundreds of native species that are not protected by federal or state regulations are found within the watershed.

Federally designated critical habitat for the Southern California steelhead currently exists in 48 miles of riverine habitat from the Pacific Ocean to the headwaters (Allen, 2012), however the Matilija Dam presents the watershed's largest migration barrier for steelhead, effectively blocking access to nearly 50 percent of prime spawning habitat. Federally designated critical habitat for the tidewater goby occurs in the Ventura River estuary and extends upstream approximately 0.5 mile to the Main Street Bridge (U.S. FWS, 2005). Federally designated critical habitat for the California red-legged frog occurs at the confluence of the Ventura River and San Antonio Creek and within Matilija Creek and the surrounding upland areas, from approximately 1.6 miles downstream of Matilija Dam to the confluence with Murietta Creek and Upper North Fork Matilija Creek (U.S. FWS, 2010). Federally designated critical habitat for the southwestern willow flycatcher occurs along the mainstem of the Ventura River and its associated riparian corridor from the Pacific Ocean to Matilija Dam (U.S. FWS, 2013). Federally designated critical habitat for the California condor overlaps with upper Matilija Creek, Upper North Fork Matilija Creek, and Old Man Creek (U.S. FWS, 1976). Figure 3 illustrates critical habitats for these federally listed species.

Figure 3 Critical Habitats within the Ventura River Watershed



Regulation and Management

Management and regulation of ecosystem components within the watershed involve multiple overlapping jurisdictions: the U.S. Army Corps of Engineers regulates activities within the Waters of the United States; the State and/or Regional Water Quality Control Board(s) regulates activities within Waters of the State; and the California Department of Fish and Wildlife manages lakes and streambeds and the plants, invertebrates, fish, amphibians, birds, mammals that may inhabit them. Sensitive plant and wildlife species and their habitat are afforded protection by numerous state, federal, and local laws administered by federal, state, and local agencies. Additionally, nesting birds are regulated by the Migratory Bird Treaty Act and California Fish and Game Code. The Ventura County General Plan defines a Locally Important Species as a plant or animal species that is not an endangered, threatened, or rare species, but is considered by qualified biologists to be a quality example or unique species within the County and region (VCPD, 2011). The following criteria further define what local qualified biologists have determined to be Locally Important Species in Ventura County:

Locally Important Plants

- Taxa that are declining throughout the extent of their range AND have five or fewer element occurrences (observations in distinct locations) in Ventura County. This indicates that these species are both broadly declining and locally rare, making them particularly vulnerable to extinction.

Locally Important Animals

- Taxa for which habitat in Ventura County is crucial for their existence either globally or in Ventura County. This includes:
  - Taxa for which the population(s) in Ventura County represents 10 percent or more of the known extant global distribution; or
  - Taxa for which there are five or fewer element occurrences, or less than 1,000 individuals, or less than 2,000 acres of habitat that sustains populations in Ventura County; or
  - Native taxa that are generally declining throughout their range or are in danger of extirpation in Ventura County.

Water Quality

Regulatory Overview

Water quality in the Ventura River Watershed is managed through an integrated, multi-layered regulatory framework administered primarily by the Los Angeles Regional Water Quality Control Board (LARWQCB) under authority delegated from the Clean Water Act and the Porter-Cologne Water Quality Control Act. This framework addresses point and non-point source discharges across surface water, groundwater, and hydrologically connected systems, and is designed to protect designated beneficial uses while accommodating variable hydrologic and land-use conditions.

Foundational Regulatory Framework

The Water Quality Control Plan for the Los Angeles Region (Basin Plan) provides the overarching policy foundation for water quality management in the Ventura River Watershed. The Basin Plan:

- Designates beneficial uses for surface waters, groundwater, and coastal waters
- Establishes narrative and numeric water quality objectives

- Defines implementation mechanisms, including permits, general orders, monitoring programs, and Total Maximum Daily Loads (TMDLs)

The Basin Plan is a living document that is periodically updated through the triennial review process to reflect evolving science, climate conditions, and regulatory priorities, making it the central and durable regulatory anchor for watershed-scale planning.

Regulation of Point Source Discharges

Point source discharges to surface waters are primarily regulated through the National Pollutant Discharge Elimination System (NPDES) permitting program. Within the Ventura River Watershed, this includes:

- Municipal wastewater treatment facilities
- Industrial and construction stormwater discharges
- Municipal Separate Storm Sewer Systems (MS4s)

The Ventura River Watershed is subject to the Regional Phase I MS4 Permit adopted by the LARWQCB in 2021, which consolidated previous county-specific permits into a single regional framework. This permit establishes:

- Prohibitions on non-stormwater discharges
- Technology- and performance-based requirements
- Receiving-water limitations tied to Basin Plan objectives and TMDLs
- Monitoring, reporting, and adaptive management obligations

Municipal permittees, collectively coordinated through the Ventura Countywide Stormwater Quality Management Program, implement structural, operational, and planning programs to reduce pollutant loading from urban areas to receiving waters. This program was formed in 1994 and monitors both water quality within river systems as well as representative outfalls.

Regulation of Non-Point Source Discharges

In contrast to point sources, non-point source discharges arise from diffuse land uses such as agriculture, rural development, and landscape-scale hydrologic processes. These discharges are regulated primarily under the Porter-Cologne Act through Waste Discharge Requirements (WDRs) and general orders.

Agricultural Discharges

Discharges from irrigated agricultural lands are now regulated under the General Waste Discharge Requirements for Discharges from Irrigated Agricultural Lands (Agricultural Order), which replaced the earlier “Conditional Waiver” framework in the Los Angeles Region. The Agricultural Order:

- Applies to discharges of irrigation return flows, tile drainage, stormwater runoff, and nutrient leaching that may affect surface water or groundwater
- Requires monitoring, reporting, and implementation of management practices
- Allows compliance either individually or through approved third-party coalitions, such as the Ventura County Agricultural Irrigated Lands Group (VCAILG)

This updated regulatory approach reflects an increased emphasis on nutrient management, groundwater protection, and long-term trend analysis, aligning agricultural regulation more closely with watershed resilience and drinking water protection goals.

Groundwater Quality Regulation and Drinking Water Protection

Groundwater quality in the Ventura River Watershed is regulated through a combination of Basin Plan objectives, WDRs, and statewide drinking water standards. While groundwater does not fall directly under the federal Clean Water Act, it is fully regulated under Porter-Cologne, which applies to any activity that could affect the quality of waters of the state, including groundwater.

Drinking water quality standards are established as Maximum Contaminant Levels (MCLs) under Title 22 of the California Code of Regulations and are administered by the State Water Resources Control Board Division of Drinking Water. These standards:

- Include primary MCLs to protect public health and secondary MCLs addressing aesthetic qualities such as taste and odor
- Serve as key benchmarks for assessing groundwater quality trends
- Inform regulatory responses where groundwater contributes to surface water impairment through baseflow or subsurface discharge

Integrated Oversight, TMDLs, and Adaptive Management

The Ventura River Watershed includes multiple water bodies listed as impaired under Clean Water Act Section 303(d). In response, the LARWQCB has adopted TMDLs that allocate allowable pollutant loads across both point and non-point sources, explicitly recognizing their combined and cumulative influence on water quality.

Across all regulatory programs, a consistent emphasis is placed on:

- Self-monitoring and reporting
- Adaptive management and iterative program refinement
- Coordination among land use authorities, water purveyors, agricultural interests, and resource agencies

Together, these programs form a comprehensive regulatory structure that manages water quality contributions from stormwater, wastewater, agriculture, groundwater, and land-disturbing activities in an integrated manner, supporting both regulatory compliance and long-term watershed resilience.

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Appendix M

Historical Climate Events

Historical Climate Events

The Ventura River Watershed is susceptible to a diverse range of climate hazards, including extreme heat, drought, wildfire, flooding, sea level rise, and more recently noted, changing patterns of marine fog. Historically, these hazards have significantly impacted local communities, agricultural activities, services, and infrastructure throughout the watershed.

Evaluating past climate events provides insight into the nature and severity of potential future climate risks. This section describes each key climate hazard and details historical events that exemplify the types of impacts these hazards have had on the region. These historical hazard events are regional events and may include information from areas outside the Watershed but within Ventura County. Table 1 summarizes key historical climate hazard events that have impacted the Ventura County Watershed and nearby regions, illustrating the range and severity of climate-related risks to communities, ecosystems, and infrastructure. Five of the six climate hazards analyzed in this Plan are represented in the table with corresponding historical events. Because marine fog is a chronic and gradual hazard that accumulates impacts over time rather than through discrete, acute events, it is not included in the table. Following the table, a more detailed discussion of each climate hazard is provided along with the impacts climate hazards have had on the water resource systems.

Table 1 Historical Climate Hazards and Events Affecting the Ventura County Watershed and Surrounding Areas

Climate Hazard / Event Name	Date(s)	Description
Extreme Heat	September 5 – 6, 2020	Temperature highs reached 120°F in the Fillmore foothills and Oak View. Other records included Thousand Oaks (119°F), Ojai (118°F), Piru (117°F), and Santa Paula (113°F). Widespread heat-related health impacts and strain on power infrastructure were reported.
Extreme Heat	August 31 – September 3, 2007	A multi-day heat wave brought record-breaking temperatures and high humidity to Ventura County. High temperatures ranged from 105°F to 112°F. Nearby Los Angeles County reported 18 heat-related deaths. Numerous residents across Ventura County were treated for heat-related illnesses.
Drought	2018 – 2020	This period followed the historic 2012–2017 drought and was marked by below-average rainfall in Ventura County. Lake Casitas and other regional reservoirs remained at reduced capacity, extending water conservation measures. Ecological stress and wildfire risk remained high due to persistent dry conditions.
Drought	2012 – 2017	The most intense and prolonged drought in California's instrumental record. Ventura County experienced severe water stress, significant agricultural impacts, and heightened wildfire risk. Water deliveries fell to unprecedentedly low levels, which led to heavy groundwater pumping, causing hundreds of wells and small water systems to go dry. Groundwater basins experienced significant level declines, and **Lake Casitas dropped to below 35 percent capacity** (CNRA, 2021). **The State and Ventura County implemented mandatory water conservation measures and curtailed thousands of diversions from main rivers.**
Drought	1986 – 1992	A six-year statewide drought that affected municipal and agricultural water supplies. Ventura County implemented mandatory water conservation measures and began exploring recycled water and groundwater banking projects. Additionally, the Casitas Municipal Water District and the Carpinteria Valley Water District began the Ventura-Santa Barbara Counties Intertie Project for emergency transfer of SWP water, although rains came before the project was complete.
Drought	1976 – 1977	One of the most severe single-year droughts in California history. Ventura County experienced widespread water rationing, and agricultural water deliveries were

Climate Hazard / Event Name	Date(s)	Description
		sharply curtailed. The event became a catalyst for new water management policies across the state.
Wildfire – 2017 Thomas Fire	December 4, 2017 –12, 2018	The Thomas Fire was sparked by power lines owned by Southern California Edison. The Thomas Fire was active for 39 days and burned a total of 281,893 acres. 274 structures were damaged, 1,063 structures were destroyed, and two firefighters were injured. It is estimated that 80% of the Watershed burned. Boil water orders were issued for residents in Ventura and Ojai due to potential contamination of the water supply caused by power outages and loss of water pressure (CNRA, 2021).
Wildfire – 1985 Wheeler Fire	July 1 – July 15, 1985	The Wheeler Fire ignited in Wheeler Gorge northwest of Ojai and quickly grew under hot, windy conditions at a time when statewide fire resources were stretched thin. The fire burned 118,000 acres, including extensive portions of the upper Ventura River Watershed, before being contained after 15 days. It destroyed 19 homes, damaged 37 outbuildings, and caused roughly $3 million in agricultural losses. The fire threatened communities, burned through Matilija Canyon, and caused severe watershed impacts, including widespread high-intensity burn areas that led to erosion, debris flow hazards, and riparian corridor damage.
Wildfire – 1932 Matilija Fire	September 7 – September 20, 1932	The 1932 Matilija Fire was the largest fire in state history for 71 years until the 2003 Cedar Fire in San Diego. The Matilija Fire burned 219,254 acres in Los Padres National Forest, including a significant portion within the Watershed.
Extreme Precipitation and Flooding – 2022-2023 Floods	December 2022 – March 2023	Unprecedented rainfall hit Ventura County, leading to several months' worth of rainfall falling in less than one hour in many areas throughout the county. These floods led to debris flows on roads throughout the county, resulting in over 5,000 truckloads of debris removal and Governor Newsom declaring a state of emergency.
Extreme Precipitation and Flooding – 1995 Storm	January – February 1995	A series of intense winter storms in January brought widespread flooding across the Ventura River Watershed. In just three storm cycles, more than 16 inches of rainfall were recorded at the Ventura City Hall rain gage, and the upper watershed swelled to 43,700 cfs at Foster Park. Highway 101, Highway 33, and Highway 150 were closed due to flooding and debris flows, isolating communities and disrupting regional mobility. Extensive crop losses, localized flooding, and infrastructure damage resulted in millions of dollars in regional impacts.
Extreme Precipitation and Flood – 1969 Flood	January 18 – 27, 1969	Record rainfall brought 43 inches in nine days above Ojai. Devastating floods hit Casitas Springs and Live Oak Acres. Citrus orchards were destroyed, roads and rail lines were washed out, and wastewater treatment facilities failed, releasing raw sewage into the Ventura River. Matilija Dam filled with silt, reducing reservoir capacity significantly.
Extreme Precipitation and Flood - Floods of 1938	February – March 1938	Major regional flooding from prolonged rainfall. Ventura River overflowed its banks in several locations, damaging agricultural land, bridges, and early floodplain structures. These floods spurred later flood control development.
Sea Level Rise and Storm Surge – 2024 Coastal Flood	December 28 – 30, 2024	A series of powerful storms in the Pacific Ocean drove towering waves into the California coastline, which triggered flooding and posed a significant risk to people and structures along the coast. Several streets, cars, and homes along the Ventura coast were flooded as waves, as high as 20 feet, hit the Ventura Pier. In total, eight people were injured. Similar impacts occurred upstream at Foster Park, leading to an exposed water pipeline, rerouting of the mainstem of the Ventura River, and emergency repairs to address impacts to fish passage infrastructure. The levee system and operations at Robles Diversion were similarly impacted.
Sea Level Rise and Storm Surge – 1997–98 El Niño Winter	Winter 1997 – 1998	Severe El Niño-driven storms damaged property along the Ventura County coastline. A bridge over the Ventura River was washed out due to flooding and debris flows, requiring emergency repairs.

Climate Hazard / Event Name	Date(s)	Description
Sea Level Rise and Storm Surge – Great Storm of '88	January 17 – 18, 1988	A powerful extratropical storm struck the Pacific Coast from Baja California to San Francisco, rapidly intensifying into a meteorological "bomb" with 33-foot waves – the highest ever recorded along the West Coast. The storm caused severe beach erosion, shrinking Ventura County beaches by 75-150 feet, and led to flooding, structural damage, and $28 million in mainland coastal damages.
Sea Level Rise and Storm Surge – 1982–83 El Niño Winter	Winter 1982 – 1983	The 1982–83 El Niño resulted in wave-induced erosion, property damage, and infrastructure impacts in Ventura County. It was one of the strongest El Niño on record at the time, producing record wave heights, elevated tides, and consistent storm surges throughout Southern California. Ventura, with its exposed beaches (like Pierpont and Solimar) and key infrastructure (like the Pacific Coast Highway), was vulnerable to these hazards. Ventura County saw damage along its beaches from wave action and coastal erosion, though not to the same extreme extent as some other counties.

Historical Impacts from Extreme Heat on Water Resource Systems

The following sections explore ways extreme heat has impacted the watershed's water resource systems.

Water Supply: Historical Impacts from Extreme Heat

Increased Evaporation: Evaporation directly impacts Lake Casitas and other reservoir and surface water body levels. Evaporation rates vary due to a variety of factors, but periods of extreme heat can increase evaporative processes. Evaporation rates are considered in Casitas MWD water management plans (Urban Water Management Plans, Water Efficiency and Allocation Programs, etc.) (WUCA & AMWA, 2020).

Heat Resilience and Water Access: During heat waves throughout Ventura County, numerous residents have been treated for heat related illnesses and cooling centers have opened to serve vulnerable populations. Access to reliable potable water supply is critical during these events, particularly for outdoor workers, and the unhoused community. The State of California mandated protections for agricultural workers working in temperatures above 95 degrees, including a requirement for access to cool water (WUCA & AMWA, 2020).

Increased Transpiration: Extreme heat causes crops vital to the region's economy, such as avocados, to require more water. During the 2018 heat waves, agricultural damages were recorded in the county. Additionally, extreme heat increases evapotranspiration in plants, which increases water uptake demand, reducing water supply availability in other parts of the water supply system, such as groundwater recharge (Mishra et al. 2023).

Flood Management: Historical Impacts from Extreme Heat

Infrastructure Degradation: Extreme heat has contributed to the wear and breakdown of materials in flood infrastructure across the Ventura River Watershed. During the 2020 and 2021 heatwaves, the Ventura County Watershed Protection District reported increased maintenance needs for culverts, drains, and levees due to cracking and wear from sustained high temperatures (VCWPD, 2022). These conditions reduce structural reliability and increase failure risk during storm events.

Reduced Infiltration and Flash Flooding: Extended heat waves have dried and hardened soils, especially in the Ojai Valley and Lower Ventura River areas, reducing infiltration and increasing runoff. Following the 2017 and 2019 heatwaves, storm events produced faster runoff and localized flash flooding due to low soil absorption (Walter, 2015; VCWPD, 2022).

Groundwater Management: Historical Impacts from Extreme Heat

Increased Groundwater Demand: During extreme heat events, groundwater extraction rises sharply to meet elevated municipal, residential, agricultural, and ecological demands. Higher temperatures drive evapotranspiration in irrigated landscapes and increase water needs for cooling and consumption. This often results in unscheduled or peak-period pumping by water agencies and private well users. Historical data, such as during the 2017 heat wave, show marked upticks in groundwater withdrawals across the watershed (UVRGA, 2022), contributing to seasonal drawdown and long-term declines in storage levels.

Impaired Recharge and Soil-Water Dynamics: Extreme heat dries out soils and reduces percolation, weakening natural recharge pathways for shallow aquifers. Hardened soils from prolonged heat or drought periods become less permeable, preventing rainfall from replenishing groundwater effectively when storms do arrive. This effect is not experienced in the sandy and gravelly recharge zones along the main river corridor, but rather in other parts of the watershed, including uplands, rangelands, and agricultural soils, where finer-textured soils can lose permeability following prolonged heat or drought. This effect has been observed following multi-week heat events, where increased runoff and decreased infiltration led to diminished seasonal recharge despite storm activity (Reinsch et al. 2024).

Ecosystems: Historical Impacts from Extreme Heat

Aquatic Habitat Stress: High temperatures have directly reduced streamflow and increased water temperatures, threatening cold-water species like the endangered Southern California steelhead. In summer 2021, North Fork Matilija Creek experienced severe drying, with stream temperatures in some reaches exceeding 80°F, making the habitat unsuitable for steelhead that rely on deep pools and cool water. Likewise, rapid drying of seasonally wet areas (ponds, season wetlands, riparian zones) can negatively impact the amphibians and reptiles that depend on those areas for breeding (e.g., California red-legged frog, southwestern pond turtle, etc.) (CDFW, 2025).

Riparian Vegetation Decline: Extended durations of thermal stress and hydrogeologic deficit have increased evapotranspiration rates and physiological stress among native phreatophytes, specifically Salix and Populus species. Documented trends in San Antonio Creek and the Upper Ventura River indicate significant canopy dieback, reduced riparian shading, and increased bank exposure. These structural changes accelerate fluvial thermal loading and contribute to the degradation of critical aquatic habitats (Upper Ventura River Groundwater Agency [UVRGA] 2022).

Phenological Disruptions: Extreme heat has been linked to shifts in the timing of plant blooming, insect emergence, and wildlife behavior. These shifts can decouple ecological relationships (e.g., mistimed insect hatches can deprive young fish of critical food sources). Though data are limited in the Watershed, these phenomena are increasingly being documented across California's Mediterranean ecosystems (Walter, 2015).

Water Quality: Historical Impacts from Extreme Heat

Elevated Water Temperatures and Dissolved Oxygen Depletion: High air temperatures during heatwaves have led to increased water temperatures in the Ventura River and its tributaries (U.S. EPA, 2024). Warmer water holds less dissolved oxygen, which is critical for aquatic life. Monitoring from 2008 to 2011 documented substantial diurnal fluctuations in dissolved oxygen levels during late summer, with some reaches falling below biological thresholds necessary to support aquatic species (Leydecker, 2012).

Algal Blooms and Eutrophication: Elevated temperatures can increase evaporation rates in irrigation canals and reservoirs, concentrating pollutants and reducing available water for crop irrigation. Excessive algal growth has been observed in the Ventura River, and parts of the river have been formally

listed as impaired for algal blooms and eutrophic conditions under Section 303(d) of the Clean Water Act (Walter, 2015).

Lake Casitas' Water Quality: Lake Casitas, the primary surface water supply for the watershed, has experienced water quality impacts due to extreme heat. Increased surface temperatures have contributed to algal growth, causing taste and odor problems in drinking water. The Casitas Municipal Water District has responded with seasonal algaecide applications to manage algal blooms and protect supply reliability (Casitas MWD, n.d.).

Cultural Resources: Historical Impacts from Extreme Heat

Archaeological Sites, Cultural Activities, and Ethnobiologically Significant Natural Resources: Extreme heat can negatively affect cultural resources in multiple ways, including the degradation of archaeological sites, disruption of traditional cultural practices, and loss of ethnobiologically significant natural resources. Prolonged high temperatures may cause soil desiccation and cracking, exposing archaeological materials to damage from erosion or human activity. Rising temperatures can also limit access to rivers, springs, and other sites important for ceremonies and traditional gatherings, while stressing ecosystems and native plant species used for medicinal and ceremonial purposes. Although these specific impacts have not been systematically documented in the Ventura River Watershed, they have been observed in other regions and are likely affecting cultural resources in the watershed as well (Flanigan et al., 2018; Baird, 2008; Karuk Tribe Department of Natural Resources, 2016). There is a pressing need for focused research and collaboration with Indigenous communities to better understand and protect cultural resources from the growing threat of extreme heat.

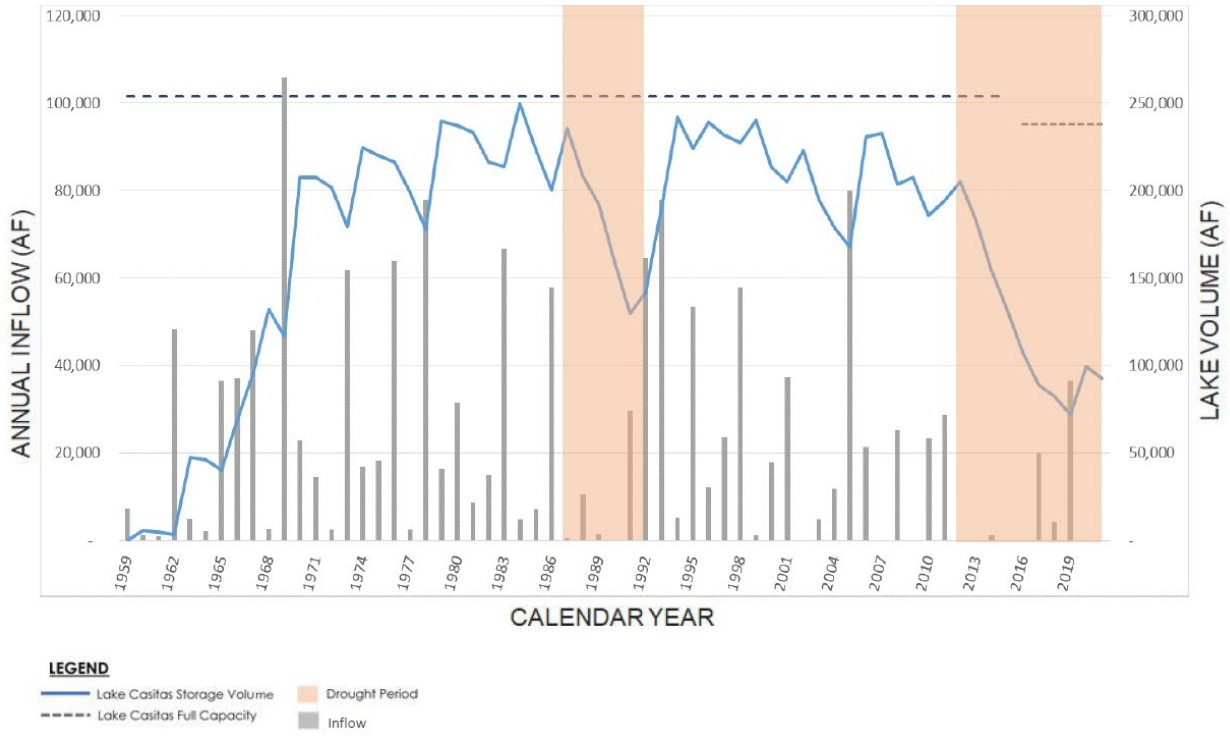
Historical Impacts from Drought on Water Resource Systems

The following sections explore ways drought has impacted the Watershed's water resource systems.

Water Supply: Historical Impacts from Drought

Reduced Reservoir Levels: Casitas MWD carefully manages Lake Casitas to maintain supplies even during multi-year drought periods. The most severe test of the reservoir's function since its construction was the dry period from 2012-2017. In December 2018, Lake Casitas reached a record low level at 30.5 percent of capacity. It recovered from this low point after 5 years, reaching full capacity in April 2024 when the reservoir reached the spillway elevation. Prolonged drought conditions in the early 2000s and mid-2010s caused steep drops in Lake Casitas water levels, prompting boating restrictions and closures of campgrounds and shoreline access (Casitas MWD, 2016). Figure 1 depicts lake volume (AF), annual inflow (AF), and drought periods in Lake Casitas from 1959 to 2019.

Figure 1 Historical Lake Levels, Inflow, and Drought Periods of Lake Casitas



Source: Urban Water Management Plan (Casitas Municipal Water District, 2021).

Conservation Measures: Casitas MWD has developed a Water Efficiency and Allocation Program (WEAP) which includes six drought or water shortage stages. Each stage includes target demand reductions, which may be achieved via voluntary or mandatory conservation measures. Retail providers of water from Casitas MWD have developed drought planning tools which align with the Casitas MWD WEAP to ensure adherence with conservation measures and compliance with conservation targets. Table 2 describes the five stages of the WEAP, along with Lake Casitas associated storage level.

Table 2 Stage Conditions from Casitas Municipal Water District's Water Efficiency and Allocation Program

Table 3 – Stage Conditions from Casitas Municipal Water District's "*WEAP*"

Stage	Stage Title	Lake Casitas Storage (%)	Demand Reduction
1	Water Conservation	100% to 50%	0%
2	Water Shortage Warning	50% to 40%	20%
3	Water Shortage Imminent	40% to 30%	30%
4	Severe Water Shortage	30% to 25%	40%
5	Critical Water Shortage	25% to 0%	50%

Increased Cost of Water: Due to concerns over water supply reliability, the City of Ventura – Ventura Water and Casitas MWD have initiated the planning and construction for interconnections with nearby water districts, which would enable the transfer of water from the SWP via water transfer agreements. The cost of these projects is significant, and water purchased from the SWP is generally more expensive than water sourced from local sources. The City of Ventura – Ventura Water is also considering the construction of a desalination plant, which, if enacted, is also expected to increase water rates for city residents. In the long term, these projects are expected to enhance water supply reliability for the watershed but also increase the cost of water. As these projects move forward, it will be critical to incorporate equity considerations into planning and rate-setting to ensure that low-income and vulnerable households are not disproportionately impacted by rising water costs.

Emergency Water Transfers: In 1990, water agencies in the Watershed participated in plans for emergency transfer of SWP water to the City of Carpinteria in Santa Barbara County via water transfer agreements through an effort called the Ventura-Santa Barbara Counties Intertie Project. Rains in 1991 arrived before the plans were fully implemented.

Loss of Economic Productivity: Drought conditions lead to loss of economic productivity, which can be particularly challenging for the agricultural sector. Increased cost of water and water delivery shortages can lead to decisions to fallow land. A report prepared for the U.S. Department of Agriculture estimated that the 2021-2022 drought forced California agricultural communities to fallow 395,000 acres of land, leading to $1.1 billion in revenue losses and the loss of an estimate 8,745 jobs across the state (Lopez, 2022).

Flood Management: Historical Impacts from Drought

Reduced Infiltration and Increased Runoff: Extended droughts have dried and hardened soils across the watershed, limiting infiltration capacity. When precipitation returns after dry periods, runoff increases substantially, raising the risk of flash flooding. This was observed during the post-drought period in the early 1960s, when hardened soils in the Watershed contributed to intense surface runoff and localized flooding (VCOES, 2022; Walter, 2015 Watershed Management Plan).

Infrastructure Deterioration and Response: Drought stress has historically led to cracking and settlement in flood management structures such as culverts and levees, reducing their reliability during storm events. The 1945–1965 drought revealed critical weaknesses in Ventura County's flood control systems, prompting major investments in water infrastructure, groundwater storage, and drainage improvements that continue to shape current flood management practices (Walter, 2015 Watershed Management Plan; VCWPD, 2022).

Groundwater Management: Historical Impacts from Drought

Historical Groundwater Depletion: Groundwater elevations in the watershed reached historic lows during the droughts of 1976–1977, 1986–1992, and 2012–2017. These periods of prolonged dryness led to reductions in natural recharge (OBGMA, 2022; UVRGA, 2022).

Ecosystems: Historical Impacts from Drought

Invasive Species Encroachment and Habitat Degradation: Extended drought has contributed to the spread of invasive plant species, most notably *Arundo donax* (arundo), which forms dense monocultures along riparian corridors. Arundo consumes significantly more water than native vegetation and outcompetes native plants, degrading riparian habitat and reducing biodiversity (California Bay Delta Authority, 2006). Its thick root systems and persistent biomass can obstruct instream habitat and alter natural hydrology, posing direct threats to amphibians and fish.

Reduced Flow and Wildlife Impacts: During drought years, reduced streamflow limits fish passage to perennial reaches in the upper watershed, often confining access to brief windows during storm runoff events (St. George & Horgan, 2022). Southern California steelhead are adapted to these conditions, but diminished summer baseflows and rising water temperatures reduce the availability of critical deep pools and cool-water refugia. These changes have constrained suitable rearing habitat for juveniles (Spina, 2006). Additionally, rapid drying of seasonal wetlands and ponded areas has negatively affected breeding success for sensitive amphibians and reptiles, including the California red-legged frog and southwestern pond turtle.

Water Quality: Historical Impacts from Drought

Reduced Dilution and Elevated Pollutant Levels: Prolonged droughts, especially from 2012 to 2017, lowered the groundwater table and reduced baseflow contributions to the Ventura River and its tributaries. With lower surface water flows and minimal groundwater recharge, the watershed experienced increased concentrations of total dissolved solids, nitrates, and other agricultural inputs, particularly in areas with heavy irrigation and fertilizer use. Reduced natural dilution during drought exacerbated these pollutant levels in both surface and groundwater. When rainfall returned after dry periods, accumulated pollutants were flushed into streams, further degrading water quality (CDFW, 2015).

Steelhead Stress and Water Chemistry Shifts: During drought monitoring in 2014 and 2015, the California Department of Fish and Wildlife observed critically low dissolved oxygen levels in stagnant stream segments and elevated water temperatures throughout the watershed. The absence of riffle flows, which are normally responsible for oxygenation, combined with low water inputs and stagnation, created unsuitable conditions for steelhead survival, contributing to documented population declines (CDFW, 2015).

Impacts on Recreation: During the 2012–2017 drought, low flows in the Ventura River led to stagnant pools and elevated water temperatures, creating conditions that promoted algal blooms and reduced water quality for recreational uses such as swimming and wading (VRWC, 2014). At Lake Casitas, prolonged drought resulted in higher concentrations of nutrients and contaminants due to reduced dilution, occasionally triggering taste, odor, and algae-related advisories that impacted boating and fishing activities (Casitas MWD, 2016).

Aging Infrastructure and Systemic Vulnerabilities: Aging infrastructure, particularly systems developed by mutual water companies in the 1930s and 1940s, may struggle to manage increased contamination and altered water chemistry associated with drought, leading to higher treatment costs and service disruptions (Loxton, 2021). Historically, droughts in the Ventura River Watershed have revealed systemic vulnerabilities in the region's ability to reliably guarantee water quality, threatening local economic activities and public health.

Cultural Resources: Historical Impacts from Drought

Exposure and Erosion of Archaeological Sites: Drought-related declines in surface water levels and vegetation cover have increased erosion in some parts of the watershed, leading to the exposure and degradation of archaeological sites. Previously buried resources became more susceptible to physical disturbance, vandalism, and increased foot traffic, particularly along drying riverbeds and reservoir margins (Flanigan et al., 2018).

Disruption of Cultural Practices Dependent on Water: Drought has impacted traditional activities of Indigenous and local communities in the watershed, particularly those connected to water, such as

ceremonies, basket-making, and subsistence fishing. Reduced river flows and declining aquatic species availability have limited the ability to carry out these cultural practices (Flanigan et al., 2018).

Loss of Ethnobiologically Significant Resources: Sustained drought has contributed to the decline of native vegetation used for food, medicine, and ceremony, which are vital resources to the cultural identity and practices of Indigenous communities. As habitat conditions worsen, culturally significant plants such as willow, tule, and mugwort may decline, impacting both the landscape and traditional ecological knowledge associated with these species (Flanigan et al., 2018).

Historical Impacts from Wildfire on Water Resource Systems

The following sections explore ways wildfire has impacted the Watershed's water resource systems.

Water Supply: Historical Impacts from Wildfire

Physical Damages: Wildfire flames or debris flows may cause leakages, loss of water system pressure, and water system outages, which may also result in water quality issues. Reservoirs are also susceptible to physical damage through excessive sedimentation and siltation. For example, following the 2017 Thomas Fire, water supply operations of the Robles Diversion and Fish Passage Facility were affected due to the transport of sediments and ash from burnt areas and subsequent accumulation of sediments at the forebay of the facility.

Debris Flows: Following the 2017 Thomas Fire, extreme hydrologic impacts were experienced throughout the watershed. Streamflow monitoring throughout the watershed indicated that post-fire runoff deposited increased sediment in stream channels, especially the forebay, slowing stream flows and decreasing the rate of percolation into groundwater, causing the Lake Casitas diversion to cease operations and resulting in a costly sediment removal effort (Casitas MWD, 2022).

Water Response Shortages: During wildfire emergency response, adequate pipe size, water supply, and pressure for firefighting response is critical and systems are designed in accordance with the California Fire Code (California Code of Regulations, 2022). However, increasingly large catastrophic wildfire events can strain these systems beyond their design capacity. During the 2017 Thomas Fire, Ventura Water's system experienced unprecedented demand, leading to both reduced water pressure and critical supply shortages. Firefighting crews drew water at a rate that exceeded replenishment capacity, and numerous private service lines broke as homes were damaged or destroyed, causing uncontrolled water loss across the system. In some areas, storage tanks were nearly depleted, and pumps were unable to maintain service levels due to simultaneous demand and infrastructure damage. These supply and pressure limitations hindered response effectiveness and underscored the need for more resilient, redundant water systems during wildfire events (City of Ventura After Action Review, 2017).

Flood Management: Historical Impacts from Wildfire

Runoff Amplification: Loss of canopy interception and soil permeability after the 2003 Piru and 2017 Thomas fires produced peak flows high enough to overtop low-water crossings and inundate access roads near Foster Park (Walter 2015; VCWPD 2022).

Sediment & Debris Loading: Ash, cobbles, and woody debris mobilized by the first post-fire storms rapidly filled debris basins on San Antonio and Matilija creeks, aggraded main-stem channels, and clogged culverts – reducing conveyance capacity and raising flood stages (Walter 2015; VCWPD 2022).

Infrastructure Damage & Maintenance Burden: Ventura County Watershed Protection District conducted emergency dredging, channel re-grading, and culvert clearing for several years after the Thomas Fire; similar long-term maintenance followed the 1985 Wheeler Fire (VCWPD 2022).

Prolonged Hazard Period: Elevated runoff, erosion, and debris-flow risk persist for three to five years until vegetative cover and soil structure recover, so VCWPD now incorporates post-fire sediment surveys and hazard assessments into its routine flood-management program (Walter 2015; VCOES 2022).

Groundwater Management: Historical Impacts from Wildfire

Fire-Return Frequency: Historically, the Ventura River Watershed has experienced moderate wildfires approximately every ten years and extreme wildfires every twenty years. In 2017-2018, the Thomas Fire, which burned over 280,000 acres (approximately 440 square miles), affected roughly 154 square miles of the 226 square miles of the watershed's land area (UVRGA, 2022).

Sedimentation & Recovery: Post-wildfire hydrological regimes result in dramatic increases in watershed sediment yield. Specifically, after the Thomas Fire, suspended sediment concentrations were up to 32.5-times higher than measurements taken before the Thomas Fire. These changes disrupt streamflow, erode streambanks, and can choke out riparian and aquatic habitat. However, strong storm systems following wildfire events can quickly push fine sediments out of streambeds and retore the watershed to its pre-fire conditions (Jumps 2020).

Ecosystems: Historical Impacts from Wildfire

Vegetation Conversion and Fuel Loading: Some shrub species are obligate resprouters that use stored carbon reserves to regenerate from existing stems shortly after a fire event. These species require low intensity fires and sufficient carbon reserves for the seed to sprout. However, since the expansion of modern fire suppression techniques, which has resulted in increased fire suppression on all fires, even low intensity ones, the fire regime in Ventura County has shifted. These fuel suppression techniques have contributed to a larger amount of fuel loading, which traditionally would burn naturally over time. Due to this high fuel loading, large wildfires have occurred throughout the region. These large, high intensity fires burn far too hot for the obligate seeders to resprout, causing the proliferation of invasive annual grasses and herbaceous plants to sprout in their place. These invasive species contribute to the high ignitability of the Watershed, as they increase the dry fuel loads, in place of the fire adapted species. (DiTomaso et al., 2005).

Riparian and Aquatic Habitat Damage: Substantial changes to riparian and aquatic habitats within the Ventura River Watershed occurred in late 2017 and early 2018, when, following a prolonged regional drought, the Thomas Fire burned roughly 154 square miles of the 226 square mile Ventura River Watershed (Jumps et.al, 2022). Riparian woodland and alluvial scrub habitats on the floodplains of the entire Matilija Creek sub-watershed, including the main stem Matilija Creek and North Fork Matilija Creek, and the upper main stem of the Ventura River were substantially damaged by the Thomas Fire, and most of the chaparral and other plant communities on adjacent slopes (from floodplain to ridgeline) were burned almost completely (VCWPD & Hunt & Associates Biological Consulting Services, 2019).

Wildlife Mortality and Displacement: Wildfires in the region cause the direct mortality of wildlife, as well as indirect mortality due to the loss of habitat, food sources, and seed banks (Backlund, 2008). After large intense fires, such as the Thomas Fire, wildlife must travel farther for food and shelter and some wildlife traveled into urban core areas, such as Downtown Ventura. Large fires can cause ecological fragmentation, leading to degradation in biodiversity and habitat. The Thomas Fire ignited in December during a Santa Ana wind event and, less than a month after the fire was extinguished, a series of storm events resulted in mass erosion of the burned slopes and transportation of large amounts of sediment into the watershed. Aquatic habitats were substantially impacted by sedimentation from the debris flow.

Water Quality: Historical Impacts from Wildfire

Erosion, Turbidity, and Water-Chemistry Impacts: Following major wildfires such as the 2017 Thomas Fire, the Ventura River Watershed experienced significant erosion, sedimentation, and water quality degradation. The loss of vegetation led to unstable soils and elevated turbidity in runoff, reducing water clarity and light penetration, which impaired aquatic habitat and photosynthesis. Monitoring after the fire documented increased nutrient loads, heavy metals, and other pollutants in surface waters, likely mobilized by ash and debris from burned vegetation and structures (Stillwater Sciences, 2020; Jumps et al., 2022). Dissolved oxygen levels declined, surface water temperatures rose due to canopy loss, and harmful algal blooms were observed in slower reaches (Stillwater Sciences, 2020). These impacts reduced the recreational and aesthetic value of riparian areas, particularly in high-use zones like the Ventura River and Matilija Creek (Casitas MWD, 2020).

Post-Thomas-Fire Sediment Surge: The 2017 Thomas Fire impacted both surface quality in the Ventura River, leading to increased sedimentation, and altered streambed conditions. Post-fire storm events resulted in fine suspended sediment concentrations in the Ventura River that were 32.5-times higher in 2018 than pre-fire conditions. Furthermore, the fire resulted in a fine suspended sediment concentration that was approximately 200 times greater than pre-fire conditions, indicating a substantial increase in sedimentation rates due to the fire (Jumps et al., 2022).

Cultural Resources: Historical Impacts from Wildfire

Physical damage from thermal stress: Thermal stress from rapid temperature increase can physically damage cultural structures and artifacts resulting in shattering, fracturing, spalling, crazing, cracking, etc. depending on the material type (NPS, 2016; Ryan, 2010).

Post-fire damage: Post-fire damage results in increased weathering, erosion, and redistribution. Accelerated erosion after a fire can wash away, bury, or redistribute archaeological materials. The spatial redistribution of cultural resources, combined with thermal impacts on dating techniques, complicates archaeological interpretation (Ryan, 2010).

Fire suppression activities: Human response to wildfires through fire suppression activities, such as scouting and line construction, can cause mechanical damage to artifacts and structures. Fire retardants, foam, and water can chemically damage surfaces, while rapid quenching of heated materials can lead to fractures. Wildfires often uncover previously unknown sites and artifacts due to vegetation removal. Without protection, these newly exposed sites can be vulnerable to increased vandalism (Ryan, 2010).

Historical Impacts from Extreme Precipitation and Flooding on Water Resource Systems

The following sections explore ways extreme precipitation and flooding have impacted the Watershed's water resource systems.

Water Supply: Historical Impacts from Extreme Precipitation and Flooding

Physical Damage and Operational Disruption: High intensity precipitation events, both on the hourly and annual timescale, can increase the potential for flooding and flash floods. These floods and flash floods can cause physical damage to water system components due to inundation, precipitation-induced landsliding, and erosion. The 2005 storms caused major damage to Ventura Water's well facilities near Foster Park, as well as the Avenue Treatment Plant, a water treatment facility along highway 33 that treats water directly from the Ventura River. The wells are subject to inundation and erosion during storm events, and the 2005 winter storms destroyed Nye Well 1A and damaged Nye Wells 2, 7, and 8. Two pipelines that connected the wells to the Avenue Treatment Plant were also damaged during the

storms. Significant precipitation and high flow conditions in the watershed during January and February 2023 led to extensive erosion and heavy debris accumulation at the Robles Diversion and Fish Passage Facility, impacting its operations. Additionally, massive scouring occurred in Foster Park, resulting in exposure of approximately 25 feet of Ventura Water's Nye Wells 7 & 8 conveyance pipeline (Ayub & Nelson, 2023).

Sedimentation: Flooding is also partially responsible for the sedimentation and siltation behind the Matilija Dam. The 1969 flood caused massive siltation in the reservoir, which reduced the capacity of the reservoir significantly. These flood events can also cause changes to streambed elevations due to the increased sedimentation, impacts the groundwater to surface water exchange, and smother aquatic and riparian habitats.

Erosion Damage: Large flood events, including the 1969, 1978, and 2023 floods damaged Robles Diversion Dam and portions of it had to be rebuilt.

Treatment System Overflow: During periods of extreme atmospheric river activity, wastewater conveyance infrastructure can suffer catastrophic structural failure or become hydraulically overwhelmed by excessive infiltration and inflow (I&I) and sediment transport. In January 2023, extreme precipitation in the Ventura River Watershed triggered major infrastructure compromises within the Ojai Valley Sanitary District's collection system, resulting in the discharge of approximately 14 million gallons of untreated effluent into the river system (California Regional Water Quality Control Board [RWQCB] 2023). This event necessitated extended beach closures and posed significant risks to public health. This incident mirrors historical precedents, such as the 1969 floods, where peak fluvial discharge overwhelmed regional treatment capacities, leading to the uncontrolled release of raw sewage into coastal waters (Ventura County Watershed Protection District [VCWPD] 2022). Such spills disproportionately affect socioeconomically disadvantaged communities in the lower watershed, where hydraulic accumulation of pollutants is highest and local infrastructure for emergency notification is often insufficient. These populations face systemic barriers to disaster recovery and may experience exacerbated health vulnerabilities due to baseline environmental disparities (RWQCB 2023).

Flood Management: Historical Impacts from Extreme Precipitation and Flooding

Runoff and Infrastructure Strain: Extreme precipitation and associated flooding events pose some of the greatest challenges to flood management in Ventura County. Short-duration, high-intensity storms – especially atmospheric river events during winter months – have historically produced rapid runoff, flash flooding, and significant damage to flood control infrastructure (VCWPD, 2022; Walter, 2015 Watershed Management Plan).

Infrastructure Vulnerabilities and Upgrades: The steep terrain of the watershed, coupled with already saturated soils from winter precipitation, can create conditions that overwhelm river channels, levees and stormwater systems. Past major flood events, such as those in 1969, 1992, and 1995, resulted in extensive infrastructure damage across Ventura County and led to federal disaster declarations by FEMA. These events revealed that many rural bridges were undersized and vulnerable to overtopping or washout, urban storm drain systems lacked the capacity to manage intense runoff volumes, and levees along the Ventura River were susceptible to erosion and overtopping during peak flows. In the aftermath, agencies initiated upgrades to bridge designs, stormwater infrastructure, and levee reinforcement projects to improve regional flood resilience (VCOES, 2022).

Historical Flood Events and Community Impacts: Historical flooding has frequently affected communities, including low-income communities, adjacent to the Ventura River in both the upper

(Meiners Oaks, Mira Monte, Oak View) and lower watershed (Casitas Springs, City of Ventura) and along San Antonio Creek (Ojai). The watershed's most severe flood occurred in January of 1969. It damaged communities throughout the watershed from Casitas Springs and Live Oak Acres to Forest Park (see Figure 2) and thirteen people lost their lives (Poush, 1969). Agricultural areas, roads, and water conveyance and treatment infrastructure were also damaged throughout the watershed. A powerful Pacific storm brought more than half a foot of rain on Ventura County in 1995, driving hundreds of residents from their flooded homes and claiming the life of a man believed to be unhoused who drowned in the Ventura River during the flood (Weiss,1995).

Disproportionate Impacts on Low-income Communities: Flooding events disproportionately affect low-income communities, such as low-income households and unhoused individuals. These communities often lack the resources to recover quickly, face higher risks of property damage, and experience greater economic strain due to inadequate infrastructure and limited access to emergency services (Headwaters Economics, 2023).

Figure 2 1969 Flood Damages Map

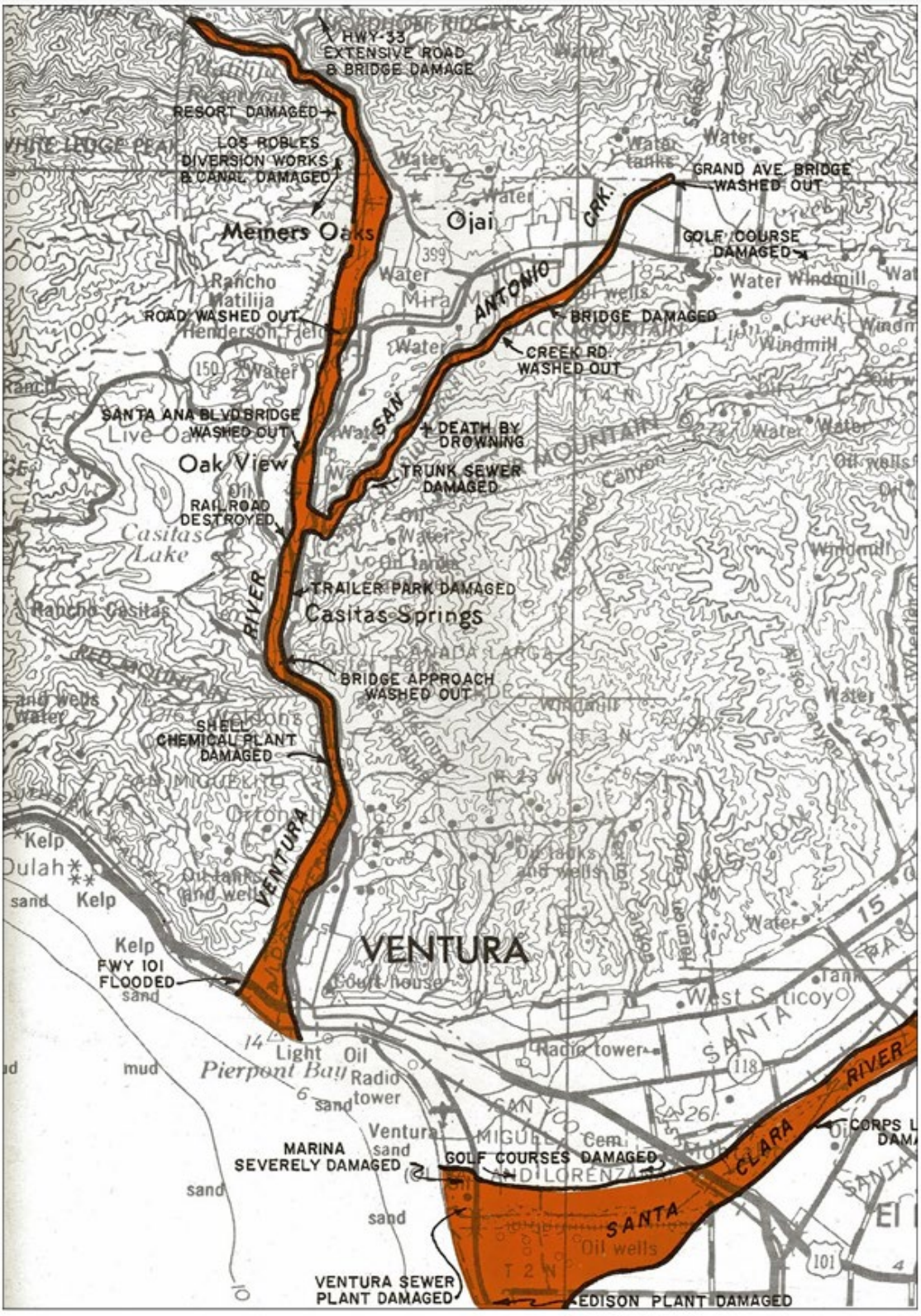


Figure 3.3.2.3.1 1969 Flood Damages Map

Source: Ventura County Flood Control District

Groundwater Management: Historical Impacts from Extreme Precipitation and Flooding

Rapid Runoff and Limited Infiltration: The steep terrain of the Ventura River Watershed is characterized by a network of streams that discharge water over short distances at high velocities. In such an environment, stormflows move rapidly, and intense downpours in the upper watershed can result in streamflows that exceed the capacity of their banks. For instance, during the 1992 flood, the Ventura River's flow rate surged from less than 100 cfs to 46,700 cfs within approximately three hours (Walter, 2015 Watershed Management Plan). Additionally, in early January 2023, an atmospheric river delivered approximately 18 inches of precipitation. The intensity of this event corresponded with a 20-year rain event and a 50-year rain event for the lower and upper regions of the watershed, respectively (Walter, 2015 Watershed Management Plan). These events significantly impact local infrastructure that provides alternative sources of water, increasing the risk of stress on groundwater resources.

Ecosystems: Historical Impacts from Extreme Precipitation and Flooding

Climate Patterns and Soil Saturation: Hydrogeologic response in the Ventura River Watershed is highly sensitive to antecedent soil moisture, where peak discharge events are frequently exacerbated by late-season storms falling on pre-saturated catchments. During the 1969 flood event, sustained precipitation throughout January and February reached a critical saturation threshold, resulting in massive overland flow, systemic levee failure, and catastrophic infrastructure compromise across the drainage basin (Ventura County Watershed Protection District [VCWPD] 2022). A similar pattern emerged in 2005, when cumulative seasonal rainfall saturated the upper Matilija Canyon sub-watershed; subsequent high-intensity February cells triggered mass wasting, riparian uprooting, and significant aggradation within the mainstem river channel (The Nature Conservancy [TNC] 2022). Most recently, in January 2024, an atmospheric river following a wet December cycle induced rapid flash flooding and significant planform channel migration within Matilija Canyon and the Ventura River estuary, demonstrating how high antecedent moisture continues to amplify flood magnitude and geomorphic instability (Ventura County Public Works Agency [VCPWA] 2024). **Channel Reset and Vegetation Loss:** During the January 9, 2023 storm, large areas of vegetation along the Ventura River were ripped out. The floodplain reset shifted the primary flow of the river into historic channels within the wide floodplain. Additionally, in 2005 the upper Matilija Creek received 95 inches of rainfall and large areas of riparian vegetation were uprooted or inundated with sediment during this flood season (The Nature Conservancy California, 2022).

Post-Flood Algal Blooms: Large storm events that reset river channels in the Watershed, including those in 2005 and 2011, have been followed by significant algal blooms in the early dry season. These high-flow events strip riparian vegetation, leaving exposed rock and gravel that increase sunlight penetration and create ideal conditions for algal growth. Algae is naturally present in the watershed, but after such events, biomass levels have reached thresholds that depress dissolved oxygen concentrations, negatively impacting aquatic species including the endangered Southern California steelhead (Leydecker et al., 2012). These dynamics contributed to the formal listing of the Ventura River as impaired for algae and eutrophic conditions under Section 303(d) of the Clean Water Act (LARWQCB, 2012).

Water Quality: Historical Impacts from Extreme Precipitation and Flooding

Runoff-Driven Pollution and Impervious Surfaces: Heavy rainfall accelerates erosion and pollutant runoff, and can expose and damage infrastructure (e.g., pipelines, storage tanks) that impacts water quality and aquatic habitats. Flooding events in agricultural areas increase the mobilization of fertilizers, pesticides, and sediment into rivers and wetlands. In addition, scouring of riparian vegetation that offers solar shading and stream temperature modification, heightens risks of algal blooms (i.e., eutrophication) and aquatic habitat degradation in the dry season during low flows. Impervious surfaces such as rooftops, roads, and parking lots in urban environments intensify flood flows by preventing water from

infiltrating the ground or returning to the atmosphere through evapotranspiration. While urbanization is limited in the watershed, impervious areas lead to higher peak streamflows and greater overall runoff volumes. Additionally, these impervious surfaces hinder groundwater recharge. They also collect pollutants and sediments, which can elevate levels of nutrients, bacteria, and other contaminants in nearby streams, rivers, and coastal waters.

2022–2023 Atmospheric River Storm Impacts: From late December 2022 to March 2023, California experienced unprecedented atmospheric river storms, with some areas receiving over 18 inches of rain in 24 hours. The severe weather led to Ventura County, as well as State and Federal governments, declaring states of emergency. Erosion and mudslides made main fire roads impassable, created deep sinkholes, and heavily damaged trails, especially in upper canyons. The intense erosion altered stream habitats and increased sediment loads in waterways. These events highlight the challenges of managing runoff and the need for improved land management and soil conservation practices in the region (Ventura Land Trust, 2023).

Cultural Resources: Historical Impacts from Extreme Precipitation and Flooding

Physical damage: During a flood, archaeological sites can suffer significant physical damage, leading to the destruction of valuable artifacts. Additionally, site erosion caused by overflowing water and the formation of new channels can further compromise the integrity of these sites. Floods can also damage trails, leading to a decline in important vegetation species, landscape features, and cutting off access to and damage of cultural places (Flanigan et al., 2018).

Post-flood natural impacts: After a flood, there is an increased risk of subsidence, which is the gradual sinking or settling of the soil (Flanigan et al., 2018). This can occur due to soil saturation, erosion, and structural damage. Subsidence can cause structural damage to historical structures, alter ethnobiologically significant natural resources, and harm cultural landscapes.

Post-flood human impacts: Post-flood activities, such as cleanup and construction, can significantly damage cultural artifacts. For instance, heavy machinery used during cleanup can inadvertently crush or displace artifacts (Flanigan et al., 2018).

Historical Impacts from Sea Level Rise and Storm Surge on Water Resource Systems

The following sections explore ways sea level rise and storm surge have impacted the watershed's water resource systems.

Water Supply: Historical Impacts from Sea Level Rise and Coastal Flooding

Storm Surge Vulnerabilities to Wastewater Infrastructure: Historical events demonstrate the vulnerabilities of water supply infrastructure to sea level rise and coastal flooding. The large floods of 1969, for example, caused the Santa Clara River to overflow, breaking pipes at the City of Ventura's wastewater treatment plant and causing raw sewage to flow into the ocean for weeks (Jenkin, 2015).

Flood Management: Historical Impacts from Sea Level Rise and Coastal Flooding

Coastal Inundation, Erosion, and Shoreline Retreat: The Ventura River Watershed includes a narrow but highly vulnerable coastal stretch where the river meets the Pacific Ocean. Coastal flooding in this area is exacerbated by sea level rise and backwater effects, particularly during high tides or storm surge. Since the early 20th century, chronic erosion and shoreline retreat have affected public infrastructure, dunes, and estuarine habitat at the river mouth (Walter, 2015 Watershed Management Plan; VCWPD, 2022).

Backwater Effects at the River Mouth: During high-magnitude storm events, elevated sea levels and storm surges can hydraulically obstruct the downstream discharge of the Ventura River, inducing a backwater effect that increases upstream stage heights. This phenomenon, documented during both historical and contemporary flood cycles, places significant hydraulic pressure on flood control infrastructure near the estuary, including the structural integrity of levees and the functional capacity of stormwater outfalls (Ventura County Watershed Protection District [VCWPD] 2022). **Notable Coastal Flooding Events (1982–83, 1997–98, and 2024)**: Several El Niño-linked storms have historically caused major coastal flooding in the Ventura River Watershed and surrounding areas. The 1982–1983 and 1997–1998 El Niño events generated high surf and elevated tides that caused significant erosion along the Ventura Promenade and Surfer's Point, damaging public infrastructure and natural buffers (Walter, 2015 Watershed Management Plan). Most recently, in January 2024, a strong atmospheric river storm system caused widespread flooding in the Ventura River estuary and adjacent neighborhoods. High tides and storm surge combined to damage streets along Pierpont Lane and flood dozens of homes and businesses (Jenkin, 2024; Office of the Governor, 2024).

Flood Management Response: Surfer's Point Retreat: The Surfer's Point Managed Retreat Project, initiated in 2011, was developed in response to repeated storm damage and chronic erosion. The project relocated bike paths and parking inland, rebuilt coastal dunes, and installed a buried cobble berm to buffer wave impacts. It remains a key example of nature-based flood risk reduction for sea level rise–affected areas in the watershed (City of Ventura, n.d.).

Equity Concerns: As noted in the Extreme Precipitation & Flooding section above, flooding events disproportionately affect low-income communities, such as low-income households and unhoused individuals. These communities face systemic barriers and often lack access to the resources to recover quickly, face higher risks of property damage, and experience greater economic strain due to inadequate infrastructure and limited access to emergency services. Increases in coastal flooding would affect communities located near to the coast and rivers (Headwaters Economics, 2023). Specific data on how storm surge has impacted low-income communities in the Ventura River Watershed are not documented.

Groundwater Management: Historical Impacts from Sea Level Rise and Coastal Flooding

Saltwater Intrusion and Groundwater Quality Degradation: Sea-level rise diminishes the freshwater storage capacity of coastal hydrogeologic units by facilitating the landward migration of the freshwater-seawater interface within shallow, unconfined alluvial aquifers. This saline encroachment displaces potable groundwater and elevates the local water table, concurrently degrading water quality through increased chloride concentrations and total dissolved solids. While formal documentation of seawater intrusion is currently absent within the Ventura River Watershed, the hydrogeodynamic mechanism is a well-established vulnerability in analogous California coastal basins and represents an escalating risk to the Lower Ventura River Groundwater Basin (County of Ventura 2019). **Shallow Groundwater Rise and Infrastructure Impacts**: Rising sea levels can also elevate freshwater tables in coastal areas, especially where groundwater is already shallow. In the Ventura River Watershed, parts of the Lower Ventura River Groundwater Basin are near the estuary and ocean, making them susceptible to chronic nuisance flooding as groundwater levels approach or exceed the surface. This can damage infrastructure, compromise septic systems, and reduce available soil storage for stormwater infiltration (VCWPD, 2022).

Future Risks to the Lower Ventura Basin: Although direct impacts from sea level rise have not yet been observed in the Lower Ventura River Groundwater Basin, the basin's proximity to the ocean and its shallow alluvial structure place it at risk of saltwater intrusion and elevated groundwater tables in

coming decades. These changes would reduce usable groundwater storage and require adaptation strategies to protect both water quality and flood resilience (Walter, 2015 Watershed Management Plan; VCOES, 2022).

Ecosystems: Historical Impacts from Sea Level Rise and Coastal Flooding

Tidal Dynamics and Coastal Vulnerability: Although the Ventura River Watershed includes only a small stretch of coastline, it is a coastal watershed that drains directly into the Pacific Ocean. As such, the estuarine environment at the Ventura River's mouth is influenced by tidal dynamics and is vulnerable to sea level rise and coastal flooding.

Salinity Gradient and Habitat Shifts: Salinity concentration affects sediment characteristics and habitat for sensitive species. The biological community within the estuary is structured by the salinity gradient from fresh to seawater. Freshwater species become less abundant with increasing salinity and are gradually replaced by marine species. Estuarine salinity is dynamic and can be significantly influenced by specific events such as intrusions of upwelled ocean water.

Long-Term Ecological Function Threats: Over time, sea level rise and coastal flooding can compromise local ecosystem resilience and challenge their ecological functions, such as providing nursery habitat for fish, buffering floods, and filtering water.

Water Quality: Historical Impacts from Sea Level Rise and Coastal Flooding

Saltwater Intrusion and Groundwater Quality Degradation: As mentioned in the previous groundwater management section, sea level rise reduces the freshwater storage capacity of coastal groundwater basins by allowing denser seawater to intrude into shallow, unconfined aquifers. This process displaces stored freshwater and elevates the water table while degrading water quality due to increased salinity. Though saltwater intrusion has not been formally documented in the Ventura River Watershed, the mechanism has been well established in coastal California basins and presents a growing threat to low-lying groundwater basins near the coast, including the Lower Ventura River Groundwater Basin (Walter, 2015 Watershed Management Plan; VCWPD, 2022).

Future Preparedness and Management Priorities: While sea level rise and saltwater intrusion have not yet had a direct impact on the Ventura River Watershed's groundwater basins, local agencies are prioritizing efforts to prepare for and prevent these potential issues in the future.

Cultural Resources: Historical Impacts from Sea Level Rise and Coastal Flooding

Archaeological Sites: While no specific archaeological sites in the Ventura River Watershed are documented to have been damaged by sea level rise, the estuary and adjacent coastal areas are known to contain cultural resources that are vulnerable to coastal erosion and inundation. Sea-level rise can submerge low-lying coastal sites and accelerate erosion during storm events, potentially washing away or degrading artifacts and site integrity (NPS, 2016;).

Cultural Activities: Marine-driven inundation and chronic shoreline recession present significant risks to the continuity of Indigenous and traditional practices, including subsistence harvesting of marine resources, shellfish gathering, and ceremonial activities performed within the river estuary and littoral zones. While a systematic database of these cultural disruptions for the Ventura River Watershed is currently absent, historical data from high-magnitude El Niño Southern Oscillation (ENSO) events, specifically the 1982–1983 and 1997–1998 cycles, demonstrate that extreme wave run-up and storm surges physically obstruct coastal access and degrade the integrity of shoreline sites used for cultural heritage (County of Ventura 2019).

Ethnobiologically Significant Natural Resources: The Ventura River Estuary and surrounding dunes support a range of native plant species used for food, medicine, and ceremony by Indigenous communities. While there are no documented losses tied directly to sea level rise, progressive inundation, saltwater intrusion, and shoreline erosion threaten these habitats. Continued loss of estuarine and riparian vegetation due to climate-driven changes may reduce the availability of culturally important plant species over time (NPS, 2016; VCOES, 2022).

Historical Impacts from Marine Fog on Water Resource Systems

Unlike other climate hazards such as drought, extreme heat, and flooding, marine fog does not typically manifest as discrete, event-based occurrences. Instead, fog is a recurring seasonal phenomenon, consistently influencing coastal climate conditions within the Ventura River Watershed each year. Due to its regular, cyclical nature and the lack of distinct historical episodes, no individual historical events have been identified or included in this section. However, observed long-term trends indicate a general decline in fog prevalence over recent decades (Williams et al. 2015a), underscoring the significance of fog decline as an ongoing climatic influence rather than an episodic hazard.

The following sections explore ways sea level rise and storm surge have impacted the watershed's water resource systems.

Water Supply: Historical Impacts from Marine Fog

Temperature Regulation and Ecological Moisture: Marine fog plays an important role in regulating coastal temperature and evaporative demand in the region, as well as providing water resources for ecological function.

Declining Fog Frequency and Supply Reliability: While direct impacts of marine fog on local water supply in the watershed are not well quantified, long-term trends which indicate a general decline in fog prevalence over recent decades may impact water supply reliability.

Flood Management: Historical Impacts from Marine Fog

Atmospheric Stabilization and Soil Moisture Retention: Low-level stratocumulus clouds and advection fog play a critical role in the hydroclimatology of the Ventura River Watershed by modulating energy flux and maintaining antecedent soil moisture. The persistence of the marine boundary layer stabilizes the lower troposphere, which inhibits the convective instability required for high-intensity, localized storm development and subsequent flash flooding (California Department of Water Resources [DWR] 2013). By attenuating solar radiation and suppressing surface temperatures, marine fog significantly reduces potential evapotranspiration, thereby mitigating the soil desiccation that often leads to increased runoff coefficients during precipitation events. This maritime influence historically facilitates greater infiltration capacity and moderates peak discharge rates by maintaining a more consistent hydrologic state within the watershed's coastal and transitional zones (Western Regional Climate Center [WRCC] 2016).
Precipitation Variability: Should marine fog frequency and duration decline, the loss of atmospheric stability could lead to greater variability in storm behavior, including the potential for more intense, localized rainfall events when conditions are favorable.

Reduced Infiltration: Declining marine fog presence could also contribute to drier soil prior to storms, reducing infiltration capacity and increasing surface runoff, thereby heightening flash flood potential (Walter, 2015 Watershed Management Plan).

Groundwater Management: Historical Impacts from Marine Fog

Declining Fog Cover and Evaporative Stress: Long-term observations suggest that marine fog has decreased along the southern California coastline over recent decades (Williams et al., 2015). The reduction in fog cover can lead to increased evaporative stress, irrigation demands, risk of drought stress for vegetation, and intensity of heat extremes, especially in the low-lying coastal areas of the watershed (Torregrosa et al., 2014).

Ecosystems: Historical Impacts from Marine Fog

Fog Decline Trends and Habitat Vulnerability: Decreasing marine fog could cause significant changes to terrestrial, riparian, and intertidal habitats. In the Ventura River Watershed, species at the drier edge of their climatic envelopes, including those which characterize endemic coastal forests, would be especially vulnerable to a reduction in marine fog. In 2010, researchers revealed that summertime fog hours had declined by 33 percent over the last century along the California coast (Johnstone and Dawson, 2010).

Research Initiatives and Data Gaps: The U.S. Geological Survey has facilitated an interdisciplinary community of researchers and resource managers now known as the Pacific Coastal Fog Project to respond to questions regarding fog and how it affects coastal resources. Currently, no specific historical data has been analyzed regarding marine fog and its historical impacts on the Ventura River Watershed, including impacts specific to ecosystems.

Water Quality: Historical Impacts from Marine Fog

Fog Decline and Groundwater Reliance: Long-term observations suggest that marine fog has decreased along the southern California coastline over recent decades (Williams et al., 2015a). The reduction in marine fog may increase reliance on groundwater and can lead to over-extraction, potentially resulting in a drop in water tables and less natural filtration of contaminants. This can result in higher concentrations of pollutants in the remaining groundwater.

Irrigation Runoff and Water-Quality Degradation: Additionally, increased irrigation demands due to decreased marine fog can lead to more runoff, carrying fertilizers, pesticides, and other pollutants into local waterways, further degrading water quality. While the reviewed literature does not document the direct impact of reduced marine fog on the Ventura River Watershed's groundwater basins, ongoing fog reduction could increase local communities' and vegetation's reliance on groundwater. This heightened dependence may result in greater stress and overuse of groundwater sources.

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Appendix N

Historical Water Budget

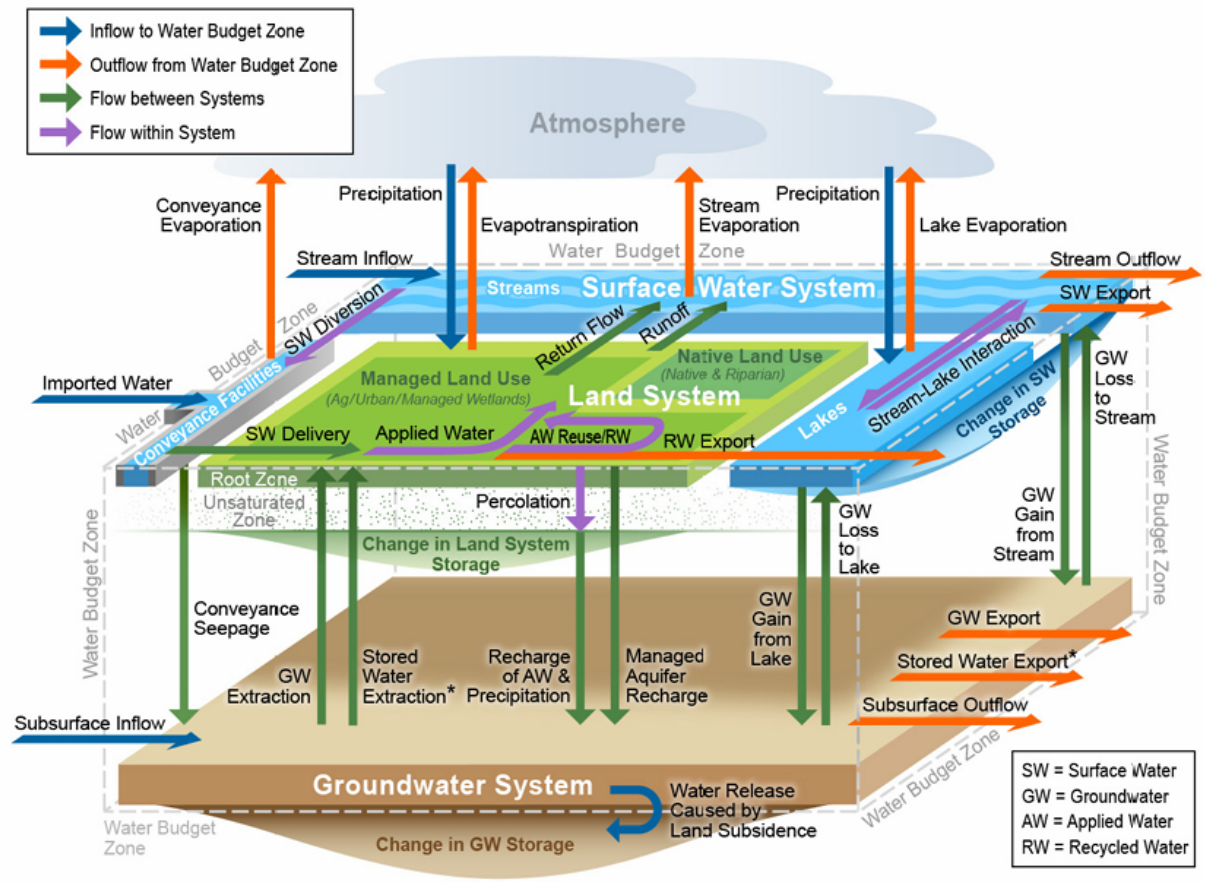
Historical Water Budget

A water budget is a quantitative accounting of water inflows, outflows, and changes in storage within a defined area over a specified period. They are used to evaluate how water moves through a system and to assess temporal changes in water availability. Water budgets illustrate hydrologic conditions and demonstrate how changes in water supply, demand, management actions, and climatic conditions can affect water resources. Water budgets can be used to support water supply planning, resource management, and evaluation of water management strategies.

Purpose

The purpose of the historical water budget presented in this chapter is to provide context for the climate vulnerability and risk assessments. The water budget serves as a baseline for understanding historical water use within the watershed as a whole, and sheds light on existing challenges that may be exacerbated by climate change. An example water budget graphic depicting various water inflows, outflows, and changes in storage is shown in Figure 1.

Figure 1 Example Water Budget Graphic



Source: DWR 2020

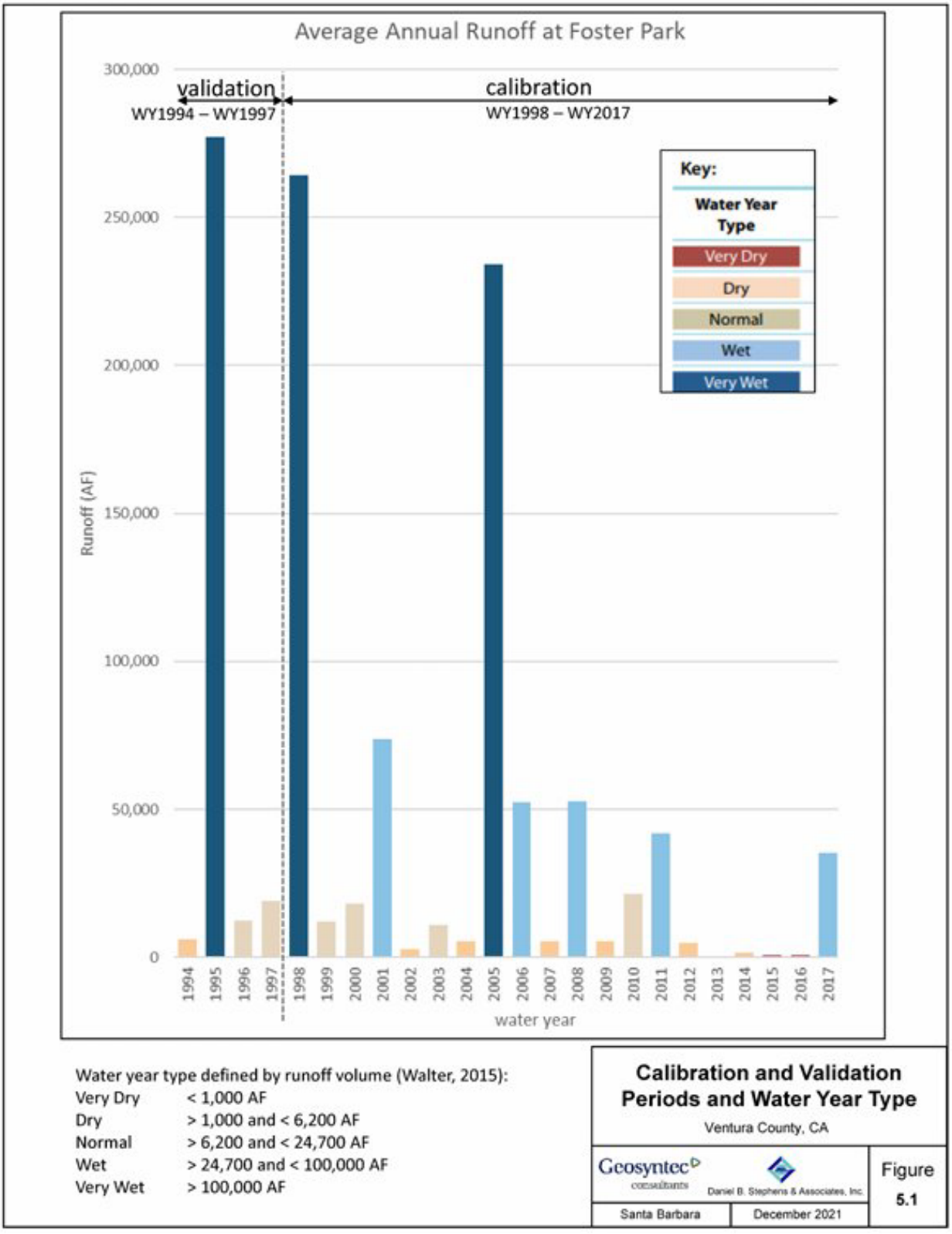
Approach

The DWR water budget handbook was utilized to define the components of each of four water budget systems: land, surface water, groundwater, and total water system budgets. The land, surface water, and total water system budgets comprise information across the entire Ventura Watershed. The groundwater budget is presented in greater detail, describing the four groundwater basins (see Chapter 3: State of the Watershed) within the watershed and the overall groundwater conditions across the watershed.

After consideration of recent, relevant groundwater and surface water models developed for the watershed, the Ventura River Watershed Groundwater-Surface Water (VRW GW-SW) Model's base case scenario results, developed by the California State Water Resources Control Board (State Water Board) in coordination with CDFW, were selected and utilized as the foundational data source for the historical water budget. The model was built using the U.S. Geological Survey (USGS) Groundwater and Surface-water Flow (GSFLOW) modeling code and has a 4-year validation period for water years between 1994 and 1997 and a 20-year calibration period spanning water years 1998 to 2017 (State Water Board 2024).

The model selection was based on the integrated nature of the VRW GW-SW's modeling code and the spatial extent of the model domain. GSFLOW is a fully-integrated groundwater-surface water numerical model, utilizing two USGS modeling codes: the Precipitation-Runoff Modeling System (PRMS) and the Modular Finite-Difference Ground-water Flow (MODFLOW) model. The VRW GW-SW Model domain is the entire Ventura River Watershed and includes the four groundwater basins that are located within the watershed extent. As shown in Figure 2, the simulation period (1994 to 2017) encompasses a wide range of hydrological conditions, or water year types, including three very wet years (1995, 1998, and 2005) and three very dry years (2013, 2015, and 2016) that occurred during the 2012-2016 drought (State Water Board 2024, Walter 2015).

Figure 2 Calibration and Validation Periods and Water Year Type



Source: State Water Board 2024

Limitations

Models are simplified representations of reality, not reality itself. The building of a model requires making assumptions and simplifications. Questions remain across resource managers within the watershed about the validity of underlying assumptions built into the VRW GW-SW Model, including those pertaining to the rate of groundwater pumping assumed to meet water demands relative to surface water deliveries. Concerns related to the characterization of the groundwater extraction water budget component were communicated and noted during development of the historical water budget. Groundwater budgets were produced for each of the four groundwater subbasins, thus allowing for presentation of data provided by interested parties for comparison with VRW GW-SW results.

The accuracy of most water budget components corresponds to the accuracy of the underlying GSFLOW model variables, either individually or in combination. While the linked nature of GSFLOW resolves several limitations of groundwater- and surface water-only models, the State Water Board's *Model Documentation Report for the Groundwater-Surface Water Model for the Ventura River Watershed* (2024) lists the limitations of the VRW GW-SW Model. Limitations include both spatial (variables averaged over the model domain's 330-foot-square grid) and temporal limitations (discretization into monthly stress periods within specific model processes). Additionally, in the calibration process, greater emphasis was placed on matching observed low-flow conditions; higher flow/runoff periods were more difficult to match without degrading low-flow performance (State Water Board 2024).

Data Sources

In addition to the base case scenario results from the VRW GW-SW Model utilized for the historical water budget analysis, entities within the watershed supplied detailed water budget information for systems under their jurisdiction. Groundwater extraction data provided by water management entities were compared with corresponding water budget components from the VRW GW-SW Model by groundwater basin. The data ascertained through review of publicly available information and through requests made to agencies within the Ventura River Watershed are shown in Table 1. The period of data considered was restricted to the period of simulation utilized by the VRW GW-SW model, for consistency. Data used in the water budgets were converted to annual volumes, expressed in acre-feet.

Table 1 Historical Water Budget Data

Data Providing Entity	Period of Data Available	Reference
VRW GW-SW Model – Base Case Scenario	1994-2017	State Water Board 2024
Upper Ventura River Groundwater Agency (UVRGA)	2005-2025	UVRGA 2022
Ojai Basin Groundwater Management Agency (OBGMA)	1985-2017	OBGMA 2017
City of Ventura – Ventura Water	2010-2025	Spreadsheet Data
Ventura River Water District (VRWD)	1994-2025	Spreadsheet Data
Miners Oaks Water District (MOWD)	2005-2025	Spreadsheet Data

According to GSP documentation, the two GSAs in the Ventura River Watershed obtained data from their constituents. The Ojai Basin Groundwater Management Agency (OBGMA) represents the City of Ojai, Casitas Municipal Water District, Ojai Water Conservation District, Senior Canyon Mutual Water Company, Siete Robles Mutual Water Company, and Hermitage Mutual Water Company. The Upper Ventura River Groundwater Agency (UVRGA) member agencies are the Ventura River Water District, Miners Oaks Water District, City of Ventura – Ventura Water, Casitas Municipal Water District, and the County of Ventura. Therefore, although data was also provided by the City of Ventura, the Ventura River

Water District, and the Miners Oak Water District, it is assumed that each entity's groundwater extraction data has been incorporated accurately into each of the GSPs. Therefore, the GSP data was utilized for the purposes of individual groundwater basin characterization.

Water Budget Components

As defined by DWR's Water Budget Handbook, data sources for the land, surface, groundwater, and total water budget components are identified in Tables 2 through 5 (DWR 2024). Unless otherwise noted as exceptions (see notes for Segment768 and OWTS flows) in Tables 2 through 5 in Section 1.3 Results, the sources listed below are original GSFLOW output variables from the Ventura River Watershed GW-SW model. Definitions for variables identified in this section can be found in Section 1.4.

Several water budget components were deemed not applicable or were not used in this analysis to ensure consistency with model capabilities and to avoid double counting of flows. Components labeled 'N/A' represent processes that are either negligible within the Ventura River Watershed or cannot be explicitly represented within the GSFLOW modeling framework, such as stored water extraction and recycled water export. In contrast, components identified as not used, specifically those categorized as Within System in the DWR Water Budget Handbook, were intentionally excluded because they represent internal transfers rather than true gains or losses to the system. Including these components would result in double counting of water that is already captured through other inflow or outflow terms, such as recharge, evapotranspiration, or return flows. This approach ensures that the resulting water budget accurately reflects net system inflows, outflows, and changes in storage.

Outflow to ocean is quantified at the furthest downstream GSFLOW surface water location on the Ventura River. The quantity is utilized in two of the watershed-wide water budgets (total and surface water) and presented in each of the respective figures for these water budgets' respective figures, Figure 3 and Figure 5. In the total watershed water budget, the outflow term is Stream Outflow. In the surface water system water budget, the outflow term is Surface Water Outflow to Ocean.

Results

Primary characteristics and challenges for the Ventura River Watershed are illuminated by the water budget analysis. Precipitation is the sole source of inflow water in the watershed. Water storage opportunities are restricted by geology (small, shallow aquifers) and topography (limiting surface water body size), resulting in limited groundwater and surface water storage within the watershed. The steep terrain and geologic features of the Ventura River Watershed yield conditions where aquifers within the watershed rapidly recharge and rapidly drain. This creates challenges for the sustained use of groundwater storage areas. Lake Casitas serves as the watershed's primary water storage reservoir.

Water budget closure (the relative balance of water budget inputs and outputs) was evaluated by calculating the annual volume of unaccounted water in each system's budget and determining the percentage difference (i.e., error divided by the average of total inflows and outflows for each year) for each of the watershed-wide water budgets. The percentage difference did not exceed six percent in any water budget for any given year in the **watershed-wide** water budgets. This calculation assessed internal consistency of VRW GW-SW Model results. However, there is error associated with each GSFLOW component due to assumptions and limitations of the model. Different storage terms are quantified directly by GSFLOW; these are presented within the watershed-wide water budget figures alongside the other GSFLOW water budget variables. The error term is not graphed with the respective watershed-wide water budget figures. Instead, it is presented tabularly in Attachment A.

For the **individual groundwater basin** water budgets, the storage and error term is represented as a combined term. This is due to a difference in method; Zonebudget variables were utilized to characterize water budget components for the individual groundwater basins. Zonebudget is a USGS MODFLOW post-processing program external to GSFLOW.

Total Watershed

Total watershed water budget components are documented in Table 2. Figure 3 provides the annual water budget volumes for the Ventura River Watershed inflow and outflow components across the period of analysis, 1994-2017. The dominant components of the total system water budget, which describes the water budget at a watershed scale, are: 1) precipitation, the primary inflow; 2) evapotranspiration, the main outflow; and 3) stream outflow to the ocean, a secondary but significant outflow. Water storage increases during wet years (e.g., 1995, 1998, 2005) and decreases during dry periods, particularly during the 2012–2016 drought.

Exports from the Ventura River watershed include potable water supplied by the City of Ventura to Midtown and Eastside service areas located outside the watershed boundary, treated wastewater discharges to the Santa Clara River watershed, and water delivered by the Casitas Municipal Water District to customers within the Rincon Creek and adjacent coastal watersheds. The quantities and sources (surface water, groundwater, stored, or recycled) of these exports were not modeled within the VRW GW-SW Model. They are assumed to be negligible for this analysis.

Table 2 Total Water Budget Components

Flow Type	Water Budget Component	GSFLOW Output Variable(s)
Inflow	Precipitation on Land System	Precip_Q - LakePrecip_Q
Inflow	Precipitation on Lakes	LakePrecip_Q
Inflow	Stream Inflow	N/A
Inflow	Imported Water	N/A
Inflow	Subsurface Inflow	GHB_In (LIST_File)
Inflow	Water Release from Land Subsidence	N/A
Outflow	Evapotranspiration	CanopyEvap_Q + SnowEvap_Q + ImpervEvap_Q + DprstEvap_Q + CapET_Q + SwaleEvap_Q + UnsatET_Q
Outflow	Stream Evaporation	N/A
Outflow	Lake Evaporation	LakeEvap_Q
Outflow	Conveyance Evaporation	N/A
Outflow	Riparian Evapotranspiration	SatET_Q
Outflow	Stream Outflow	Segment768_Q[1]
Outflow	Subsurface Outflow	NetBoundaryFlow2Sat_Q
Outflow	Subsurface Outflow to Ocean	CHD_Out (LIST_File)
Outflow	Surface Water Export	N/A
Outflow	Groundwater Export	N/A
Outflow	Stored Water Export	N/A
Outflow	Recycled Water Export	N/A
	Change in Storage	Cap_S + Grav_S + Dprst_S + SnowPweqv_S + Canopy_S + Imperv_S + Unsat_S + Lake_S + Sat_S

Note:

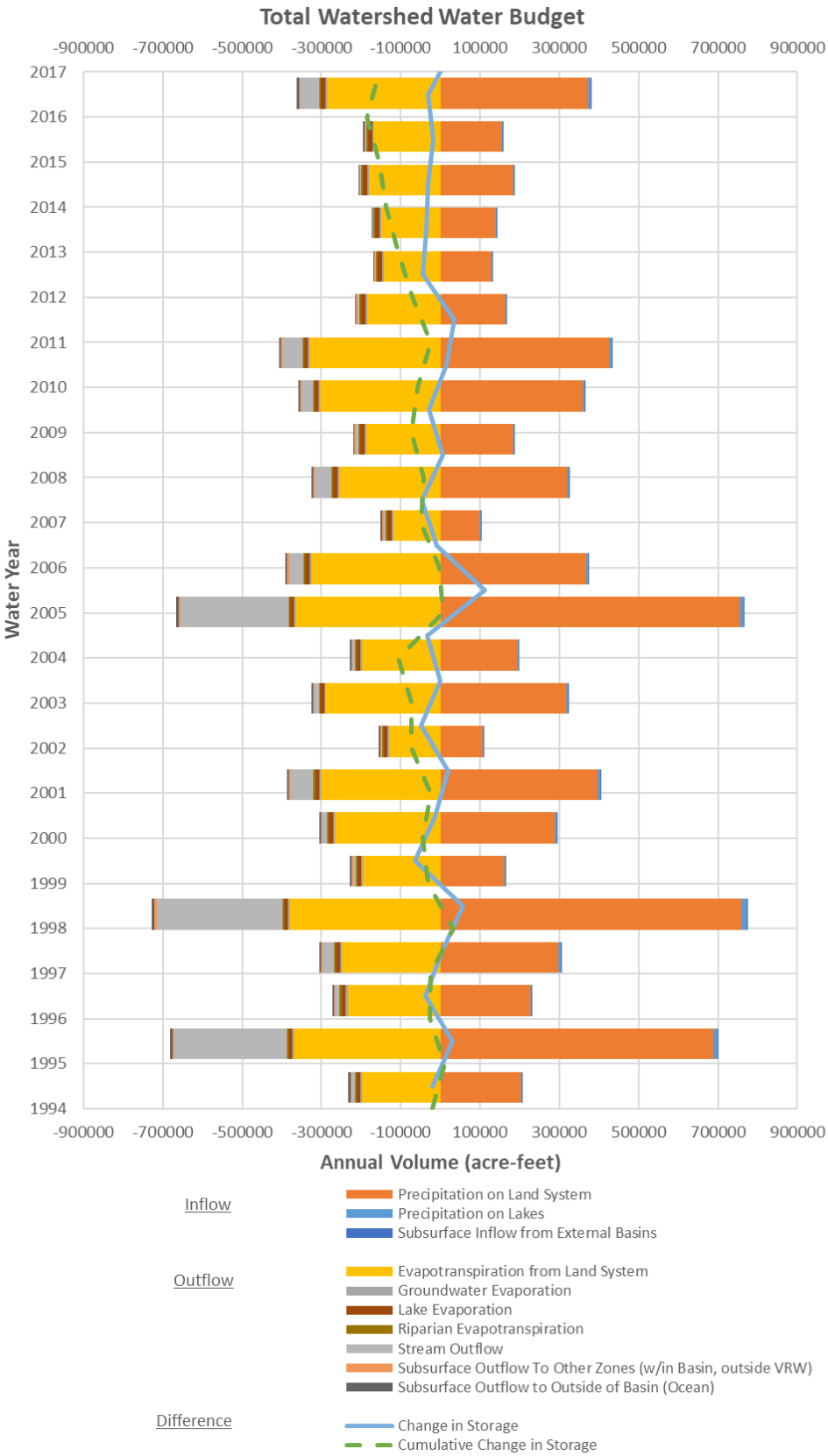
1. Segment768_Q from GSFLOW model re-run to capture surface runoff to ocean.

Key:

N/A = Not applicable: Water budget components are not included because their flows are either negligible in the Ventura River Watershed or cannot be represented in GSFLOW.

Not used: The Water Budget Components defined in the DWR Water Budget Handbook as “Within System” are not applied (i.e. “not used”), as use would lead to double-counting of flows within the water budget.

Figure 3 Ventura River Watershed, Total Watershed Water Budget



Land System

Land system watershed water budget components are documented in Table 3. The annual water budget volumes for Ventura River Watershed's land system inflow and outflow components for the period of analysis are provided in Figure 4. Precipitation is the primary inflow to the land system and surface water deliveries and groundwater extraction contribute smaller though roughly comparable amounts from year to year. Among outflow components, evapotranspiration is consistently the largest, whereas the magnitude of runoff varies depending on the water year type, contributing significantly during wetter years. Recharge occurs throughout the analysis period, with higher volumes in wet years and lower volumes in dry years. Applied water (irrigation) is an outflow from the land system and an inflow into the groundwater system. Onsite wastewater treatment system (OWTS) water is the only source of managed aquifer recharge in the watershed. Storage in the land system (i.e. in vegetation and the unsaturated soil zone) is negligible.

Table 3 Land Water Budget Components

Flow Type	Water Budget Component	GSFLOW Output Variable(s)
Inflow	Precipitation on Land System	Precip_Q – LakePrecip_Q
Inflow	Surface Water Delivery	StreamOut_Q – Segment768_Q[1]
Inflow	Groundwater Extraction	NetWellFlow_Q
Inflow	Stored Water Extraction	N/A
Within System	Applied Water	Not used
Outflow	Evapotranspiration	CanopyEvap_Q + SnowEvap_Q + ImpervEvap_Q + DprstEvap_Q + CapET_Q + SwaleEvap_Q + UnsatET_Q
Outflow	Runoff	HortSroff2Stream_Q + HortSroff2Lake_Q + DunnSroff2Stream_Q + DunnInterflow2Lake_Q + Interflow2Stream_Q
Outflow	Return Flow	BoundaryStreamFlow_Q (Inflow to Streams (WWTP))
Outflow	Recharge of Applied Water and Precipitation	RechargeUnsat2Sat_Q
Outflow	Managed Aquifer Recharge	*Calculated OWTS Recharge*[2]
Outflow	Recycled Water Export	N/A
	Change in Storage	Cap_S + Grav_S + Dprst_S + SnowPweqv_S + Canopy_S + Imperv_S + Unsat_S

Notes:

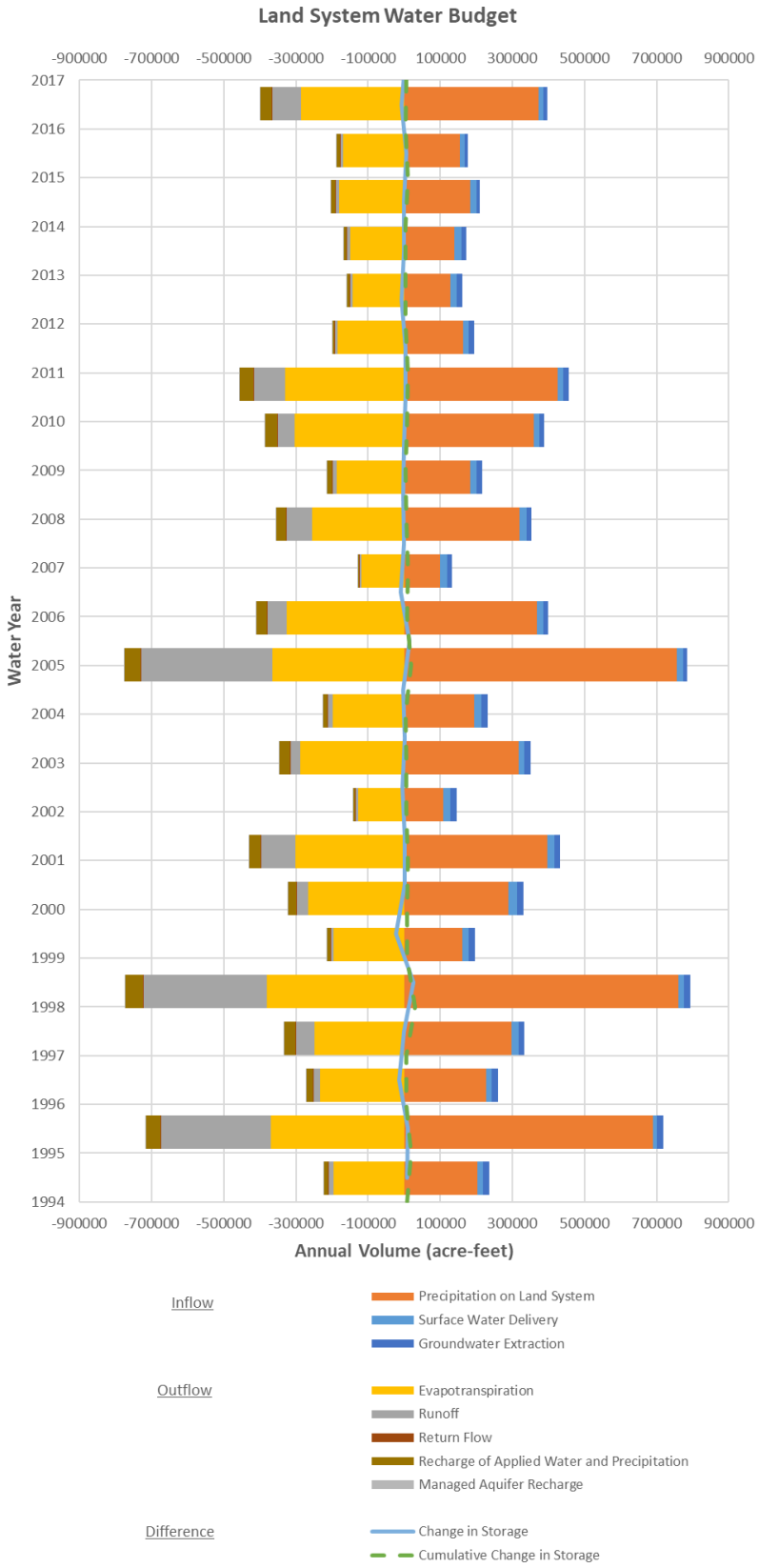
1. Segment768_Q from GSFLOW model re-run to capture surface runoff to ocean.
2. Onsite Wastewater Treatment System (OWTS) flow reflected as MAR quantity. Calculation from VRW GW-SW Model post-processed GSFLOW output files.

Key:

N/A = Not applicable: Water budget components are not included because their flows are either negligible in the Ventura River Watershed or cannot be represented in GSFLOW.

Not used: The Water Budget Components defined in the DWR Water Budget Handbook as "Within System" are not applied (i.e. "not used"), as use would lead to double-counting of flows within the water budget.

Figure 4 Ventura River Watershed Land System Water Budget



Surface Water System

Surface water system watershed water budget components are documented in Table 4. Figure 5 provides the annual surface water system budget volumes for Ventura River Watershed with all inflow and outflow components across the period of analysis. During wet years, precipitation and surface water outflow to the ocean dominate inflow and outflow components, respectively. However, the exchange of water between streams and groundwater is prominent across all water year types. Surface water deliveries vary annually, depending on water-year conditions. Water stored in surface reservoirs during wet years is lower during drier periods.

Table 4 Surface Water Budget Components

Flow Type	Water Budget Component	GSFLOW Output Variable(s)
Inflow	Stream Inflow	N/A
Inflow	Imported Water	N/A
Inflow	Precipitation on Lakes	LakePrecip_Q
Inflow	Runoff	HortSroff2Stream_Q + HortSroff2Lake_Q + DunnSroff2Stream_Q + DunnInterflow2Lake_Q + Interflow2Stream_Q
Inflow	Return Flow	BoundaryStreamFlow_Q (Inflow to Streams (WWTP))
Inflow	Stream Gain from Groundwater	GW_To_SFR (LIST_File)
Inflow	Lake Gain from Groundwater	GW_To_LAK (LIST_File)
Outflow	Surface Water Outflow to Ocean[1]	Segment768_Q[1]
Outflow	Surface Water Exports	N/A
Within System	Surface-Water Diversions	Not used
Within System	Surface-Water Diversion (Robles)	Not used
Outflow	Conveyance Evaporation	N/A
Outflow	Surface Water Delivery	StreamOut_Q – Segment768_Q[1]
Outflow	Stream Loss to Groundwater	SFR_To_GW (LIST_File)
Outflow	Lake Loss to Groundwater	LAK_To_GW (LIST_File)
Outflow	Lake Evaporation	LakeEvap_Q
Outflow	Stream Evaporation	N/A
	Change in Storage	Lake_S

Note:

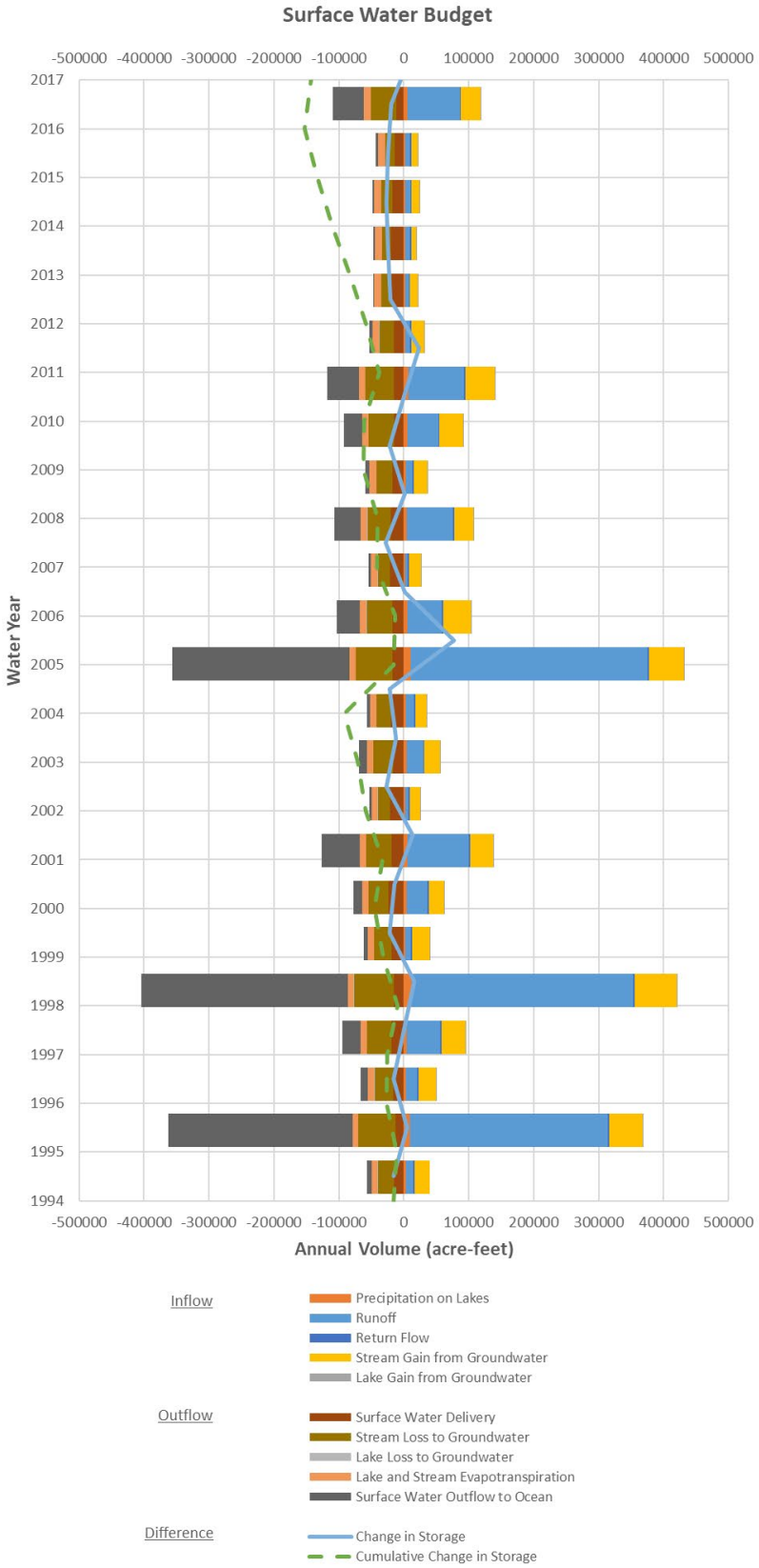
1. Segment768_Q from GSFLOW model re-run to capture surface runoff to ocean.

Key:

N/A = Not applicable: Water budget components are not included because their flows are either negligible in the Ventura River Watershed or cannot be represented in GSFLOW.

Not used: The Water Budget Components defined in the DWR Water Budget Handbook as “Within System” are not applied (i.e. “not used”), as use would lead to double-counting of flows within the water budget.

Figure 5 Ventura River Watershed Surface Water System Water Budget



Groundwater System

Results of the groundwater system historical water budget analysis are presented for the Ventura River Watershed, as well as for the individual groundwater basins within the watershed.

Watershed-Wide Groundwater Budget

Groundwater system water budget components are documented in Table 5 for the watershed wide water budget. Figure 6 provides results of the Ventura River Watershed groundwater system water budget for the period of analysis. The interconnection between groundwater and surface water for the Ventura River and its tributaries is illustrated by the water budget inflow component "groundwater gains from stream" and outflow component "groundwater loss to stream and surface". This exchange is amplified during wet years, and the contribution of recharge varies from year-to-year, with significant recharge corresponding to storage increases in wet years. The quantity of groundwater extraction varies over the analyzed period, though reductions resulting from conservation efforts are evident during the 2012-2016 drought.

Table 5 Groundwater Budget Components

Flow Type	Water Budget Component	GSFLOW Output Variable(s)
Inflow	Recharge of Applied Water and Precipitation	RechargeUnsat2Sat_Q
Inflow	Managed Aquifer Recharge	*Calculated OWTS Recharge*[1]
Inflow	Groundwater Gain from Stream	SFR_To_GW (LIST_File)
Inflow	Groundwater Gain from Lake	LAK_To_GW (LIST_File)
Inflow	Conveyance Seepage	N/A
Inflow	Subsurface Inflow	GHB_In (LIST_File)
Inflow	Water Release from Land Subsidence	N/A
Outflow	Groundwater Extraction	NetWellFlow_Q
Outflow	Stored Water Extraction	N/A
Outflow	Riparian Evapotranspiration	SatET_Q
Outflow	Groundwater Loss to Stream	GW_To_SFR (LIST_File)
Outflow	Groundwater Loss to Lake	GW_To_LAK (LIST_File)
Outflow	Subsurface Outflow[1]	NetBoundaryFlow2Sat_Q
Outflow	Subsurface Outflow to Ocean	CHD_Out (LIST_File)
Outflow	Groundwater Export	N/A
Outflow	Stored Water Export	N/A
	Change in Storage	Sat_S

Note:

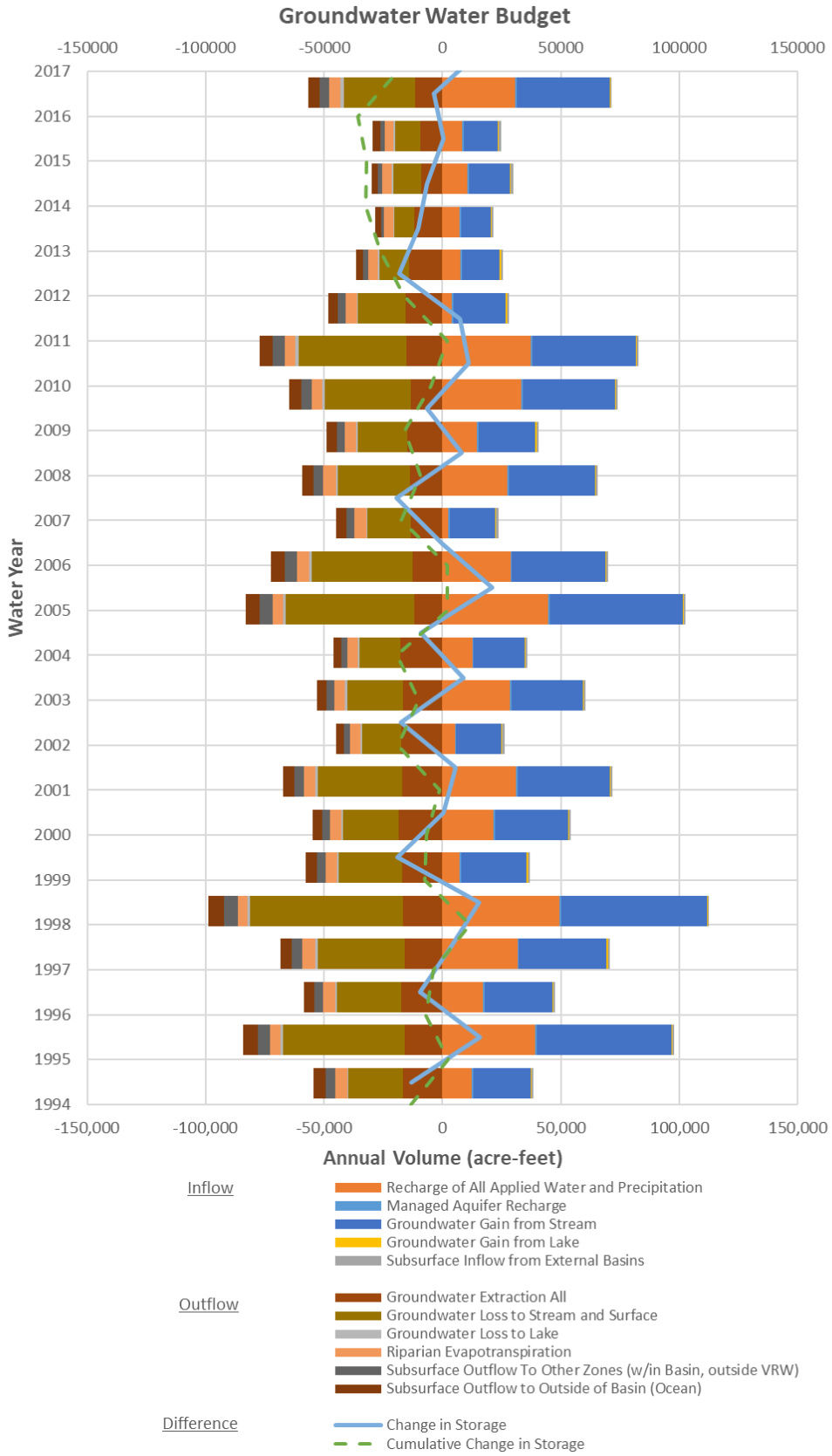
1. Onsite Wastewater Treatment System (OWTS) flow reflected as MAR quantity. Calculation from VRW GW-SW Model post-processed GSFLOW output files.

Key:

N/A = Not applicable: Water budget components are not included because their flows are either negligible in the Ventura River Watershed or cannot be represented in GSFLOW.

Not used: The Water Budget Components defined in the DWR Water Budget Handbook as "Within System" are not applied (i.e. "not used"), as use would lead to double-counting of flows within the water budget.

Figure 6 Ventura River Watershed Groundwater System Water Budget



Individual Groundwater Basins Water Budgets

The following discussion focuses on the primary water budget components for the groundwater basins. Ventura River Watershed GW-SW Model groundwater extraction quantities are compared with those provided by individual water districts where available. Zonebudget GSFLOW Variables are used to define the groundwater water budget components, defined in Table 6.

Table 6 Component Definition for Basin Groundwater Budgets

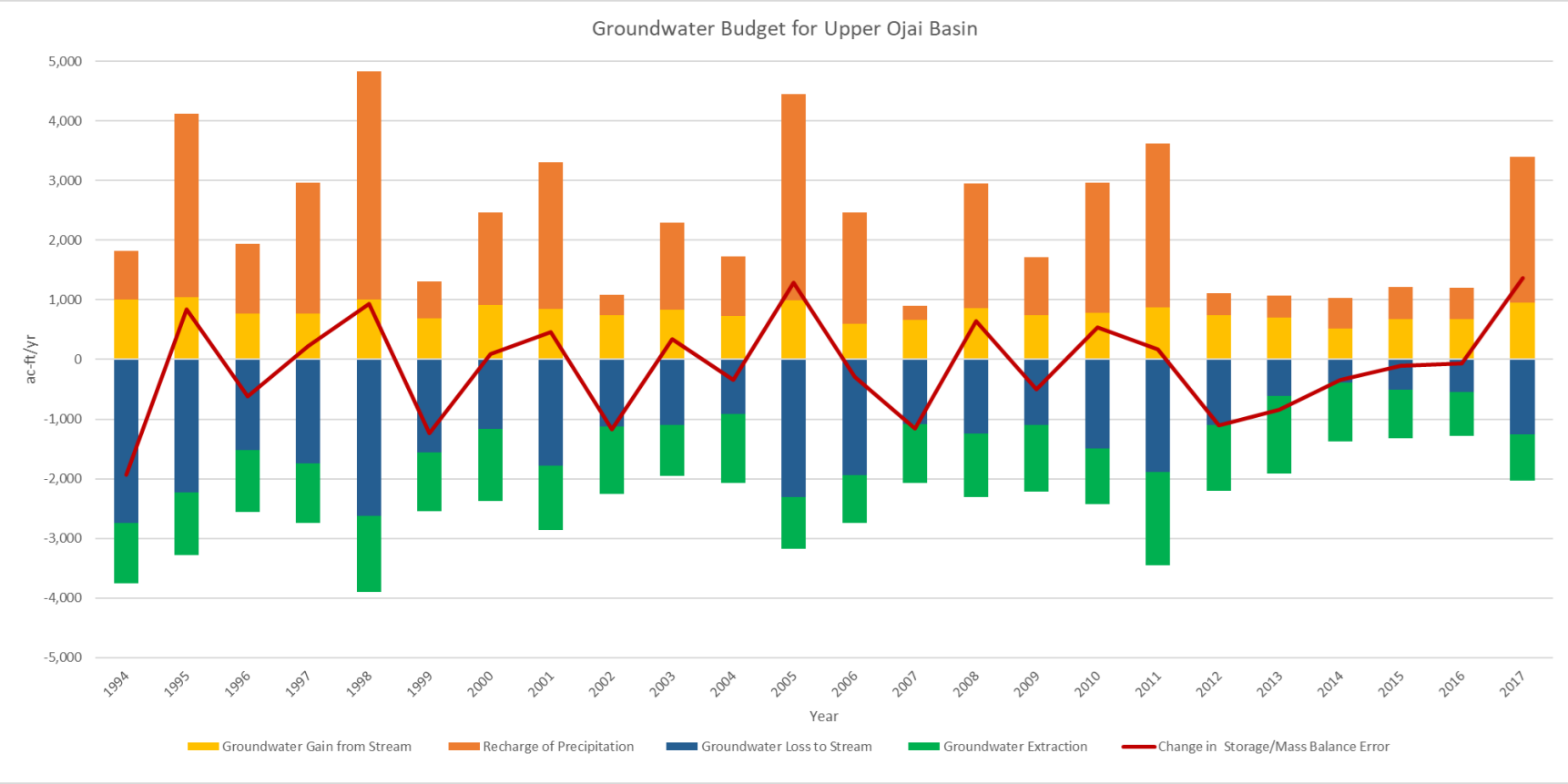
Flow Type	Component	GSFLOW Zonebudget Variables
Inflow	Recharge of Precipitation	Recharge From Soil – GW ET – Surface Leakage
Inflow	Groundwater Gain from Stream	SFR to GW
Inflow	Groundwater Gain from Lake	Lake to GW
Outflow	Groundwater Extraction	Pumping
Outflow	Groundwater Loss to Stream	GW to SFR
Outflow	Groundwater Loss to Lake	GW to Lake
	Change in Storage/Mass Balance Error	Sum of Inflow and Outflow Components

Key:
SFR= Streamflow Routing
GW = Groundwater
ET = Evapotranspiration

Upper Ojai Groundwater Basin

The annual water budget volumes for the Upper Ojai Groundwater Basin inflow and outflow components for the period 1994-2017 are provided in Figure 7. Recharge from precipitation and groundwater gains from streams are the most significant inflows to the Upper Ojai Groundwater Basin. Recharge occurs primarily through precipitation and overland runoff. The interconnection between groundwater and surface water is evidenced by the exchange between surface water and groundwater. Groundwater extraction varies by water year type; conservation (i.e., less groundwater pumping) is evident during drier years. Groundwater storage fluctuates annually and in wetter years there is generally recharge in of the aquifer and in drier years there is depletion of the aquifer.

Figure 7 Groundwater Budget for Upper Ojai Groundwater Basin



Note: Recharge from precipitation and groundwater gains from streams are the most significant inflows to the Upper Ojai Groundwater Basin. Recharge occurs primarily through precipitation and overland runoff. The interconnection between groundwater and surface water is evidenced by the exchange between surface water and groundwater. Groundwater extraction varies by water year type; conservation (i.e., less groundwater pumping) is evident during drier years. Groundwater storage fluctuates annually and in wetter years there is generally recharge in of the aquifer and in drier years there is depletion of the aquifer.

Ojai Valley Groundwater Basin

Figure 8 provides results of the groundwater budget for the Ojai Valley Groundwater Basin for period 1994-2017. Inflows to the Ojai Valley Groundwater Basin are primarily recharge from local precipitation and intermittent streamflow (groundwater gain from stream) from San Antonio Creek. Most outflow is from groundwater pumping, with a smaller percentage from groundwater discharge to streams. In drought years, the groundwater extraction greatly exceeds groundwater recharge. For example, from 2012 to 2016, there were approximately 21,400 acre-ft of extraction and only 5,500 acre-ft of recharge from precipitation. Result in a net deficit of 15,900 acre-ft.

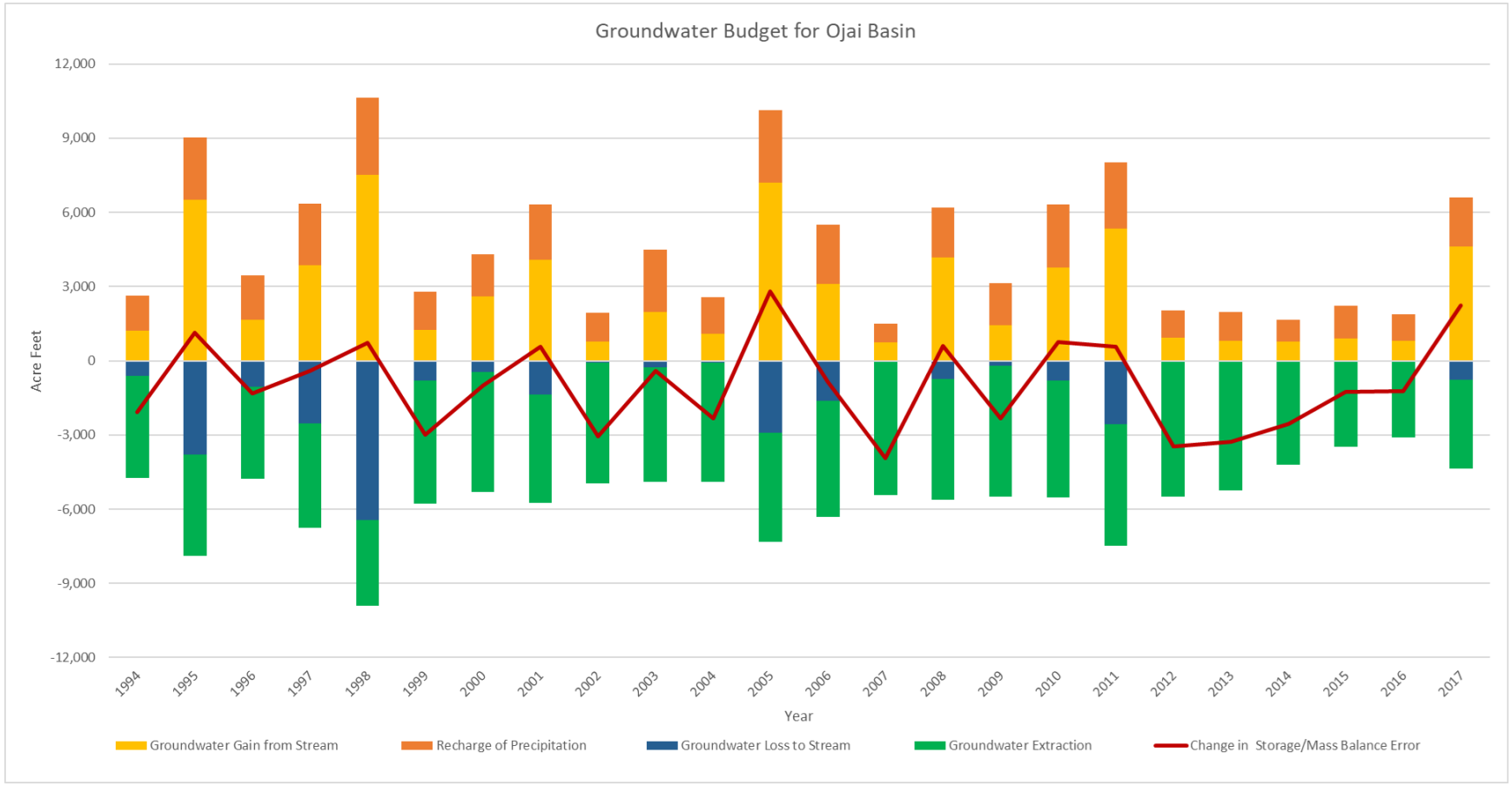
Table 7 presents the annual groundwater extraction data from the VWR GW-SW Model that was used in the historical water budget analysis compared to estimated annual groundwater extraction data provided by OBGMA for the period 1994-2017. Overall, OBGMA estimates greater groundwater extraction than modeled within the VRW GW-SW Model. However, both estimates are within four percent of each other. This percentage is calculated by dividing the difference between estimates by the average of the two estimates.

Table 7 Comparison of Ojai Valley Groundwater Basin Pumping (Extraction) Data

Water Year	VRW GW–SW Groundwater Extraction Data (acre-feet)	OBGMA Total Estimated Groundwater Extractions (acre-feet)	Difference (acre-feet)
1994	4,104	5,585	+1,481
1995	4,094	4,433	+339
1996	3,715	3,902	+187
1997	4,227	4,328	+101
1998	3,470	3,869	+399
1999	4,999	4,444	-555
2000	4,875	5,090	+215
2001	4,393	6,267	+1,874
2002	4,913	4,992	+79
2003	4,622	5,088	+466
2004	4,808	4,697	-111
2005	4,396	4,649	+253
2006	4,704	4,484	-220
2007	5,388	5,070	-318
2008	4,870	5,052	+182
2009	5,290	5,394	+104
2010	4,734	4,971	+237
2011	4,902	5,125	+223
2012	5,438	5,310	-128
2013	5,216	5,469	+253
2014	4,200	3,610	-590
2015	3,458	3,620	+162
2016	3,082	3,239	+157
2017	3,570	3,826	+256

*Source: OBGMA Annual Report (2016–2017): Table 2 – Total Estimated Groundwater Extractions (Col F).

Figure 8 Groundwater Budget for Ojai Valley Groundwater Basin



Note: Inflows to the Ojai Valley Groundwater Basin are primarily recharge from local precipitation and intermittent streamflow (groundwater gain from stream) from San Antonio Creek. The majority of outflow is from groundwater pumping, with a smaller percentage from groundwater discharge to streams.

Upper Ventura River Groundwater Basin

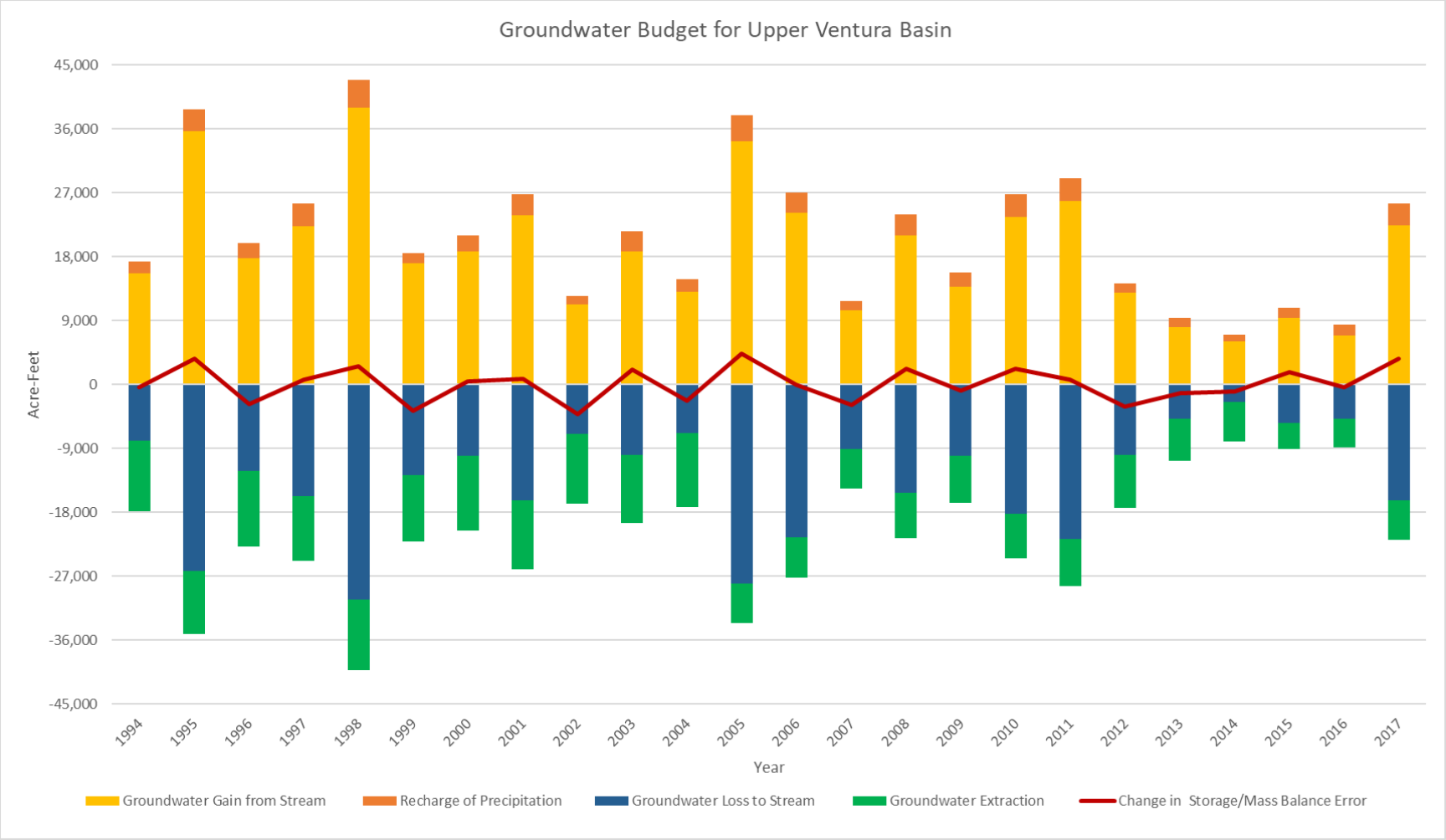
The annual water budget volumes for Upper Ventura River Groundwater Basin for the period of analysis are provided in Figure 9. The Upper Ventura River Groundwater Basin features significant surface water-groundwater interaction. Infiltration and discharge to and from creeks and the Ventura River account for the majority of the water balance. Groundwater extraction makes up a smaller percentage; however, it is the largest volume across the four groundwater basins within the Ventura River Watershed. In drought years, the groundwater recharge is significantly less than in wet years.

A comparison of the annual groundwater extraction data from the Ventura River Watershed GW-SW Model that were used in the historical water budget analysis and the estimated annual groundwater extraction data provided by UVRGA for the Upper Ventura Groundwater Basin is provided in Table 8. Overall, UVRGA estimates slightly less groundwater extraction than that modeled within the VRW GW-SW Model. The estimates are within eleven percent of each other. This percentage difference is calculated by dividing the difference between estimates by the average of the two estimates.

Table 8 Comparison of Upper Ventura Groundwater Basin Pumping (Extraction) Data

Water Year	VRW GW–SW Groundwater Extraction Data (acre-feet)	UVRGA GSP Table 3.3-06 Summed Pumping Data (acre-feet)	Difference
2006	5,617	5,009	-608
2007	5,648	5,488	-160
2008	6,382	6,055	-327
2009	6,741	6,105	-636
2010	6,274	5,975	-299
2011	6,657	5,176	-1,481
2012	7,410	6,391	-1,019
2013	5,850	4,955	-895
2014	5,517	5,316	-201
2015	3,709	3,279	-430
2016	3,992	3,448	-544
2017	5,510	5,045	-465

Figure 9 Groundwater Budget for Upper Ventura Groundwater Basin



Note: The Upper Ventura River Groundwater Basin features significant surface water-groundwater interaction. Infiltration and discharge to and from creeks and the Ventura River account for the majority of the water balance.

Lower Ventura River Groundwater Basin

Figure 1-10 provides results of the groundwater budget for the Lower Ventura River Groundwater Basin for the period of analysis. Similar to the Upper Ventura River Groundwater Basin, the Lower Ventura River Groundwater Basin has significant surface water-groundwater interactions with creeks and the Ventura River. Due to limitations of calculations generating Zonebudget GSFLOW output variables, outflow to ocean volume is not reported although likely significant. Therefore, it is likely that outflow to ocean volume's relative contribution of mass balance error to the combined change in groundwater storage/mass balance error term is appreciable due to the missing term.

Summary

Historically, the Ventura River Watershed has relied on local precipitation, with no significant external water sources or managed recharge programs. This reliance reflects limited water supply diversity and contingency planning, a vulnerability that is expected to intensify under changing climatic conditions. Long term drought (both local and regional) poses significant risk to the watershed.

Water storage opportunities within the watershed are constrained by geologic conditions, including small and shallow aquifers, as well as topographic features that limit surface water storage capacity. These constraints result in limited groundwater and surface water storage availability, with Lake Casitas serving as the primary water storage reservoir in the watershed.

Groundwater–surface water interaction is a defining feature of the Ventura River Watershed, resulting in interconnected water resources that have agricultural, municipal, industrial, and ecological uses. Extraction of groundwater reduces the availability of surface water; extraction of surface water reduces recharge to groundwater. Uses of either affect ecosystem health.

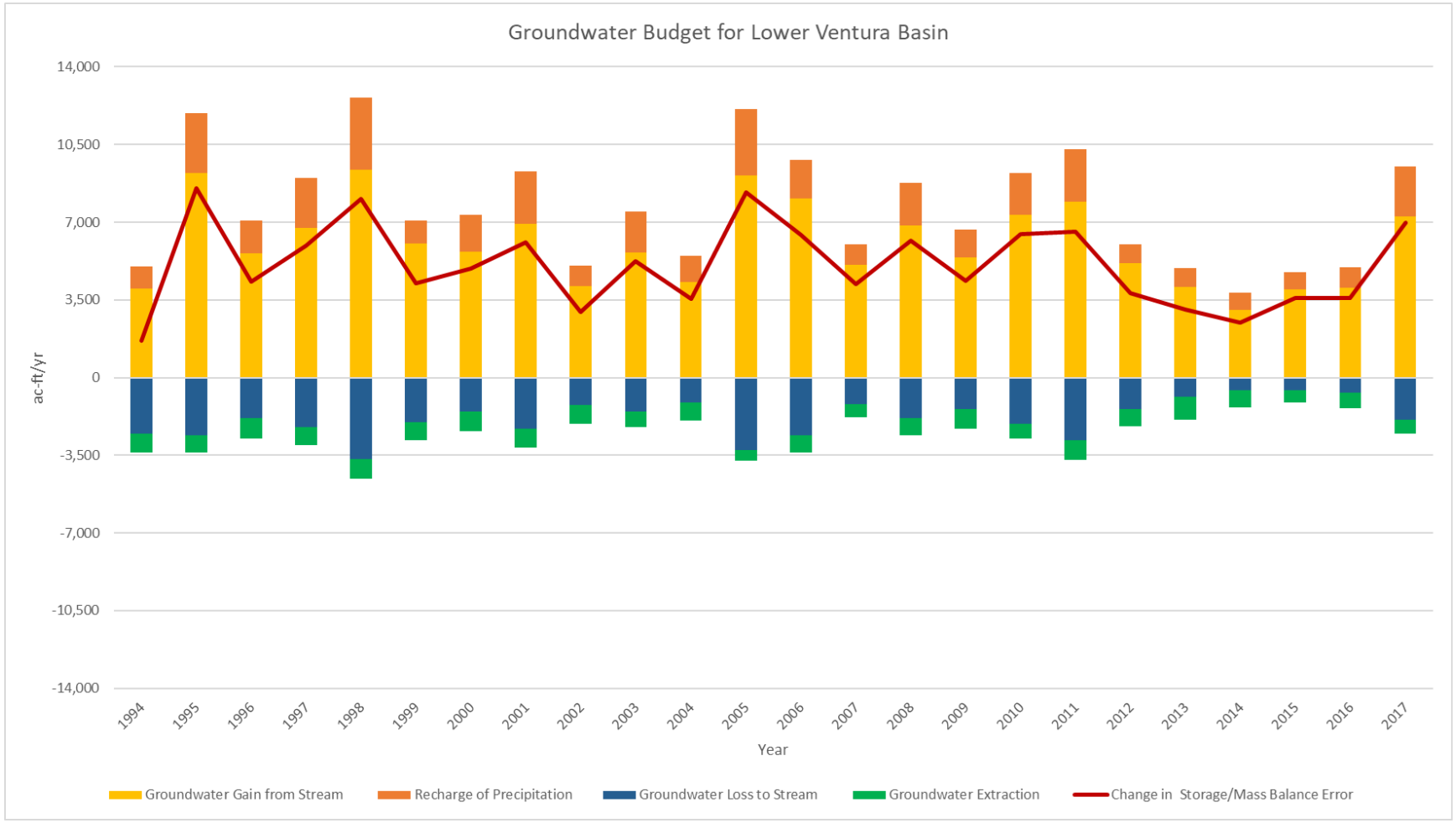
Steep terrain and geologic characteristics contribute to rapid aquifer recharge and drainage, leading to significant variability in groundwater and riverine surface water availability. Some of the river channels are ephemeral, having high infiltration rates. Recharge primarily occurs during wet years and declines during dry years. Onsite wastewater treatment systems represent the only source of managed aquifer recharge within the watershed. Primary outflows from the watershed include evapotranspiration and surface water discharge to the ocean, particularly during wet years when runoff is elevated.

Community Insight

In discussions related to the water budget, the watershed community advocated for democratization of water supplies across the watershed. They noted that definitions of sustainability vary by water type and sector, as do management objectives. A potential future connection to imported water supplies is not universally considered to be an enhancement to resilience; statewide water supplies are also subject to variability. Demand-side management was identified as a key opportunity to enhance watershed resilience, supported by communication tools such as real-time or weekly water-supply tracking.

The water budget as presented herein identifies recent-history. However, development has affected the watershed since the 1600s; additional studies of historical water budgets from earlier periods should be complied to illuminate natural watershed function prior to development. Resilience measures such as nature-based solutions and beaver dam analogues could be investigated in such studies.

Figure 10 Groundwater Budget for Lower Ventura Groundwater Basin



Note: Groundwater gain from stream component dominates groundwater budget for the Lower Ventura Basin, a response to the local shallow groundwater table. Outflow to ocean is not reported, although likely significant. The relative contribution of mass balance error to the combined change in groundwater storage/mass balance error term is likely appreciable due to the missing term.

Historical Water Budget Data Tables

Table 9 Ventura River Watershed, Total Watershed Water Budget (acre-feet)

Plotting Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Precipitation on Land System	203207	689116	226430	298656	761246	161605	288979	397092	107445	316844	193393	755081	368723	99567	319869	183562	359136	424954	164102	128268	139361	182732	153818	373487
Precipitation on Lakes	3123	9900	3687	4871	11793	2493	4834	6118	1888	4956	3264	10630	5201	1568	4981	2654	5432	6446	2506	2149	1742	2020	2546	5669
Subsurface Inflow from External Basins	837	656	786	691	554	844	783	695	902	769	841	598	705	909	746	826	714	658	900	930	907	879	903	714
Evapotranspiration from Land System	-196480	-369482	-233640	-247271	-380427	-194733	-266099	-301211	-128268	-288961	-197791	-364230	-325329	-118269	-254741	-186736	-302615	-329673	-184841	-142840	-150010	-181021	-168468	-284971
Groundwater Evaporation	-5016	-4350	-5253	-5689	-4057	-4656	-4791	-4759	-4469	-4070	-4421	-4586	-5121	-5213	-5255	-4892	-4517	-4522	-4587	-4177	-3767	-3902	-3717	-4845
Lake Evaporation	-9427	-9090	-9731	-9911	-8797	-8754	-9453	-9072	-9207	-9247	-9565	-9588	-9836	-10022	-10196	-10085	-9428	-9402	-10091	-10279	-10475	-10423	-10259	-10256
Riparian Evapotranspiration	-5016	-4350	-5253	-5689	-4057	-4656	-4791	-4759	-4469	-4070	-4421	-4586	-5121	-5213	-5255	-4892	-4517	-4522	-4587	-4177	-3767	-3902	-3717	-4845
Stream Outflow	-7203	-283912	-11386	-28425	-318815	-7006	-12969	-58418	-2674	-11900	-5498	-272213	-35719	-3936	-41109	-6394	-28568	-49172	-4868	-2213	-2504	-2634	-3436	-48190
Subsurface Outflow to Other Zones (w/in Basin, outside VRW)	-4150	-5309	-3622	-4077	-5861	-3905	-3260	-4134	-2542	-3317	-2529	-5366	-5130	-3355	-4059	-3315	-4341	-4906	-3203	-2050	-1412	-1879	-2094	-3991
Subsurface Outflow to Outside of Basin (Ocean)	-4987	-5965	-4409	-4769	-6415	-4749	-4043	-4829	-3444	-4086	-3370	-5963	-5835	-4263	-4805	-4140	-5055	-5563	-4104	-2980	-2320	-2758	-2997	-4705
Change in Storage	-20610	31234	-38256	3553	57391	-63907	-13007	19851	-48651	-1321	-32425	112586	-8670	-46887	6104	-30035	14249	34229	-45481	-35069	-32369	-17221	-30341	30195
Cumulative Change in Storage	-20610	10624	-27632	-24079	33312	-30595	-43602	-23751	-72402	-73723	-106148	6438	-2232	-49120	-43016	-73050	-58802	-24572	-70053	-105122	-137491	-154712	-185053	-154858
Water Budget Error	-4501	-14020	-4134	-5167	-12227	390	2197	-3130	3812	-1762	2329	-12809	-8792	-1340	-5929	-3378	-8008	-9933	-3292	-2302	124	-3667	-7079	-12128

Table 10 Ventura River Watershed, Land System Watershed Water Budget (acre-feet)

Plotting Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Precipitation on Land System	203207	689116	226430	298656	761246	161605	288979	397092	107445	316844	193393	755081	368723	99567	319869	183562	359136	424954	164102	128268	139361	182732	153818	373487
Surface Water Delivery	15630	12700	16263	19271	15135	18243	23287	19032	21166	16651	20010	17579	17658	20925	19404	17910	14946	15415	15478	18464	20556	17483	14237	11390
Groundwater Extraction	16536	15833	17225	16084	16818	17055	18411	16858	17432	16557	17877	11832	12729	13186	13831	14778	13380	14990	15576	14210	12007	9099	9121	11390
Evapotranspiration	-196480	-369482	-233640	-247271	-380427	-194733	-266099	-301211	-128268	-288961	-197791	-364230	-325329	-118269	-254741	-186736	-302615	-329673	-184841	-142840	-150010	-181021	-168468	-284971
Runoff	-11723	-303727	-16903	-50688	-341431	-8097	-31184	-93780	-4951	-24622	-12217	-364408	-53599	-3982	-70219	-10583	-47613	-86068	-7053	-5916	-7768	-8183	-7184	-80570
Return Flow	-2296	-2296	-2303	-2296	-2296	-2296	-2303	-2296	-2296	-2296	-2303	-2296	-2559	-2234	-2424	-2114	-2179	-2328	-1891	-1756	-1773	-1660	-1712	-1750
Recharge of Applied Water and Precipitation	-12328	-39210	-16974	-31637	-49404	-7393	-21374	-31053	-5215	-28535	-12543	-44784	-28699	-2377	-27365	-14528	-33239	-37450	-4091	-7616	-7138	-10602	-8285	-30803
Managed Aquifer Recharge	-664	-705	-711	-706	-702	-711	-711	-706	-712	-707	-712	-703	-707	-713	-709	-710	-705	-704	-715	-712	-713	-712	-714	-707
Change in Storage	8984	10052	-13185	-218	25601	-23290	842	1068	-4656	1597	-1897	14664	-10299	360	-3355	-1525	3074	3107	-6331	-460	377	6245	-6784	2932
Cumulative Change in Storage	8984	19036	5850	5632	31233	7943	8786	9853	5197	6794	4898	19562	9263	9623	6268	4742	7816	10923	4593	4133	4510	10755	3971	6903
Water Budget Error	2899	-7822	2573	1631	-6662	6962	8163	2868	9258	3335	7610	-6593	-1484	5743	1001	3105	-1963	-3971	2894	2561	4146	892	-2403	-5467

Table 11 Ventura River Watershed, Surface Water System Watershed Water Budget (acre-feet)

Plotting Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Precipitation on Lakes	3123	9900	3687	4871	11793	2493	4834	6118	1888	4956	3264	10630	5201	1568	4981	2654	5432	6446	2506	2149	1742	2020	2546	5669
Runoff	11723	303727	16903	50688	341431	8097	31184	93780	4951	24622	12217	364408	53599	3982	70219	10583	47613	86068	7053	5916	7768	8183	7184	80570
Return Flow	2296	2296	2303	2296	2296	2296	2303	2296	2296	2296	2303	2296	2559	2234	2424	2114	2179	2328	1891	1756	1773	1660	1712	1750
Stream Gain from Groundwater	23047	51616	27363	36612	64368	26920	23481	35789	16419	23741	16935	54306	42621	18337	30203	21014	36229	45845	20084	12278	8199	11740	10658	30256
Lake Gain from Groundwater	530	977	730	1007	1249	521	865	1070	601	1092	862	1131	820	439	937	712	1131	1265	551	637	586	654	751	1285
Surface Water Delivery	-15630	-12700	-16263	-19271	-15135	-18243	-23287	-19032	-21166	-16651	-20010	-17579	-17658	-20925	-19404	-17910	-14946	-15415	-15478	-18464	-20556	-17483	-14237	-11390
Stream Loss to Groundwater	-24297	-56856	-28625	-37085	-61577	-27438	-30896	-39032	-18965	-30189	-21525	-56176	-39348	-19038	-36287	-24013	-39029	-43706	-21984	-15897	-12411	-17314	-14441	-39117
Lake Loss to Groundwater	-516	-468	-476	-454	-432	-496	-468	-435	-481	-404	-390	-419	-468	-524	-459	-462	-409	-399	-478	-458	-429	-398	-349	-287
Lake and Stream Evapotranspiration	-9427	-9090	-9731	-9911	-8797	-8754	-9453	-9072	-9207	-9247	-9565	-9588	-9836	-10022	-10196	-10085	-9428	-9402	-10091	-10279	-10475	-10423	-10259	-10256
Surface Water Outflow to Ocean	-7203	-283912	-11386	-28425	-318815	-7006	-12969	-58418	-2674	-11900	-5498	-272213	-35719	-3936	-41109	-6394	-28568	-49172	-4868	-2213	-2504	-2634	-3436	-48190
Change in Storage	-16294	5490	-15495	328	16380	-21611	-14406	13063	-26338	-11685	-21408	76797	1770	-27886	1310	-21787	204	23858	-20813	-24576	-26308	-23995	-19870	10289
Cumulative Change in Storage	-16294	-10804	-26299	-25971	-9592	-31202	-45609	-32546	-58884	-70569	-91977	-15180	-13410	-41296	-39985	-61773	-61568	-37711	-58523	-83100	-109407	-133402	-153272	-142983
Water Budget Error	-61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	-1	0

Table 11 Ventura River Watershed, Groundwater System Watershed Water Budget (acre-feet)

Plotting Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Recharge of All Applied Water and Precipitation	12328	39210	16974	31637	49404	7393	21374	31053	5215	28535	12543	44784	28699	2377	27365	14528	33239	37450	4091	7616	7138	10602	8285	30803
Managed Aquifer Recharge	664	705	711	706	702	711	711	706	712	707	712	703	707	713	709	710	705	704	715	712	713	712	714	707
Groundwater Gain from Stream	24297	56856	28625	37085	61577	27438	30896	39032	18965	30189	21525	56176	39348	19038	36287	24013	39029	43706	21984	15897	12411	17314	14441	39117
Groundwater Gain from Lake	516	468	476	454	432	496	468	435	481	404	390	419	468	524	459	462	409	399	478	458	429	398	349	287
Subsurface Inflow from External Basins	837	656	786	691	554	844	783	695	902	769	841	598	705	909	746	826	714	658	900	930	907	879	903	714
Groundwater Extraction All	-16536	-15833	-17225	-16084	-16818	-17055	-18411	-16858	-17432	-16557	-17877	-11832	-12729	-13186	-13831	-14778	-13380	-14990	-15576	-14210	-12007	-9099	-9121	-11390
Groundwater Loss to Stream and Surface	-23047	-51616	-27363	-36612	-64368	-26920	-23481	-35789	-16419	-23741	-16935	-54306	-42621	-18337	-30203	-21014	-36229	-45845	-20084	-12278	-8199	-11740	-10658	-30256
Groundwater Loss to Lake	-530	-977	-730	-1007	-1249	-521	-865	-1070	-601	-1092	-862	-1131	-820	-439	-937	-712	-1131	-1265	-551	-637	-586	-654	-751	-1285
Riparian Evapotranspiration	-5016	-4350	-5253	-5689	-4057	-4656	-4791	-4759	-4469	-4070	-4421	-4586	-5121	-5213	-5255	-4892	-4517	-4522	-4587	-4177	-3767	-3902	-3717	-4845
Subsurface Outflow to Other Zones (w/in Basin, outside VRW)	-4150	-5309	-3622	-4077	-5861	-3905	-3260	-4134	-2542	-3317	-2529	-5366	-5130	-3355	-4059	-3315	-4341	-4906	-3203	-2050	-1412	-1879	-2094	-3991
Subsurface Outflow to Outside of Basin (Ocean)	-4987	-5965	-4409	-4769	-6415	-4749	-4043	-4829	-3444	-4086	-3370	-5963	-5835	-4263	-4805	-4140	-5055	-5563	-4104	-2980	-2320	-2758	-2997	-4705
Change in Storage	-13300	15692	-9576	3443	15411	-19007	557	5721	-17657	8767	-9121	21125	-142	-19361	8149	-6723	10971	7264	-18337	-10033	-6438	529	-3687	16973
Cumulative Change in Storage	-13300	2392	-7184	-3740	11670	-7336	-6779	-1058	-18715	-9948	-19069	2056	1914	-17447	-9298	-16020	-5049	2215	-16122	-26156	-32594	-32065	-35751	-18778
Water Budget Error	-2323	-1848	-1454	-1108	-1509	-1916	-1176	-1238	-976	-1026	-860	-1630	-2187	-1870	-1675	-1591	-1528	-1439	-1600	-687	-255	-657	-959	-1817

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Table 12 Ventura River Watershed, Groundwater Budget for Upper Ojai Groundwater Basin (acre-feet)

Year	Recharge of Precipitation	Groundwater Gain from Stream	Groundwater Extraction	Groundwater Loss to Stream	Change in Storage/ Mass Balance Error
1994	811	1,008	-1,005	-2,745	-1931
1995	3,078	1,050	-1,050	-2,232	847
1996	1,166	769	-1,036	-1,517	-618
1997	2,190	769	-999	-1,738	223
1998	3,829	1,000	-1,278	-2,621	930
1999	619	690	-976	-1,564	-1231
2000	1,544	918	-1,205	-1,163	93
2001	2,470	842	-1,078	-1,776	459
2002	345	738	-1,127	-1,124	-1167
2003	1,467	830	-859	-1,093	345
2004	995	734	-1,146	-920	-337
2005	3,468	987	-865	-2,309	1282
2006	1,868	592	-800	-1,944	-284
2007	242	664	-988	-1,080	-1161
2008	2,088	858	-1,063	-1,245	638
2009	968	742	-1,114	-1,101	-505
2010	2,179	787	-926	-1,494	545
2011	2,756	871	-1,569	-1,888	171
2012	370	738	-1,108	-1,100	-1100
2013	368	702	-1,300	-615	-844
2014	510	519	-990	-382	-344
2015	532	681	-815	-500	-103
2016	525	683	-736	-543	-70
2017	2,443	959	-779	-1,254	1370

Table 13 Ventura River Watershed, Groundwater Budget for Ojai Valley Groundwater Basin (acre-feet)

Year	Recharge of Precipitation	Groundwater Gain from Stream	Groundwater Extraction	Groundwater Loss to Stream	Change in Storage/ Mass Balance Error
1994	1,430	1,206	-4,104	-626	-2094
1995	2,532	6,507	-4,094	-3,797	1148
1996	1,794	1,669	-3,715	-1,062	-1314
1997	2,508	3,848	-4,227	-2,545	-417
1998	3,145	7,502	-3,470	-6,444	733
1999	1,542	1,259	-4,999	-789	-2987
2000	1,727	2,589	-4,875	-448	-1007
2001	2,234	4,093	-4,393	-1,366	568
2002	1,142	786	-4,913	-64	-3049
2003	2,514	1,972	-4,622	-272	-408
2004	1,492	1,083	-4,808	-89	-2323
2005	2,930	7,190	-4,396	-2,919	2804
2006	2,368	3,118	-4,704	-1,621	-839
2007	773	733	-5,388	-51	-3933
2008	2,040	4,165	-4,870	-748	587
2009	1,705	1,439	-5,290	-192	-2338
2010	2,536	3,775	-4,734	-807	770
2011	2,692	5,342	-4,902	-2,568	564
2012	1,090	944	-5,438	-51	-3455
2013	1,168	818	-5,216	-33	-3263
2014	874	789	-4,200	-20	-2558
2015	1,332	900	-3,458	-20	-1246
2016	1,063	817	-3,082	-16	-1218
2017	1,999	4,603	-3,570	-785	2247

Table 14 Ventura River Watershed, Groundwater Budget for Upper Ventura Groundwater Basin (acre-feet)

Year	Recharge of Precipitation	Groundwater Gain from Stream	Groundwater Extraction	Groundwater Loss to Stream	Change in Storage/ Mass Balance Error
1994	1,718	15,670	-9,929	-7,856	-397
1995	3,155	35,640	-8,890	-26,250	3655
1996	2,162	17,832	-10,684	-12,103	-2794
1997	3,135	22,368	-9,120	-15,656	728
1998	3,913	39,010	-10,019	-30,253	2650
1999	1,438	17,071	-9,415	-12,722	-3628
2000	2,276	18,719	-10,544	-9,966	485
2001	2,955	23,892	-9,701	-16,333	813
2002	1,251	11,271	-9,837	-6,884	-4200
2003	2,839	18,797	-9,611	-9,855	2169
2004	1,786	13,116	-10,337	-6,866	-2302
2005	3,702	34,235	-5,536	-28,067	4334
2006	2,896	24,198	-5,617	-21,538	-61
2007	1,286	10,482	-5,648	-9,028	-2909
2008	2,877	21,064	-6,382	-15,264	2296
2009	2,042	13,802	-6,741	-9,965	-862
2010	3,170	23,619	-6,274	-18,247	2268
2011	3,278	25,836	-6,657	-21,762	695
2012	1,259	12,995	-7,410	-9,957	-3113
2013	1,355	8,095	-5,850	-4,848	-1248
2014	923	6,073	-5,517	-2,460	-981
2015	1,433	9,386	-3,709	-5,349	1761
2016	1,481	6,948	-3,992	-4,789	-352
2017	3,046	22,478	-5,510	-16,334	3681

Table 15 Ventura River Watershed, Groundwater Budget for Lower Ventura Groundwater Basin (acre-feet)

Year	Recharge of Precipitation	Groundwater Gain from Stream	Groundwater Extraction	Groundwater Loss to Stream	Change in Storage/ Mass Balance Error
1994	1,016	3,995	-819	-2,542	1651
1995	2,720	9,200	-797	-2,592	8531
1996	1,473	5,603	-910	-1,835	4331
1997	2,251	6,743	-782	-2,246	5966
1998	3,246	9,376	-894	-3,661	8067
1999	1,038	6,046	-804	-2,024	4256
2000	1,668	5,672	-888	-1,546	4906
2001	2,338	6,937	-844	-2,318	6112
2002	931	4,108	-828	-1,248	2963
2003	1,850	5,638	-702	-1,535	5251
2004	1,201	4,290	-821	-1,112	3558
2005	2,974	9,123	-502	-3,258	8337
2006	1,754	8,062	-806	-2,585	6424
2007	908	5,086	-582	-1,193	4220
2008	1,897	6,861	-761	-1,824	6173
2009	1,239	5,420	-868	-1,428	4363
2010	1,900	7,334	-689	-2,072	6472
2011	2,377	7,923	-872	-2,841	6586
2012	863	5,141	-808	-1,402	3795
2013	866	4,081	-1,027	-865	3055
2014	771	3,047	-774	-568	2477
2015	767	3,977	-556	-586	3601
2016	899	4,056	-716	-664	3575
2017	2,232	7,267	-620	-1,892	6987

Historical Water Budget Variable Definitions

Table 16 GSFLOW Output Variables Utilized in Water Budgets

Variable Name	Description
Precip_Q	Volumetric flow rate of precipitation
LakePrecip_Q	Volumetric flow rate of precipitation on lake surfaces
StreamOut_Q	Volumetric flow rate of streamflow leaving the model domain
Segment768_Q	Volumetric flow rate of streamflow at outlet segment 768 (ocean boundary)
BoundaryStreamFlow_Q	Volumetric flow rate of streamflow entering the model domain (boundary inflow)
NetWellFlow_Q	Net volumetric flow rate of groundwater extraction or injection from wells
CanopyEvap_Q	Evaporation of intercepted precipitation from plant canopy reservoirs
SnowEvap_Q	Volumetric flow rate of snowpack evaporation or sublimation
ImpervEvap_Q	Volumetric flow rate of evaporation from impervious areas

Variable Name	Description
DprstEvap_Q	Evaporation from surface depressions
CapET_Q	Evapotranspiration from capillary reservoirs of the soil zone
SwaleEvap_Q	Evaporation from swale areas
UnsatET_Q	Evapotranspiration from the unsaturated zone
HortSroff2Stream_Q	Hortonian runoff to streams
HortSroff2Lake_Q	Hortonian runoff to lakes
DunnSroff2Stream_Q	Dunnian (saturation-excess) runoff to streams
DunnInterflow2Lake_Q	Dunnian interflow to lakes
Interflow2Stream_Q	Slow and fast interflow to streams
RechargeUnsat2Sat_Q	Recharge from the unsaturated zone to the saturated zone
LakeEvap_Q	Volumetric flow rate of evaporation from lakes
Lake_S	Volume of water stored in lakes
Cap_S	Volume of water in capillary reservoirs (soil zone)
Grav_S	Volume of water in gravity reservoirs (soil zone)
Dprst_S	Volume of water stored in surface depressions
SnowPweqv_S	Snowpack water equivalent storage
Canopy_S	Volume of intercepted precipitation stored in plant canopies
Imperv_S	Volume of water in impervious reservoirs
Unsat_S	Volume of water in the unsaturated zone
Sat_S	Volume of water in the saturated zone (groundwater storage)
NetBoundaryFlow2Sat_Q	Volumetric flow rate across the external groundwater boundary (positive = inflow)
CHD_Out	Volumetric flow rate of groundwater discharge to constant-head boundaries (ocean)
GW_To_SFR	Groundwater discharge to stream network (stream gain)
SFR_To_GW	Stream loss to groundwater system
GW_To_LAK	Groundwater discharge to lakes
LAK_To_GW	Lake leakage to groundwater
GHB_In	Volumetric inflow through general-head boundaries
SatET_Q	Evapotranspiration from the saturated zone (riparian ET)

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Appendix O

Problem Statements

Problems Statements

The following problem statements summarize the major challenges that communities, ecosystems, and infrastructure in the Ventura River Watershed currently face. Their purpose is to clearly identify the conditions that limit watershed resilience and to highlight where adaptation strategies are most needed. These statements draw from existing public-agency documents, watershed plans, vulnerability assessments, and input gathered through a community forum, key partner interviews, and Advisory Group review. They reflect historical events, local data, and diverse lived experience across the watershed. Problem statements are organized into five thematic areas: Infrastructure; Natural Resources; Cultural Resources; Communities and Land Use; and Operations and Community Services.

Thematic Area: Infrastructure

1. *Wildfires Damage Water Infrastructure and Temporarily Interrupt Water Supply*

Wildfires increasingly threaten above-ground built water supply infrastructure in the Ventura River Watershed. Surface water facilities and conveyance (e.g., the Robles Diversion and the San Antonio Creek Spreading Grounds) experience elevated turbidity, sediment and debris loading, and access constraints after wildfire, reducing diversion capacity and increasing maintenance demands. Wildfire and extreme heat can melt plastic service lines and meters, cause electrical pump failures, destroy tanks, damage above-ground appurtenances, and render other critical water supply infrastructure unusable. During subsequent storm events, erosion and debris flows can clog diversions and intakes, damage above-ground facilities, and increase turbidity, leading to service disruptions and costly repairs. For example, during the 2017 Thomas Fire, water tanks were damaged and pipes melted, impairing drinking water system operations. These disruptions can leave communities without safe drinking water for days or even weeks, as was the case for westside Ventura after the 2017 Thomas Fire when the community was placed on boil-water notice for several days. These direct and cascading impacts from wildfires can require costly repairs, increase operational and maintenance demands, and create short-term service gaps, temporarily jeopardizing reliable and safe drinking water access in affected service areas within the watershed.

2. *Extreme Precipitation and Flooding Damage Stormwater, Water Supply, and Wastewater Systems*

Stormwater and Flood Control Systems

Extreme precipitation and flooding events increasingly overwhelm stormwater and flood control systems in the Ventura River Watershed, leading to localized flooding, infrastructure failures, and environmental hazards. Urban storm drain systems (MS4) are typically designed from a 10-year storm at short-duration intensities (e.g., 15 minutes to 1 hour); when rainfall intensities exceed design capacity, localized flooding can damage public and private property and elevate public health and safety risks. High river flows and floodwaters can erode flood control structures and also breach levees and erode flood control structures, making them more vulnerable to damage. Recent storms have eroded flood control features around Foster Park, while coastal storm drains near the Ventura River estuary have been overwhelmed and damaged during high-flow events, causing localized flooding and repeated maintenance needs. Several critical levee systems along the lower Ventura River are currently classified as deficient and have been decertified by the U.S. Army Corps of Engineers, meaning they no longer meet federal standards for flood protection. This loss of accreditation has significant implications for

watershed resilience, as it places neighborhoods, particularly in the City of Ventura and Casitas Springs, at higher risk of inundation.

Water and Wastewater Systems

Drinking water and wastewater systems also face significant challenges during extreme precipitation and flood events, and from the lasting damage these events cause. Drinking water infrastructure has sustained localized damage, access constraints, and water-quality management issues from previous storms. Past flooding has damaged key water supply and conveyance infrastructure, such as the Robles Diversion, the Robles Diversion Fish Passage Facility, and water supply facilities and distribution lines at Foster Park, forcing Casitas Municipal Water District and City of Ventura – Ventura Water to rely temporarily on more costly replacement sources while Ventura River supplies were offline or reduced.

Wastewater systems are equally vulnerable. Floodwaters can expose or rupture wastewater pipes, causing large-scale sewage spills. In January 2023, an estimated 14 million gallons of untreated sewage spilled into the Ventura River, triggering beach closures and public health concerns. The spill also forced the City of Ventura to dispose of water that had already been pumped and sent to the treatment plant and to cease pumping from the Ventura River for a period of time. Together, these disruptions compromised water delivery and treatment, water quality in the Ventura River, public safety, and infrastructure reliability across the watershed.

3. Drought and Extreme Heat Reduce Surface Water, Lower Groundwater Levels, and Strain Local Water Supplies

Drought and extreme heat have historically reduced surface water flows and resulted in a reduced groundwater recharge rates critical for drinking water and agriculture in the Ventura River Watershed. The Upper Ventura River Groundwater Basin's relatively limited storage and rapid drainage mean that during drought conditions, groundwater levels are lowered, impairing baseflows and reducing reliability of shallow wells. These conditions underscore the watershed's long-standing vulnerability to drought and heat stress. Groundwater Sustainability Plans (GSPs) are designed to protect groundwater storage over the long term; however, observed temporary reductions of groundwater levels during prolonged dry periods have affected shallow wells and diminished streamflow contributions, altering local water supplies and the associated management actions to ensure reliability.

In the Upper Ventura River basin, drought-induced storage declines occur when groundwater discharge and pumping exceed recharge, whereas the Ojai basin's confined aquifers limit such drainage except when near capacity. These fluctuations represent a temporary decrease in available storage rather than a reduction in long-term reliability, as Groundwater Sustainability Plans (GSPs) are specifically designed to balance pumping with recharge over time.

Extreme heat and increased evapotranspiration put further pressure on water supplies during droughts. Requirements from CDFW's flow recommendations and NMFS' recovery plan for Southern California Steelhead to maintain instream flows add additional complexity, often requiring coordinated actions and tradeoffs among agencies. These challenges are particularly acute given the watershed's reliance on local groundwater and surface water from Lake Casitas and the Ventura River. For some agencies (e.g., VRWD and MOWD), groundwater remains the primary source, with water from Lake Casitas available as supplemental/backup after primary sources have been fully utilized.

Interconnection projects to enable delivery of imported/State Wate Project water (e.g., the Ventura–Santa Barbara Counties Intertie and the City of Ventura's State Water Interconnection Project) are planned but not yet operational, meaning communities continue to rely solely on the ample local

sources during drought. During shortages, allocation and curtailment tools are utilized to mitigate impacts, including the long-standing Water Efficiency Allocation Program (WEAP) implemented by Casitas MWD and the potential for GSA pumping restrictions currently being developed as future management actions under Groundwater Sustainability Plans (GSPs).Still, these measures cannot fully offset the recurring vulnerabilities experienced during historic droughts, particularly for shallow wells in rural and disadvantaged communities. Many of these areas fall outside the jurisdiction of established GSAs (e.g., in the Upper Ojai and Lower Ventura basins), where the lack of close monitoring, planning, and long-term management strategies has left households with unreliable supplies and heightened risks to water security for the most vulnerable residents.

4. Drought, Extreme Heat, Wildfire, and Flooding Degrade Water Quality and Increase Treatment Challenges

Prolonged drought and extreme heat lower streamflows and reservoir levels across the Ventura River Watershed, degrading water quality and increasing treatment challenges. Lower flows concentrate pollutants and constituents such as nutrients (nitrogen and phosphorus), pathogens, heavy metals, and sediment, while extreme heat raises water temperatures, each of which increase the risk of harmful algal blooms, particularly in sensitive areas such as the Ventura River and Lake Casitas. In the Ventura River, nutrient enrichment—including nitrate and phosphorus, both addressed under a Regional Water Quality Control Board Total Maximum Daily Load—is a key factor that can exacerbate algal growth beyond natural background levels. Studies in the Ventura River have shown that reduced canopy cover increases light availability, which in turn promotes algal growth; conversely, shaded reaches with intact canopy help limit excessive algal production.

Post-wildfire runoff presents a distinct water quality concern, as it can deposit ash, sediment, nutrients, heavy metals (from burned structures, vehicles, and infrastructure, and urban runoff), and organic other debris into waterways. While severe wildfires can elevate turbidity, local water providers like VRWD and Casitas MWD have successfully maintained water quality standards without significant taste or odor issues. Furthermore, the risk of forming disinfection byproducts remains low due to the watershed's historically low organic load and Casitas' use of chloramines, which are less reactive than chlorine. Fine sediment deposition can also reduce natural recharge capacity and, in wells under the influence of surface water, may increase the potential for water quality impacts and operational interruptions. Excess sedimentation can also degrade aquatic habitat quality, smothering spawning areas and altering channel morphology in ways that affect sensitive species.

Flood events can mobilize large amounts of sediment, increasing turbidity to levels. In agricultural areas—predominantly orchards in this watershed—storm events can mobilize pesticides (e.g., organophosphates, pyrethroids), nutrients (primarily nitrogen compounds), and sediment. The "first flush" of the season often carries the highest concentrations of these and other contaminants from both agricultural and urban landscapes, with water quality impacts generally diminishing as flows recede. However, back-to-back or prolonged storm events can create a different set of water-quality challenges: saturated soils and elevated groundwater levels increase the potential for nutrient leaching and surface discharge from onsite wastewater treatment systems, particularly where septic systems are shallow. Projected climate shifts present ongoing challenges to the long-term management and cost-efficiency of water supplies. These conditions require water providers to adapt infrastructure and operational strategies to maintain service reliability during increasingly variable weather patterns.

Thematic Area: Natural Resources

5. Drought, Extreme Heat, and Wildfire Degrade Ecosystems, Reduce Habitat Quality, and Spread Invasive Species

Drought, extreme heat, and wildfire are reshaping ecosystems and degrading water quality in the Ventura River Watershed. Ongoing drought conditions lead to reduced streamflows, can concentrate pollutants, elevate water temperatures, improve conditions for invasive species, and increase evapotranspiration, stressing aquatic and riparian habitats and threatening species like Southern California steelhead. Climate projections indicate increased streamflow variability, with some historically perennial reaches in the watershed experiencing more frequent or prolonged intermittent periods during multi-year droughts. These shifts in flow timing can reduce the seasonal availability of aquatic habitat and challenge the lifecycle of species, such as the Southern California Steelhead, that depend on specific hydrologic cues. These changes contribute to harmful algal blooms, lower dissolved oxygen levels, and measured changes in ecosystem health and water quality.

Runoff from burned slopes delivers ash, sediment, and contaminants into streams and reservoirs, reducing water clarity and impairing aquatic habitat. These sediment inputs can temporarily reduce the porosity of channel substrates and slow infiltration rates. While these effects typically persist only until the next high-flow event scours the channel, a short-term reduction in recharge can still add stress to groundwater-dependent ecosystems already experiencing seasonal declines in water levels. These groundwater-dependent and aquatic ecosystems are actively monitored through GSP programs to track conditions and help prevent significant and unreasonable adverse effects, consistent with SGMA requirements. Sensitive native species lose critical habitat and invasive species spread, while chaparral and other fire-adapted ecosystems in some areas face shorter fire return intervals, as evidenced by multiple large fires occurring within the same subregions over the past two decades, which can challenge post-fire recovery. Forests face additional threats from pests, diseases, and fire management pressures. Meanwhile, drought diminishes the availability of native seed stock for post-fire restoration, and local systems for seed collection and storage remain limited. While many ecosystems in the watershed demonstrate resilience and can recover following drought and wildfire when conditions improve, repeated or more severe events can limit recovery and alter long-term ecological function.

6. Drought, Extreme Heat, and Flooding Accelerate the Spread of Invasive Species in Riparian and Coastal Areas

Drought, extreme heat, and flooding are among the conditions that accelerate the spread of invasive species, degrading riparian habitats in the Ventura River Watershed. Reduced streamflow and higher temperatures weaken native riparian and estuarine vegetation, while drought favors water-hungry invasives such as *Arundo donax*, which consume large amounts of water and further reduce flows. *Arundo donax* also outcompetes native species like willow and cottonwood under a wide range of flow conditions, with drought, heat, and flood events amplifying its competitive advantage. Recent mapping shows approximately 250 acres of Arundo donax in the Ventura River, San Antonio Creek, and Lion Creek. These infestations consume substantial streamflow, alter channel morphology, exacerbate flood hazards, accelerate erosion, displace culturally significant and ecologically important native plants, and create dense, continuous fuel for wildfires.

Flood events, including post-fire floods, compound these problems by scouring native vegetation, destabilizing banks, and exposing bare ground where invasives quickly establish. This invasion cycle increases restoration costs and slows native habitat recovery. *Arundo donax*-infested areas provide less shade than healthy riparian habitats, leading to increased water temperatures, impaired water quality,

and increased predation, all of which negatively impacts sensitive species like steelhead, amphibians, and native shrubs. Extreme heat compounds these stressors by further elevating stream and land surface temperatures, reducing habitat quality for species already near the edge of their ranges. Invasive species also threaten coastal wetland areas that provide natural flood protection and critical ecosystem services for wildlife and communities. Conservation and restoration groups are making progress controlling the spread of invasive species; however the problem still remains prevalent in the watershed.

7. Sea Level Rise, Storm Surge, and Declining Marine Fog Impact Coastal and Estuarine Ecosystems

Sea level rise, storm surge, and the dissipation of marine fog are reshaping coastal landscapes and threatening sensitive ecosystems in the Ventura River Watershed. Rising ocean levels push saltwater further into coastal freshwater systems, altering natural water flows and shifting the delicate salinity gradients that structure habitats in areas like the Ventura River Estuary and Emma Wood State Beach. The Ventura River Estuary already supports a dynamic estuarine community where fluctuations in salinity influence sediment composition, coastal vegetation, and the availability of habitat for anadromous fish and other sensitive species. Although seawater intrusion has not yet been documented in the Ventura River's coastal wells, nearby areas such as the Oxnard Aquifer have experienced it, signaling growing risks. Storm surge events add further stress by overtopping beaches and dunes, eroding coastal habitats, and increasing saltwater intrusion into low-lying areas, amplifying risks to estuarine and coastal systems. Meanwhile, the decline of marine fog—which once provided essential moisture to coastal grasslands, scrublands, and dune systems—reduces humidity, exacerbates drought stress on native plants, increases evapotranspiration in the lower watershed (observed at Foster Park during summer and dry winters), and accelerates habitat transition along the coast.

8. Human Infrastructure Alters River Flows and Reduces Natural Hydrologic and Habitat Functions

Human-made infrastructure, such as groundwater pumps, dams, levees, and channelized waterways, have altered natural hydrological processes in the Ventura River Watershed. Much of this infrastructure was built legally and in good faith to meet community water supply, flood protection, and economic development needs. While infrastructure like Matilija Dam was designed to store water and manage sediment, such modifications have altered historical hydrologic patterns and sediment transport. These changes, along with land-use developments, have reduced the acreage of active floodplains that naturally dissipate energy and facilitate groundwater recharge. ; the natural resilience functions of its ecosystems and hydrologic processes, which help buffer the impacts of climate hazards.

Infrastructure such as Matilija Dam impedes sediment transport and fish migration, particularly affecting culturally significant species like Southern California steelhead. The planned removal of Matilija Dam will restore natural sediment flows and fish passage to over 17 miles of critical headwater habitat, enhancing long-term ecosystem resilience (NMFS, 2012). To resolve existing vulnerabilities, the Matilija Dam Ecosystem Restoration Project (MDERP) provides a strategic funding and implementation pathway to modernize downstream infrastructure, including upgrading levees in Meiners Oaks, Casitas Springs, and Live Oak Acres to FEMA standards and modifying the Robles Diversion Facility to safeguard regional water supply while accommodating restored sediment transport. Channelized waterways in the lower Ventura River, particularly from the Ojai Valley downstream to the river mouth, along with impervious urban landscapes, increase flow velocities, reduce infiltration, and contribute to scour of native riparian vegetation. During smaller and moderate storm events, these modifications exacerbate localized

flooding and habitat degradation, while during large atmospheric river events, flow alterations are driven primarily by storm magnitude but remain influenced by existing land cover and infrastructure, further degrading ecosystem integrity. During past floods, droughts, and wildfires in the Ventura River Watershed, these cumulative infrastructure changes have magnified vulnerabilities by constraining natural processes—such as sediment transport, groundwater recharge, and floodplain inundation—that would otherwise help sustain habitat, water quality, and biodiversity.

9. Soil Degradation and Watershed Management Practices Increase Erosion, Runoff, and Water Supply Vulnerability

Increasingly frequent and intense drought, extreme heat, and heavy rain events are reducing the effectiveness of soil and watershed protection practices in the Ventura River Watershed. In rural agricultural areas such as the Ojai Valley, Casitas Springs, and Oak View, declining soil moisture and poor soil structure impact the soil's ability to absorb, store, and slowly release water. Intensive orchard and row-crop practices that damage soil structure and reduce organic matter further degrade soil health, leading to lower crop yields, higher irrigation demands, and increased erosion and sediment runoff that can affect water quality and habitats. Land use decisions, such as urban development and vegetation clearing, reduce the land's ability to absorb and hold water, which makes flooding and drought impacts more severe. In addition, flood protection needs can conflict with habitat protection goals and regulatory requirements when sediment removal is required to maintain channel capacity.

Soil health is measured by physical structure, biological activity, and nutrient levels that support water infiltration and plant growth. Healthy soils are essential components of the watershed's natural ecosystem that provide critical services such as slowing and absorbing runoff, sustaining baseflows and supporting groundwater recharge, and sustaining vegetation and habitat that buffer the impacts of drought, heat, and flooding. Coordinated management in the watershed integrates infrastructure modernization like MDERP, incentive-based soil health programs via the VCRCD, and GSA-led groundwater protection to enhance regional flood and drought resilience. Without these exisiting coordinated soil and watershed protection policies and management, maintaining these natural services, and the community benefits they provide, will become increasingly difficult as climate pressures intensify. Failing to recognize soil health as a foundational element of green infrastructure undermines efforts to strengthen water resilience.

Thematic Area: Cultural Resources

10. Climate Hazards Degrade Cultural Resources, Traditional Lifeways, and Access to Culturally Significant Places

Climate hazards including extreme heat, prolonged drought, wildfire, extreme precipitation and flooding, sea level rise and storm surge, and the reduction of marine fog are reshaping the Ventura River Watershed, degrading the cultural resources that sustain community well-being and relationships with the land. For Tribal communities, including the Chumash, climate stressors are disrupting traditional lifeways and stewardship practices. Rising temperatures and extended drought alter the growth cycles of culturally significant plants such as willow, tule, and mugwort. Drying of springs and reduced fog weaken the conditions needed for ceremonial and healing practices, while wildfire and flooding damage soils, trails, cultural sites, and riparian corridors. Drought further limits access to springs, rivers, and wetlands that are vital for ceremonial gatherings and traditional uses. Declines in fog and moisture also shorten safe windows for cultural burning, and severe wildfires can damage soils and cultural sites in ways that restrict future cultural fire practices essential for both cultural expression and ecological

stewardship. Fluvial flooding scours river corridors and damages sacred sites and trails, displacing cultural resources and altering access routes. Coastal hazards, including sea level rise and storm surge, further imperil coastal sites of cultural and spiritual importance. These changes threaten the transfer of traditional ecological knowledge and cultural continuity.

Thematic Area: Communities and Land Use

11. Climate Hazards Reduce Access to Open Space and Impacts Community Health and Well-Being

Climate hazards including extreme heat, prolonged drought, wildfire, extreme precipitation and flooding, sea level rise and storm surge, and the reduction of marine fog are diminishing opportunities for recreation and access to open space across the watershed. Prolonged drought reduces flows in the Ventura River and its tributaries, leaving swimming holes dry and degrading water quality. Extreme heat and wildfire smoke make outdoor activities unsafe, while major fires such as the Thomas Fire have destroyed trails and recreation areas for extended periods. Heavy storms and post-fire debris flows damage roads, riverbanks, and facilities, closing access to popular areas such as Lake Casitas and leading to overcrowding at smaller sites like Big Rock Preserve. Along the coast, erosion and rising seas are narrowing beaches, straining public budgets, and requiring costly managed retreat projects such as the $17.7 million Surfers' Point Managed Shoreline Retreat Project.

Restricted access to rivers, creeks, beaches, and parks not only limits recreation but also erodes cultural and spiritual connections that are central to the identity of the Ventura River Watershed. The loss of familiar open spaces and natural phenomena, such as the region's characteristic marine fog, contributes to climate grief, a form of emotional distress caused by witnessing environmental loss and ecological change. It also limits access to open space, which is well documented to support mental health and overall well-being. Access to recreation and outdoor spaces are particularly crucial for low-income residents, unhoused individuals, and households without reliable transportation or indoor cooling, who rely on these spaces for low-cost cooling alternatives.

12. Water Access Disruptions and Rising Water Costs Disproportionately Impact Overburdened Communities

Rising temperatures are increasing regional irrigation demands while simultaneously prompting households to utilize more water for heat mitigation, particularly in homes without air conditioning. This domestic demand is further exacerbated by the declining frequency of marine fog, which historically provided seasonal cooling and supplemental moisture for landscapes in Casitas Springs, Oak View, and North Ventura. Consequently, residents dependent on shallow domestic wells face increased vulnerability during severe droughts; as local groundwater levels recede below well intakes, these households may temporarily lose access to water, highlighting critical equity gaps in the watershed's Human Right to Water protections. Agricultural communities in the Casitas Springs, Oak View, and North Ventura Avenue areas are experiencing parallel pressures driven by hydrologic variability. While the Upper Ventura River GSA (UVRGA) and Ojai Basin Groundwater Management Agency (OBGMA) have not mandated pumping reductions, agricultural productivity is challenged by the natural recession of groundwater levels and the limited availability of surface water during multi-year droughts. These fluctuations in water table depth, rather than regulatory restrictions, can temporarily reduce well yields and increase operational costs for growers dependent on shallow alluvial aquifers. When irrigation water becomes unreliable, crop losses reduce job opportunities and income for farmworkers and small-scale producers, compounding existing economic vulnerabilities. To maintain production, communities

may explore alternative water supplies, such as imported state water, potable reuse, desalination, and enhanced water recycling. However, these options are significantly more expensive and energy-intensive, placing additional strain on already-marginal agricultural operations.

These combined pressures disproportionately affect low-income households, unhoused individuals, farmworkers, renters, and small agricultural producers; groups that often lack the capital to invest in water-saving technologies or absorb higher water rates. Many of these households and small farms already operate at very low water use levels, making additional restrictions impractical and inequitable. Drought response measures, such as mandatory conservation requirements, also strain small farms, and water-dependent small businesses (such as restaurants, car washes, and laundromats), which are vital to the economies of communities like Ojai and Ventura. Rising food and water prices exacerbate these burdens, intensifying financial stress on those with the fewest resources and the least ability to adapt.

13. Extreme Heat, Drought, and Flooding Impact Water-Dependent Agriculture and Farmworker Well-Being

Agriculture in the Ventura River Watershed is increasingly threatened by extreme heat, prolonged drought, intense storms, and flooding, all of which undermine land productivity and the well-being of agricultural communities. These climate hazards interact with existing pressures, including fluctuating commodity prices, rising labor and production costs, and immigration policies that affect labor stability, intensifying risks for farmers and farmworkers. Agricultural lands cover 18.5% of the Watershed yet consume nearly half of its water supply, making agricultural operations highly vulnerable to historical, current and future water-related disruptions that can amplify these challenges. Diminishing marine fog and rising temperatures are increasing irrigation needs and shifting which crops can grow successfully. At the same time, drought limits groundwater recharge and reduces surface water availability, forcing some farmers to fallow fields, abandon crops, or shift land use entirely. Extreme precipitation and flooding increase the likelihood and severity of soil erosion, damage to agricultural infrastructure, and the loss of fertilizers and pesticides to runoff. In extreme cases, these hazards can lead to permanent losses of productive agricultural land and further threaten local food security. Because water is central to agricultural production, changes in availability and quality directly affect both crop yields and the viability of agricultural employment.

These water- and climate-related pressures impact farmworkers especially hard, putting both their health and livelihoods at risk. Extreme heat and wildfire expose workers to dangerous working conditions, increasing risks of heat- and smoke-related illness. Flooding and drought reduce the number of available workdays, decrease wages, and create job instability. Many farmworkers lack adequate protections, resources, or alternative employment options to navigate these cascading impacts. Highlighting farmworker vulnerability is particularly important in the Ventura River Watershed, where agriculture remains a major economic sector and farmworker well-being is closely tied to water availability, management, and agricultural resilience.

14. Development in Flood and Fire Hazard Zones Increases Community Exposure to Climate Risks

While development in hazard-exposed locations has been minimal over the last 25 years, recent rezoning of these areas has increased local vulnerability. By designating more land within floodplains and high fire-severity zones, these policy shifts expand the footprint of communities at risk and create new challenges for maintaining the watershed's long-term climate resilience. These land use patterns amplify risks to water resources, emergency response, and essential services when floods, wildfires, or post-fire debris flows occur. In the Watershed, development within riparian areas faces heightened

vulnerability, as flooding has repeatedly damaged homes, businesses, and infrastructure located along waterways. The presence of unhoused individuals living in river bottoms and open spaces presents further increases vulnerability, placing people at high risk during wildfires and severe storms, and sometimes contributing unintentionally to ignitions through open flame use.

Intense storms following wildfires pose a significant threat of debris flows to Casitas Springs, Oak View, and Ventura Avenue. The steep primary hillslopes bordering the Ojai Valley and Ventura River canyon can fail during peak rainfall, resulting in high-velocity sediment and boulder transport that isolates communities by blocking roadways and damaging local water and power infrastructure. These hazards affect not only properties in mapped floodplains but also homes built on vulnerable bluffs and terrace edges along the Ventura River, including areas such as Rio Via opposite the Live Oaks Acres Levee, where past rock spurs have been damaged during recent storm events. These compounding geologic and hydrologic hazards significantly magnify the vulnerability of households located near steep slopes, unstable bluffs, and post-fire landscapes.

Long-standing developments in flood zones, as well as developments built behind levees (which can currently fail or be overtopped during large storms but are being evaluated for upgrades and FEMA recertification through MDERP,), exposes households to recurring flood risks. Rural homes with limited infrastructure or non-redundant utility networks are particularly susceptible when wildfires or post-fire debris flows cut off power and road access. For low-income households in hazard-prone neighborhoods, recovery from fire or flood damage is often slow or incomplete, increasing the likelihood of permanent displacement and creating new pathways into homelessness. By locking communities into vulnerable locations, legacy development patterns constrain climate resilience and magnify the human and financial costs of responding to hazard events.

Thematic Area: Operations and Community Services

15. Wildfire, Extreme Precipitation, and Flooding Disrupt Critical Services and Emergency Operations

Extreme precipitation, flooding, and wildfire are increasingly disrupting essential community services and exposing vulnerabilities that threaten community well-being and public health. These services include, but are not limited to, water delivery, transportation networks (roadways and bridges), stormwater conveyance systems (both natural and engineered), wastewater systems, and recreation and water quality infrastructure. Utility providers maintain emergency response plans and work to restore service as quickly as conditions allow; however, wildfire- and flooding-related outages and damage can still cause temporary operational disruptions. While many critical facilities maintain backup power supplies, these vary in capacity and fuel type, and may be insufficient during prolonged outages. For agriculture, power loss disrupts irrigation schedules, leaving crops vulnerable to heat stress and threatening yields and creating significant economic consequences for producers and workers.

As climate emergencies become more frequent, these overlapping hazards threaten the continuity and reliability of interconnected services. While some local agencies maintain emergency or continuity-of-operations plans for these types of events, historic wildfire and flood incidents in the Ventura River Watershed have shown that service disruptions still occur, indicating gaps in preparedness and coordination. Major wildfires in the past decade, including the formative 2017 Thomas Fire, have also provided important lessons to inform updates to local emergency operations plans.

16. Insufficient Funding and Coordination Limit Proactive Climate-Responsive Planning Across the Watershed

Across the Ventura River Watershed, agencies and community organizations struggle to plan proactively for climate resilience, largely due to chronic funding gaps. Limited staffing, liability concerns, political will, and rigid grant requirements keep many responses reactive rather than preventative, forcing costly emergency actions that fail to build long-term solutions. Systemic inequities deepen these challenges, as many agencies lack equity-focused training and prioritization tools, leaving frontline communities (including low-income households, farmworker communities, historically marginalized neighborhoods, and individuals living without stable housing) without sufficient support.

Nature-based solutions, such as floodplain restoration and managed aquifer recharge, provide proven benefits like improved groundwater storage and natural flood attenuation, yet they remain underused due to higher upfront costs. Implementation is further challenged by complex permitting hurdles and a lack of dedicated funding for the long-term maintenance required to sustain these ecological functions. Nature-based solutions are highly applicable in urban areas like the City of Ventura, Oak View, and Meiners Oaks, where they improve water quality by filtering pollutants through soil and vegetation and reduce localized flooding by capturing and infiltrating stormwater that would otherwise overwhelm traditional drainage systems. Local agencies such as the City of Ventura, Ventura County Watershed Protection District, Casitas Municipal Water District, and the Ventura River Water District, along with organizations and networks like local land trusts and the Ventura River Watershed Council, each play a role in water supply planning, flood management, habitat restoration, and public engagement. However, these entities often operate with limited budgets, project-specific funding, and siloed mandates, reducing their ability to coordinate watershed-wide resilience planning. Public land managers and conservancies face growing pressure to balance ecological health with equitable recreational access, but inconsistent and inadequate funding for outreach, education, and watershed-wide planning limits progress. These challenges are especially acute for Ventura County Watershed Protection District (WPD). Partners consistently describe the WPD as being significantly underfunded relative to the watershed's growing flood management and maintenance needs. This chronic lack of resources limits WPD's ability to maintain existing infrastructure, pursue nature-based solutions, or participate fully in proactive, watershed-wide resilience planning.

Recent investments demonstrate that local agencies are taking meaningful steps toward improved reliability and preparedness. For example, Casitas Municipal Water District is connecting to the State Water Project, and Ventura River Water District has installed solar-powered Tesla battery systems and is adding a second water tank to increase fire storage capacity and system reliability. While these initiatives strengthen resilience, similar proactive investments are not yet widespread across the watershed, and many opportunities remain to expand planning, coordination, and funding for climate adaptation.

Current monitoring efforts for water quality, habitat, and climate conditions in the watershed, led by entities such as the Ventura Countywide Stormwater Quality Management Program, Ventura County Environmental Health Division, Santa Barbara Channelkeeper, UVRGA implementing their GSP and the Surfrider Foundation, are not systematically integrated, which can result in duplicated work, inconsistent data collection methods, and missed opportunities for adaptive management. Without stronger coordination tools, equity-focused funding streams, and integrated action, many local agencies remain constrained in their ability to address the escalating costs and consequences of climate change.

17. Outdated Permitting and Infrastructure Policies Leave Communities Vulnerable to Climate-Driven Hazards

Permitting frameworks and infrastructure policies currently in use are fragmented, in need of updating to reflect the realities of a changing climate. Operations and community services are often managed independently, which limits the ability to address cross-cutting watershed challenges effectively. Regulatory approaches often lack tools to manage the increasing severity and cascading impacts of climate-driven droughts.

While Groundwater Sustainability Plans (GSPs) for the Upper Ventura River and Ojai Valley basins establish thresholds to avoid 'significant and unreasonable' impacts specifically attributable to groundwater pumping, these regulatory targets are basin-specific and not designed to guarantee year-round ecological function or flow continuity. SGMA mandates the prevention of pumping-induced impacts, yet it does not require GSAs to ensure total habitat resilience against broader compounding stressors like extreme climate variability. The purpose of this Watershed Resilience Plan (WRP) is to build upon the foundational data and management considerations established in the GSPs by incorporating these broader climate vulnerabilities at a watershed scale. By evaluating the intersection of drought, heat, and hydrologic shifts, the WRP identifies where system-wide ecological stress may persist even within sustainably managed basins, particularly in non-prioritized areas like the Upper Ojai where cumulative evaluations of new wells are not currently required.

These gaps leave water systems and natural resources vulnerable during extended droughts and other climate extremes. Meanwhile, Indigenous water rights and traditional land and water stewardship practices remain largely excluded from planning and permitting processes. Inflexible land-use regulations, such as mandatory tree removal in high fire risk zones, undermine ecological protections like oak preservation ordinances, exposing deep conflicts between public safety goals and environmental stewardship, all at a time when climate change is severely degrading and altering ecosystems; making their protection more urgent than ever. The lack of climate-responsive insurance products and financial tools tailored to climate-specific hazards, like wildfire, limits recovery and resilience for affected communities. Additionally, while large-scale projects are urgently needed to strengthen defenses against climate impacts, there are undetermined funding streams to support their ongoing operations and maintenance, leaving these complex water supply systems vulnerable. These systemic and policy gaps undermine the adaptability, resiliency, and long-term functionality of the region’s infrastructure and resource management systems.

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Appendix P

Qualitative Vulnerability Assessment Results

Qualitative Vulnerability Assessment Results

Results of the Qualitative Vulnerability Assessment are denoted with rating as defined in Table B-1.

Table 1 Qualitative Vulnerability Assessment Ratings Key

Code	Level	Color
L	Low	Green
M	Medium	Yellow
H	High	Red
H⁺	Highest	Dark Red

Water Supply

The Water Supply System is defined as the sources of local and imported water and the network of infrastructure that collects, treats, stores, and distributes water to meet water demand.

Table 2 Qualitative Vulnerability Assessment Ratings for the Water Supply System

Functional Group	Functional Group Components	Extreme Heat	Extreme Precipitation and Flooding	Sea Level Rise and Storm Surge	Drought	Wildfire	Marine Fog
Casitas Municipal Water District Surface Water and Distribution System	Lake Casitas, Robles Canal, Robles Diversion & Fish Passage Facility, Marion Walker Pressure Filtration Plant	M	H*	N/A	H	H	N/A
Casitas Municipal Water District Groundwater Wells and Distribution System for the Ojai area	Ojai Water System Wells; San Antionio Manganese Filtration Treatment Plant	L	M	N/A	H*	M/L	N/A
Casitas Municipal Water District Groundwater Wells and Distribution System for the Ojai area	San Antionio Manganese Filtration Treatment Plant Distribution Lines	L	M	N/A	H*	H	N/A
City of Ventura – Ventura Water Surface/Subsurface/Groundwater Water Supply Infrastructure	Foster Park Subsurface Intake*, Foster Park Subsurface Dam, Foster Park Wells	N/A	H	N/A	H	H*	N/A
City of Ventura – Ventura Water Surface/Subsurface/Groundwater Water Supply Infrastructure	Avenue Water Treatment Plant	N/A	M	N/A	H	H*	N/A
City of Ventura – Ventura Water Surface/Subsurface/Groundwater Water Supply Infrastructure	Avenue Water Treatment Plant Distribution Lines	N/A	H	N/A	H	H*	N/A
City of Ventura – Ventura Water Re-Use and Reclamation Facilities	Wastewater conveyances to Ventura Water Reclamation Facility	N/A	L	H	M	M/L	L
Meiners Oaks/Mira Monte area Groundwater Supply Infrastructure	Mira Monte Well (CMWD), Meiners Oaks County Water District Wells, Ventura River Water District Wells	L	M	N/A	H*	M/L	N/A
Mutual Water Company Surface Water Supply Infrastructure in the Ojai area	Senior Canyon Reservoir	H*	H	N/A	H*	H*	N/A
Unincorporated domestic and agricultural infrastructure	Matilija Creek and North Fork Matilija Creek: Unincorporated Infrastructure, including private groundwater wells, residential graywater and rain barrel systems, private surface water intakes, agricultural wells, agricultural stock ponds**, irrigation systems**,	L	L	N/A	H	L	N/A
	Coyote Creek and Upper Ventura River: Unincorporated Infrastructure, including private groundwater wells, residential graywater and rain barrel systems, private surface water intakes, agricultural wells, agricultural stock ponds**, irrigation systems**,	L	L	N/A	H*	L	N/A
	San Antonio Creek: Unincorporated Infrastructure, including private groundwater wells, residential graywater and rain barrel systems, private surface water intakes, agricultural wells, agricultural stock ponds**, irrigation systems**,	L	L	N/A	H*	L	N/A

Functional Group	Functional Group Components	Extreme Heat	Extreme Precipitation and Flooding	Sea Level Rise and Storm Surge	Drought	Wildfire	Marine Fog
	Lower Ventura River Watershed: Unincorporated Infrastructure, including private groundwater wells, residential graywater and rain barrel systems, private surface water intakes, agricultural wells, agricultural stock ponds**, irrigation systems**,	N/A	L	M	H	L	L
Ventura County Public Works Agency Water Management Projects	Matilija Reservoir	L	H*	N/A	L	H	N/A
Wastewater Treatment in the Ojai area	Ojai Valley Sanitary District Wastewater Treatment Plant	L	H	N/A	L	H*	N/A
Wastewater Treatment in the Ojai area	Ojai Valley Sanitary District Wastewater Treatment Plant Distribution Lines	L	H	N/A	L	H*	N/A

Flood Management

The Flood Management System is the network of natural and engineered structures that conveys high flows or prevents inundation of land with the intent of reducing the impacts of flooding on communities, infrastructure, and the environment.

Table 3 Qualitative Vulnerability Assessment Ratings for the Flood Management System

Functional Group (Asset)	Functional Group Components	Extreme Heat	Extreme Precipitation and Flooding	Sea Level Rise and Storm Surge	Drought	Wildfire	Marine Fog
Natural Features	Matilija Creek and North Fork Matilija Creek, floodplains	L	L	N/A	L	M	N/A
Natural Features	Santa Ana Creek, Coyote Creek, floodplains	L	L	N/A	L	M	N/A
Diversion and Reservoir Infrastructure	Lake Casitas, Robles Diversion, Robles-Casitas Canal	L	H*	N/A	M/L	H	N/A
Regional flood management	Meiners Oaks SD Infrastructure (no levee), Mira Monte SD Infrastructure, Oak View SD Infrastructure (leveed), McDonald Canyon Detention Basin	L	H*	N/A	M/L	M	N/A
Natural Infrastructure	Meiners Oak Floodplains, Ojai Meadows Preserve	L	L	N/A	L	M	N/A
Diversions and Detention Basins	Live Oak Creek Dam and Diversion Channel, Live Oak Acres Levee	L	H*	N/A	M/L	M	N/A
Local flood management	Ojai SD Infrastructure (eastern Ojai Region, no levee), Senior Canyon Dam, (storm drainage infrastructure in other municipalities)	L	H	N/A	M/L	M	N/A
Natural Infrastructure	San Antonio Creek Floodplains (Mira Monte & East Ojai Alluvial Fans), Valley View Preserve	L	L	N/A	L	M	N/A
Natural Features and Local flood management	Ventura River Floodplain, Foster Park/Weldons/Ortonville SD Infrastructure (no levee)	N/A	H	N/A	L	M	N/A
Regional flood management (levee-protected)	Casitas Springs SD Infrastructure, Casitas Springs Levee, Fresno Canyon Debris Trap	N/A	H	N/A	M/L	M	N/A
Regional Flood Management	Ventura SD Infrastructure, Ventura River Levee, Dent Debris Basin	N/A	H	H*	M/L	M	N/A
Coastal and Estuarine Features	Surfer's Point Managed Shoreline Retreat; Ventura River Estuary, coastal beaches and wetlands	N/A	H	H*	L	M	N/A

Groundwater Management

The Groundwater Management System includes water stored in underground aquifers (i.e., groundwater basins or subbasins) and natural and engineered infrastructure, natural processes, and management practices that contribute to recharge, storage, and withdrawal.

Table 4 Qualitative Vulnerability Assessment Ratings for the Groundwater Management System

Functional Group (Asset)	Functional Group Components	Extreme Heat	Extreme Precipitation and Flooding	Sea Level Rise and Storm Surge	Drought	Wildfire	Marine Fog
Spreading Grounds & Managed Recharge	San Antonio Creek Spreading Grounds; Private managed recharge	M	L	N/A	H*	H*	N/A
Natural Recharge Reaches	Matilija Creek and North Fork Matilija Creek fractured bedrock recharge areas, riparian areas	M	L	N/A	H	L	N/A
Natural Recharge Reaches	Coyote Creek and Upper Ventura River Ventura River alluvial recharge reach, fractured bedrock recharge areas, riparian areas	M	L	N/A	H*	L	N/A
Natural Recharge Reaches	San Antonio Creek mountainfront recharge, fractured bedrock recharge areas, riparian areas	M	L	N/A	H*	M	N/A
Natural Recharge Reaches	Lower Ventura Ventura River alluvial recharge reach (Lower Basin floodplain/estuary corridor)	N/A	L	H*	H	M	N/A

Ecosystems

An ecosystem is a complex network of interconnected and interdependent systems, which includes physical (e.g., soil, air, water, climate, topography) and biological (e.g., plants, animals, fungus, algae, bacteria) components.

Table 5 Qualitative Vulnerability Assessment Ratings for the Ecosystems System

Functional Group (Asset)	Functional Group Components (Resources)	Functional Group Components (Place Names)	Extreme Heat	Extreme Precipitation and Flooding	Sea Level Rise and Storm Surge	Drought	Wildfire	Marine Fog
Beaches and Coastal Dunes	western snowy plover nesting and foraging	Surfer's Point, Seaside Wilderness Park, Emma Wood State Beach, Emma Wood State Beach Campground	N/A	M	H*	M	L	M
Estuary	tidewater goby, southern California steelhead	Ventura River Estuary	M	H	H*	H	M	M
Aquatic; Wetlands; Riparian Corridors - Matilija Creek and North Fork Matilija Creek	southern California steelhead (resident), California red-legged frog, western pond turtle, arroyo toad, least Bell's vireo, southwestern willow flycatcher, yellow-billed cuckoo, Matilija Creek and hotsprings, North Fork Matilija Creek, Bear Creek, Fish-Passage Structures, wildlife corridors, debris basins, invasive Arundo donax (threat)	Matilija Reservoir and dam, Wheeler Gorge, Los Padres National Forest	M/H	M	N/A	H	M	N/A
Aquatic; Wetlands; Riparian Corridors - Coyote Creek and Upper Ventura River	southern California steelhead, western pond turtle, least Bell's vireo, southwestern willow flycatcher, Lake Casitas, Santa Ana Creek, Coyote Creek, Ventura River, Fish-Passage Structures, wildlife corridors, debris basins, invasive Arundo donax (threat)	Casitas Dam, Robles Diversion & Fish Passage Facility, Los Padres National Forest, Ventura River Preserve	M/H	M	N/A	H*	M	N/A
Aquatic; Wetlands; Riparian Corridors - San Antonio Creek	southern California steelhead, California red-legged frog, western pond turtle, arroyo toad, southwestern willow flycatcher, Ventura River, San Antonio Creek, Lion Canyon Creek, Alluvial deposits, Fish-Passage Structures, wildlife corridors, debris basins, invasive Arundo donax (threat)	Camp Comfort	M	M	N/A	H*	H	L
Aquatic; Wetlands; Riparian Corridors - Lower Ventura	tidewater goby, southern California steelhead, California red-legged frog, western pond turtle, southwestern willow flycatcher, least Bell's vireo, Cañada Larga Creek, Ventura River, Fish-Passage Structures, wildlife corridors, Ventura River and Casitas Springs levees, debris basins, invasive Arundo donax (threat)		H	L	H*	H	H*	M/H
Valley floor and Foothills (grasslands, coastal sage scrub, chaparral, oak woodlands and savannas) - Matilija Creek and North Fork Matilija Creek	California condor, California red-legged frog	Los Padres National Forest	M	L	N/A	H	M	N/A
Valley floor and Foothills (grasslands, coastal sage scrub, chaparral, oak woodlands and savannas) - Coyote Creek and Upper Ventura River	California condor, California red-legged frog	Los Padres National Forest	M	L	N/A	H*	M	N/A
Valley floor and Foothills (grasslands, coastal sage scrub, chaparral, oak woodlands and savannas) - San Antonio Creek	California red-legged frog, Upper Ojai Valley, east end Ojai Valley floor, Gridley Canyon, alluvial fan	Los Padres National Forest, Ojai Meadows Preserve, OVLC preserves (e.g., Valley View Preserve, Ojai Meadows)	M	L	N/A	H*	M	L
Valley floor and Foothills (grasslands, coastal sage scrub, chaparral, oak woodlands and savannas) - Lower Ventura	Manuel Canyon, lower Ventura River valley floor, Hammond Canyon		N/A	L	N/A	H	H*	M
Headwater Forests and Mountainous Areas (mixed chaparral, Montane hardwood and coniferous forest) - Matilija Creek and North Fork Matilija Creek	California condor, Matilija Canyon, Cozy Dell Canyon	Matilija Falls, Los Padres National Forest, Federal Wilderness Area	M	L	N/A	H	H*	N/A
Headwater Forests and Mountainous Areas (mixed chaparral, Montane hardwood and coniferous forest) - Coyote Creek and Upper Ventura River	Santa Ynez Mountains	Los Padres National Forest	M	L	N/A	H*	H*	N/A
Headwater Forests and Mountainous Areas (mixed chaparral, Montane hardwood and coniferous forest) - San Antonio Creek	Topa Topa Mountains	Los Padres National Forest	M	L	N/A	H*	H*	L

Functional Group (Asset)	Functional Group Components (Resources)	Functional Group Components (Place Names)	Extreme Heat	Extreme Precipitation and Flooding	Sea Level Rise and Storm Surge	Drought	Wildfire	Marine Fog
Agricultural Lands and Orchards - Matilija Creek and North Fork Matilija Creek	pollinators	Orchards and croplands along North Fork Matilija	H	M	N/A	H	M	N/A
Agricultural Lands and Orchards - Coyote Creek and Upper Ventura River	pollinators	Orchards and croplands along Ventura River	H*	M	N/A	H*	M	N/A
Agricultural Lands and Orchards - San Antonio Creek	pollinators	Orchards and croplands in Ojai Valley and San Antonio Creek	H*	M	N/A	H*	M	M
Agricultural Lands and Orchards - Lower Ventura	pollinators	Taylor Ranch and croplands along Ventura River	N/A	H	H*	H	L	M

Water Quality

Water Quality is the set of parameters and properties measurable in natural water bodies, aquifers, and associated built infrastructure.

Table 6 Qualitative Vulnerability Assessment Ratings for the Water Quality System

Functional Group (Asset)	Functional Group Components	Extreme Heat	Extreme Precipitation and Flooding	Sea Level Rise and Storm Surge	Drought	Wildfire	Marine Fog
Septic Systems/ Individual Septic Treatment systems - Matilija Creek and North Fork Matilija Creek	Rural septic areas (Wheeler Springs, Ojala)	M/L	H	N/A	L	L	N/A
Septic Systems/ Individual Septic Treatment systems - Coyote Creek and Upper Ventura River	Rural septic areas (Meiners Oaks, Oak View and Oak View Vicinity, Lake Casitas area, Live Oak Acres	M/L	H	N/A	L	L	N/A
Septic Systems/ Individual Septic Treatment systems - San Antonio Creek	Rural septic areas in Upper Ojai Valley, Ojai city outskirts, San Antonio Creek drainage, Thacher Creek	M/L	H*	N/A	L	L	N/A
Septic Systems/ Individual Septic Treatment systems - Lower Ventura	Septic systems serving scattered residences and small communities, Rural septic areas in Casitas Springs	N/A	H	N/A	L	L	N/A
Natural Waterways and Waterbodies - Matilija Creek and North Fork Matilija Creek	Matilija Creek, North Fork Matilija Creek	H	M	N/A	H	M	N/A
Natural Waterways and Waterbodies - Coyote Creek and Upper Ventura River	Coyote Creek, Upper Ventura River	H	M	N/A	H	M	N/A
Natural Waterways and Waterbodies - San Antonio Creek	San Antonio Creek, Thacher Creek, Reeves Creek, Fox Canyon Barranca	H	M	N/A	H	M	L
Natural Waterways and Waterbodies - Lower Ventura	Canada Larga Creek, Lower Ventura River	N/A	H	N/A	H	M	M
Source-Water & Watershed Protection Areas - Matilija Creek and North Fork Matilija Creek	Los Padres National Forest headwaters (Matilija & North Fork canyons)	M	M	N/A	H	M/H	N/A
Source-Water & Watershed Protection Areas - Coyote Creek and Upper Ventura River	Coyote Creek watershed, wellhead protection zones for Ventura River CWD and Foster Park wells, planned PFAS/nitrate management areas in Upper Ventura River Basin	M	M	N/A	H	M/H	N/A
Source-Water & Watershed Protection Areas - San Antonio Creek	Topatopa Mountains headwaters (San Antonio Creek drainage), Ojai Basin Groundwater Management Area (wellhead protection), planned nitrate/PFAS management zones in Ojai Basin	H	H	N/A	H	M/H	N/A
Source-Water & Watershed Protection Areas - Lower Ventura	Lower Ventura River alluvial aquifer recharge corridor, Foster Park wellfield protection area (downstream zone), planned PFAS/nitrate management areas in Lower Ventura Basin	N/A	M	N/A	H	M/H	N/A

Cultural Resources

The Cultural Resources System includes Indigenous practices, such as subsistence fishing, ethnobiologically significant natural resources, and culturally important landscape elements.

Table 7 Qualitative Vulnerability Assessment Ratings for the Cultural Resources System

Functional Group (Asset)	Functional Group Components	Extreme Heat	Extreme Precipitation and Flooding	Sea Level Rise and Storm Surge	Drought	Wildfire	Marine Fog
Villages, Sacred Sites, and Ceremonial Places - Matilija Creek and North Fork Matilija Creek	Summer solstice gatherings; Los Padres National Forest; Potential sacred stream/floodplain sites in upper watershed	M	H*	N/A	M	H*	N/A
Villages, Sacred Sites, and Ceremonial Places - San Antonio Creek	Possible basket-weaving workshops and plant harvesting; cultural/sacred sites along streams and floodplains; Ojai Day Festival	M	H	N/A	M	H*	L
Villages, Sacred Sites, and Ceremonial Places - Coyote Creek and Upper Ventura River	Chumash Tule-boat launches; cultural/sacred sites along Ventura River and tributaries; Indigenous village & ranchería clusters near tributary confluences	M	H*	N/A	M	H*	L
Villages, Sacred Sites, and Ceremonial Places - Lower Ventura	Hutash Festival (Thompson Blvd) and procession from Shisholop to the Fairgrounds; Foster Park and shrine place for the sun; Wind Sycamore in Cañada Larga area; Winter Solstice shrine site at Taylor Ranch; Shisholop coastal village site; Ventura River mouth and adjacent floodplain areas; Indigenous village and rancheria clusters at river mouth	M	H	H	M	H*	M/H
Traditional Subsistence and Cultural Vegetative Resources - Matilija Creek and North Fork Matilija Creek	Trees: Oaks, Elderberry, Black Walnut, Pinon Pine Riparian/Wetland: Willow, Mugwort, Tule, Cattails, Juncus Medicinal & Cultural Plants: Datura, Artemisia, Chia Sage, Toyon, Brodiaea bulbs, Soaproot, Milkweed	M	L	N/A	H	H*	N/A
Traditional Subsistence and Cultural Vegetative Resources - San Antonio Creek	Riparian/Wetland: Willow, Tule, Mugwort, Cattails, Juncus Medicinal & Cultural Plants: Artemisia, Toyon, Soaproot, Chia Sage, Brodiaea bulbs, Milkweed Trees: Oaks, Elderberry, Black Walnut	M	L	N/A	H*	H*	L
Traditional Subsistence and Cultural Vegetative Resources - Coyote Creek and Upper Ventura River	Riparian/Wetland: Willow, Tule, Mugwort, Cattails, Juncus Medicinal & Cultural Plants: Datura, Artemisia, Chia Sage, Toyon, Soaproot, Brodiaea bulbs, Milkweed Trees: Oaks, Elderberry	M	L	N/A	H*	H*	L
Traditional Subsistence and Cultural Vegetative Resources - Lower Ventura	Riparian/Wetland: Willow, Tule, Cattails, Juncus Upland/Medicinal: Mugwort, Soaproot, Milkweed, Toyon Trees: Oaks, Elderberry	M	M/H	H	M/H	H*	H
Traditional Subsistence and Cultural Animal Resources - Matilija Creek and North Fork Matilija Creek	Steelhead, deer, mountain lion, tiger salamander, red-legged frog, Bobcats, bear, and beaver. Egret, Blue Heron, Hawk, Eagle, woodpecker, hummingbird, Skunk, Coyote, Butterfly, snakes. (Many of these appear in oral stories and creation stories.)	M	M	N/A	H	H*	N/A
Traditional Subsistence and Cultural Animal Resources - San Antonio Creek	Salmon, steelhead, deer, mountain lion, tiger salamander, red-legged frog, Bobcats, bear, and beaver. Egret, Blue Heron, Hawk, Eagle, woodpecker, hummingbird, Skunk, Coyote, Butterfly, snakes. (Many of these appear in oral stories and creation stories.)	M	M	N/A	H*	H*	L
Traditional Subsistence and Cultural Animal Resources - Coyote Creek and Upper Ventura River	Salmon, steelhead, deer, mountain lion, tiger salamander, red-legged frog, Bobcats, bear, and beaver. Egret, Blue Heron, Hawk, Eagle, woodpecker, hummingbird, Skunk, Coyote, Butterfly, snakes. (Many of these appear in oral stories and creation stories.)	M	M	N/A	H*	H*	L
Traditional Subsistence and Cultural Animal Resources - Lower Ventura	Salmon, steelhead, deer, mountain lion, tiger salamander, red-legged frog, Bobcats, bear, and beaver. Egret, Blue Heron, Hawk, Eagle, woodpecker, hummingbird, Skunk, Coyote, Butterfly, snakes. (Many of these appear in oral stories and creation stories.)	M	M	H	M	M	M/H
Coastal Beaches & Parks	Emma Wood State Beach, Emma Wood State Beach Campground, Foster Park	N/A	H	H*	L	L	M
Rivers, Reservoirs & Trail Corridors - Matilija Creek and North Fork Matilija Creek	Trails in the mountains and Los Padres NF, Creek-side greenways, swimming (river pods)	L	H*	N/A	M	H*	N/A
Rivers, Reservoirs & Trail Corridors - San Antonio Creek	Trails in the mountains and Los Padres NF, Creek-side greenways, swimming (river pods)	L	H	N/A	M	H*	M
Rivers, Reservoirs & Trail Corridors - Coyote Creek and Upper Ventura River	Creek-side greenways, swimming (river pods), Matilija Reservoir (fishing, boating, etc.)	L	H	N/A	M	H*	N/A
Rivers, Reservoirs & Trail Corridors - Lower Ventura	Ventura River Bike Trail, Ventura River Corridor, Emma Wood River Trail, creek-side greenways, swimming (river pods)	N/A	H	H*	M	M/H	M
Natural hot springs	Matilija Hot Springs, Wheeler Hot Springs	M	H*	N/A	M	M/H	N/A

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Appendix Q

Quantitative Assessment

Quantitative Assessment

Flood vulnerabilities within Ventura River water resource systems and their sensitivity to climate change were found to be priority concerns throughout the Ventura River watershed based on qualitative vulnerability assessment findings and interviews with asset managers. Engagements with Advisory Group members identified broad interest in projections of flood hazards. The common data gap, acknowledged by watershed agencies, has been a lack of analysis utilizing new climate data released in the past few years. Understanding how new climate models characterize future flood vulnerability as compared to historical could improve planning for future flood mitigation adaptation strategies. To enable the Watershed Network to robustly plan for flood possibilities and manage risk, this assessment aims to quantify and confirm this high priority concern.

Multiple approaches for a quantitative assessment were considered. These included a flood-hazard assessment, a drought/extreme heat/sea level rise hazard assessment, and a flood/wildfire hazard assessment. The project team selected the flood-hazard assessment because a detailed assessment of future changes in flood magnitude due to climate change has not been completed for this basin. Other factors considered in the selection include 1) interest expressed by asset managers in projections of flood hazards, 2) recognition of planning and implementation efforts by asset managers and interested parties in the watershed that are underway to address other hazards, and 3) the potential for redundancies or discrepancies between analyses for related efforts.

Overview

The quantitative assessment in this study is informed by assessment guidance from the DWR Watershed Resilience Planning Toolkit as well as input from VRWRP Advisory Group members on assessment objectives. It was determined that the assessment should consider flood evidence in observed and projected future climate contexts. Observed climate reflects historical evidence from weather and water observation systems. Projected future climate reflects scenarios of future climate reflecting human influences (e.g., greenhouse gas emissions) climate model simulation of global to local climate responses to these influences, and hydrologic modeling to translate local climate response into runoff. The quantitative assessment approach used in this study involves conducting new analyses focused on flood vulnerability and vulnerability-reduction assessments under these two climate contexts.

- Preliminaries: Gather and review data for the two climate contexts.
- Hydrology: Characterize runoff at hydrologic assessment locations of interest, focusing on hydrologic metrics relevant to flood control. First characterize metrics under Observed Climate. Subsequently identify projected changes in metrics within simulated historical to future projections of climate and hydrology. Lastly, impose those changes on Observed Climate metrics to estimate Future Climate metrics.
- Hydraulics: Using the projected changes in the runoff under climate change, estimate potential changes to flood elevations during peak flows at two example assessment locations.
- Vulnerability Reduction: Assess potential impacts of climate-related hazards on watershed areas near hydraulic assessment locations by correlating existing floodplain boundaries with projected changes in floodplain depth and spatial extent. Based on this analysis, adaptation strategies are identified to help reduce vulnerability.

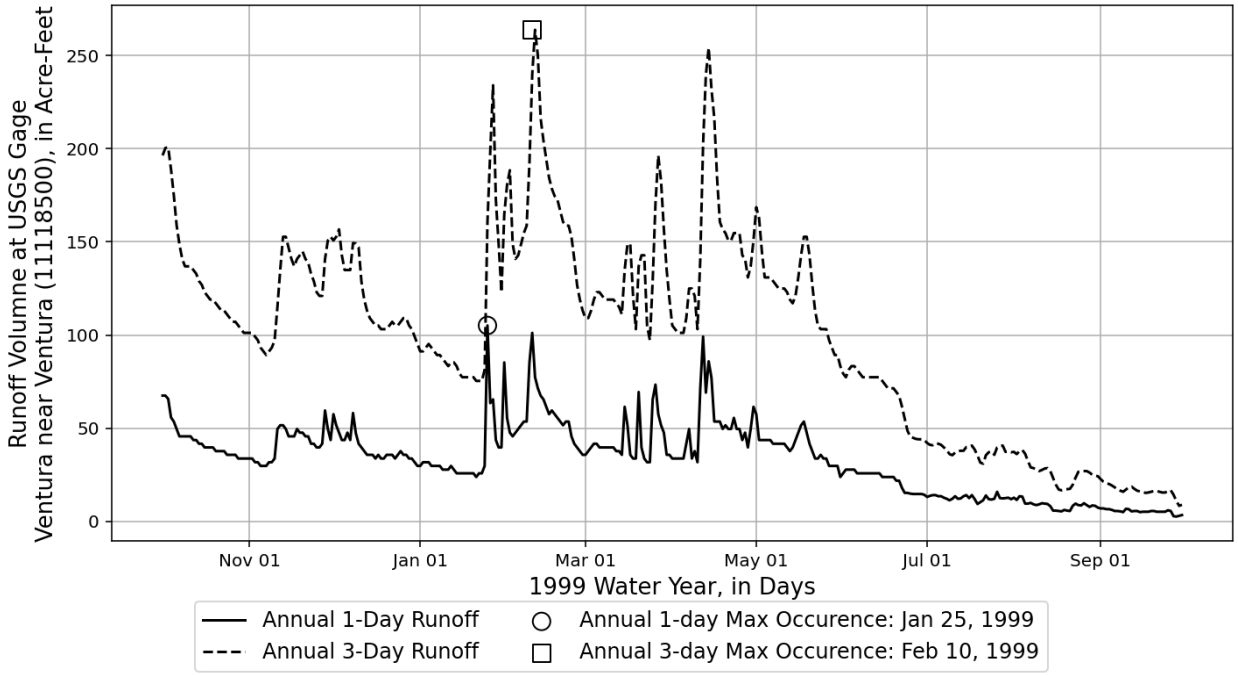
The hydrologic metrics adopted for flood analysis are meant to indicate hydrologic events and hydraulic loadings relevant to flood control, while respecting the limits of available observational and simulation

data to characterize flood vulnerability impacts under climate change. To this end, two metrics were selected to represent flood vulnerability:

- Annual 1-day maximum runoff volume (Ann1DayMax) identified every water year (WY, October-September) during a climate analysis period (e.g., Observed, Future).
- Annual 3-day maximum runoff volume (Ann3DayMax) identified every WY during a climate analysis period.3

To illustrate occurrence of Ann1DayMax and Ann3DayMax within a water year, Figure 1 shows the occurrence of both metrics, using WY 1999 as an example, at the U.S. Geological Survey National Water Information System (NWIS) gage 11118500 "Ventura River near Ventura" (USGS 2016).

Figure 1 Flood Metrics illustrated for Water Year 1999 at USGS Gage 11118500 Ventura River near Ventura.



Context

Before presenting this analysis, it is helpful to conceptually reason how Ventura River flood hydrology might respond to a warming climate, where heavier precipitation is expected because warmer air holds more moisture (Martinkova and Kysely, 2020). A paradox has been observed: despite historical warming and increases in heavy precipitation, corresponding increases in floods have not been consistently observed and in some cases flood magnitudes have diminished (Sharma et al. 2018). Flood response depends not only on precipitation intensity but also on antecedent hydrologic conditions, storm extent and persistence, catchment size and geometry, and whether precipitation falls as rain or snow. Smaller catchments relative to storm areas are expected to be more sensitive to warming because storms saturate soils across the entire catchment, increasing the fraction of rainfall contributing to runoff (Sharma et al. 2018). Consistent with these concepts, this analysis uses localized climate projections and a process-based watershed model that accounts for antecedent conditions and catchment characteristics, as explained in subsequent sections.

Data Sources

This section describes observed and projected future climate data sources used to characterize Ventura River hydrologic and hydraulic conditions relevant for the watershed flood vulnerability assessment.

Observed Climate and Hydrology

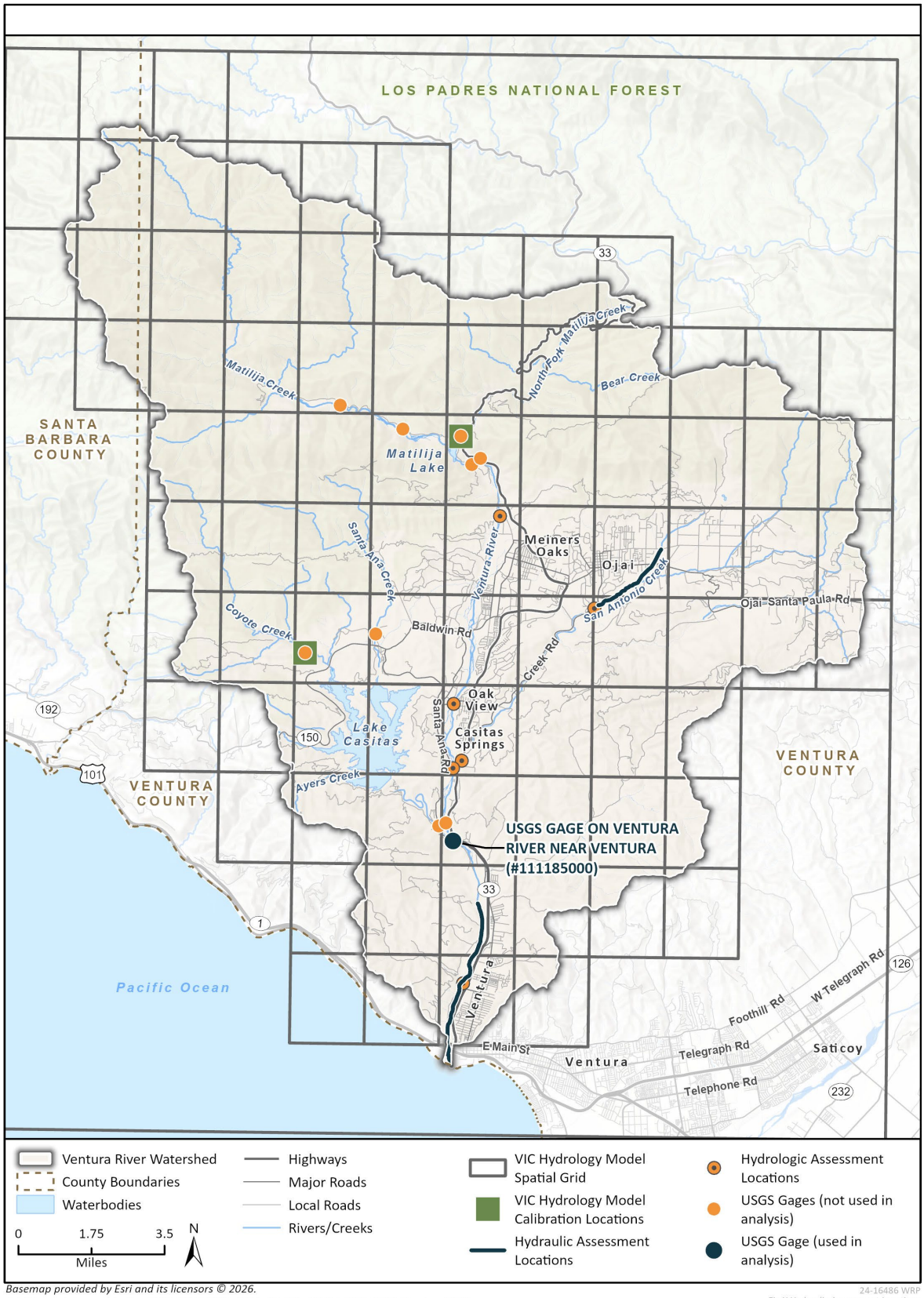
The following data sources were used in this analysis (Figure 2) under observed climate:

- Observed streamflow in the Ventura River near Ventura as reported through the USGS NWIS gage 11118500, selected from available NWIS gages within the watershed (Table 1, Figure 2) for having a period of record sufficient for supporting hydrologic assessment in this study.
- Estimated river withdrawals at the Robles Diversion structure for WY 1960-present based on using the Lake Casitas Yield Model (CMWD, 2022) reflecting diversion criteria aligned with the 2003 National Marine Fisheries Service's Biological Opinion (NOAA Fisheries, 2023).
- Simulated streamflow at hydrologic assessment locations of interest generated using the Variable Infiltration Capacity (VIC) hydrology model (Liang et al. 1994) recently calibrated at locations throughout California (Bass 2023a) including several locations in the Ventura River watershed (Figure 2), simulating runoff at 3.5 km spatial resolution throughout the watershed.
- Analyzed daily weather at 3.5 km spatial resolution used to force VIC simulation of runoff under Observed Climate and developed based on spatially distributing station-based weather observations to 3.5 km gridded resolution (Bass 2023a).
- Discharge data tabulated in the FEMA April 11, 2024 Flood Insurance Study Report, with peak discharge flow rates for the San Antonio Creek (Downstream of the Stewart Canyon Creek Confluence) and Ventura River at Shell Chemical Plant (excludes tributary area that drains to Lake Casitas) (FEMA, 2024).

Table 1 U.S. Geological Survey streamflow gauging stations within the Ventura River Watershed.

Station ID	Description	Begin Date	End Date
11114495	11114495 MATILIJA C NR RES NR MATILIJA HOT SPRINGS CA	2/15/2002	10/21/2025
11114500	11114500 MATILIJA C AB RES NR MATILIJA HOT SPRINGS CA	6/1/1948	9/30/1969
11115500	11115500 MATILIJA C A MATILIJA HOT SPRINGS	10/1/1927	9/30/1988
11116000	11116000 NF MATILIJA C A MATILIJA HOT SPRINGS CA	10/1/1928	9/30/1983
11116500	11116500 VENTURA R NR OJAI CA	10/1/1911	6/30/1924
11116550	11116550 VENTURA R NR MEINERS OAKS CA	6/1/1959	9/30/1988
11117500	11117500 SAN ANTONIO C A CASITAS SPRINGS	10/1/1949	9/30/1983
11117600	11117600 COYOTE CREEK NEAR OAK VIEW CA	10/1/1958	9/30/1988
11117800	11117800 SANTA ANA C NR OAK VIEW	10/1/1958	9/30/1988
11118000	11118000 COYOTE C NR VENTURA CA	10/1/1927	9/30/1982
11118400	11118400 VENTURA R DIV NR VENTURA CA	10/1/1969	9/30/2007
11118500	11118500 VENTURA R NR VENTURA	10/1/1929	6/15/2025
11118501	11118501 VENTURA R NR VENTURA+ DIV. CA	10/1/1932	9/30/2007

Figure 2 Study Area for Quantitative Assessment of Flood Vulnerability



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Additional data provided by CPAD, 2025; NHD, 2024; US EPA, 2022; USGS, 2025; Stantec, 2026.

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Fig X Hydraulic Assessment Locations

Future Climate and Hydrology

Future watershed climate and hydrology estimates are provided within a 129-member ensemble of recent climate and hydrology projections over California, developed in support of the 5th California Climate Change Assessment (CCCA5). The projections reflect global climate model (GCM) outputs from the Coupled Model Intercomparison Project Phase 6 (CMIP6) downscaled into localized climate over California using the LOCA2-Hybrid technique (Pierce et al. 2023a). The global projections were generated using different GCMs simulating different climate forcing pathways (i.e. Shared Socioeconomic Pathways, or SSPs, reflecting possible future greenhouse gas emissions), under different simulation variations (e.g., reflecting different climate system initial conditions, GCM physics representations, etc.). The resulting LOCA2-Hybrid CMIP6 ensemble of localized climate projections was referenced in developing the Ventura Watershed Resilience Plan's climate-related hazards (Chapter 4 Future Climate Conditions) and qualitative vulnerability assessment (Chapter 5 Climate Vulnerability and Risk Assessment).

A 21-member subset of the 129 LOCA2-Hybrid CMIP6 ensemble (Table 2) was translated into localized, gridded California statewide hydrology projections (Bass et al. 2023, Bass 2023b) using the same VIC hydrology model application referenced in the preceding section on Observed Climate data sources. The VRWRP team leveraged this 21-member subset to align with California Energy Commission initiatives, including the CCCA5, and in doing so relied on the climate projections subset selection rubric applied by the VIC modeling team at University of California Los Angeles, in collaboration with the downscaling team at Scripps Institution of Oceanography. These gridded runoff projections were generated for WY 1951-2100 and published at daily timestep. For this study, those gridded runoff results were spatially aggregated within Ventura River watershed areas tributary to hydrologic assessment locations of interest (Figure 2) to estimate streamflow.

Table 2 Global Climate Projections underlying Future Hydrology Projections used in this study.

Projection Number	Emissions Pathway	Global Climate Model	Simulation Variant [1]
1	ssp370	ACCESS-CM2	r1i1p1f1
2	ssp370	CESM2-LENS	r1i1p1f1
3	ssp245	CNRM-ESM2-1	r1i1p1f2
4	ssp370	CNRM-ESM2-1	r1i1p1f2
5	ssp585	CNRM-ESM2-1	r1i1p1f2
6	ssp245	EC-Earth3-Veg	r1i1p1f1
7	ssp370	EC-Earth3-Veg	r1i1p1f1
8	ssp585	EC-Earth3-Veg	r1i1p1f1
9	ssp370	FGOALS-g3	r1i1p1f1
10	ssp245	GFDL-ESM4	r1i1p1f1
11	ssp370	GFDL-ESM4	r1i1p1f1
12	ssp585	GFDL-ESM4	r1i1p1f1
13	ssp370	INM-CM5-0	r1i1p1f1
14	ssp370	IPSL-CM6A-LR	r1i1p1f1
15	ssp370	KACE-1-0-G	r1i1p1f1

Projection Number	Emissions Pathway	Global Climate Model	Simulation Variant [1]
16	ssp370	MIROC6	r1i1p1f1
17	ssp245	MPI-ESM1-2-HR	r1i1p1f1
18	ssp370	MPI-ESM1-2-HR	r1i1p1f1
19	ssp585	MPI-ESM1-2-HR	r1i1p1f1
20	ssp370	MRI-ESM2-0	r1i1p1f1
21	ssp370	TaiESM1	r1i1p1f1

[1] A given combination of GCM (Global Climate Model) and SSP (Shared Socioeconomic Pathways) may be analyzed using multiple global climate simulations reflecting different initial climate system conditions, different physics packages driving different atmosphere, ocean, and land processes, and/or different methods for representing climate forcings (Taylor et al. 2018). This gives rise to simulation variants that are labeled in CMIP6 using an r-i-p-f convention, where r denotes future climate realization reflecting a unique initial condition, i reflects the method to establish initial conditions, p reflects the version of GCM physics, and f reflects the version of climate forcings.

The simulated historical estimates within the runoff projections during WY 1951-2014 align with observed climate variance but not seasonal, annual, or decadal sequencing. Variance alignment is achieved by bias-correcting the underlying LOCA2-Hybrid CMIP6 climate projections' precipitation and temperature variances relative to observed climate variance (Pierce et al. 2023b) while permitting the resulting sequences to still follow GCM-simulated precipitation and temperature sequences arising from simulating the global climate system and embedded weather patterns. This leads to sequences that fit within the observed climate variance but offer unique seasonal, annual, and decadal sequencing. Thus, for the historical period of WY 2015-2100, the localized climate and hydrology outputs align with climate variance during that period but portray different plausible historical drought and flood variability.

The VIC application was calibrated at various locations throughout the state to reproduce observed runoff when driven by observed weather conditions synthesized from federal and non-federal monitoring networks. Results (Bass 2023a) show that the model can skillfully reproduce observed runoff at calibration locations. Comparison of VIC hydrology simulation of runoff to the Ventura River near Ventura during observed climate versus USGS observed streamflow at this location suggests that the VIC application is generally skillful for this study's interests (Figure 3) but also biased (Figure 4). The sequencing of simulated events generally conforms to observations, from daily occurrences of storm flows to the relative wet to dry runoff volumes on monthly and annual time scales. The magnitude of simulated runoff tends to be biased less than observations overall. These VIC application biases are corrected in a mean sense based on how projected runoff estimates are used in the Flood Vulnerability Assessment, as will be discussed later.

Annual precipitation, temperature, and runoff projections, as well as annual maximum one-day runoff projections are statistically summarized through time on Figure 5, which shows minimum and maximum values from the 21-member ensemble at each projection year as well as percentile values indicated. The projections depict a stable to slightly expanding envelope of variation for precipitation and runoff from historical to future periods, and warming temperature conditions.

Figure 3 Observed and VIC-simulated Runoff for Ventura River near Ventura.

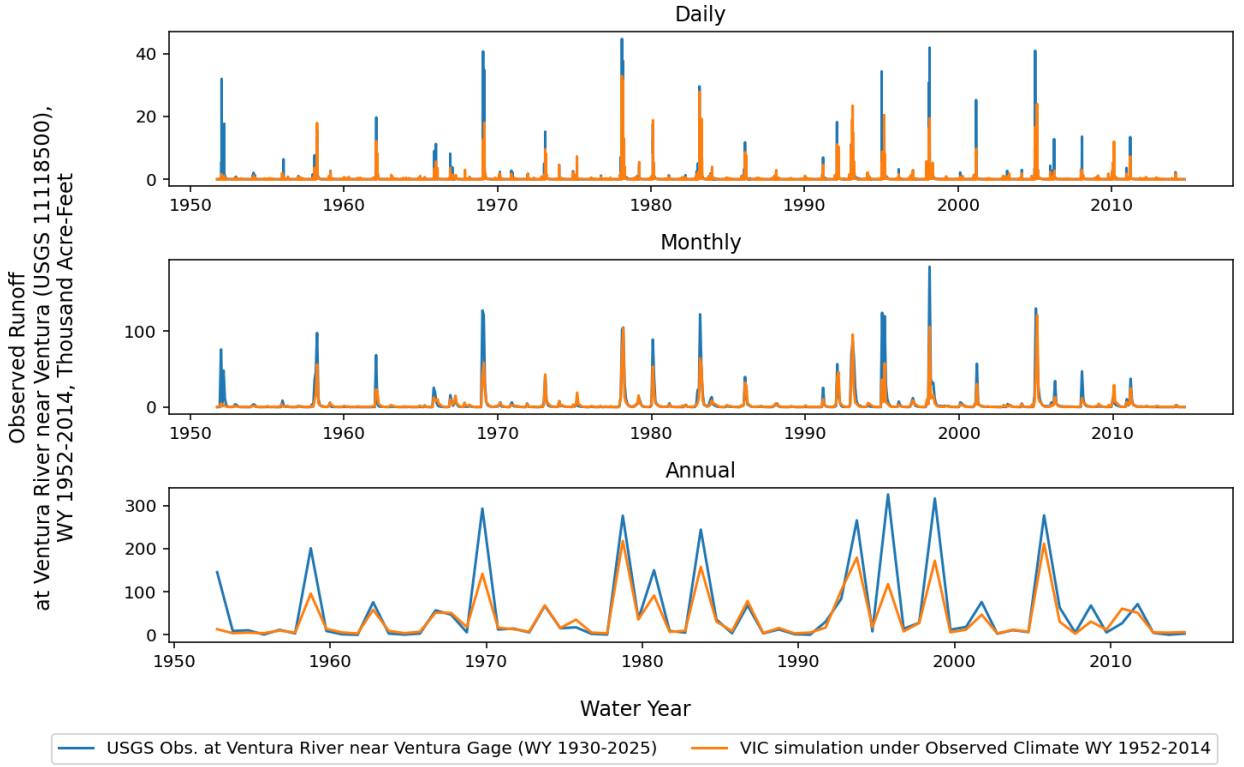


Figure 4 Relationship of Daily, Monthly, and Annual Observed versus VIC-simulated Runoff Ventura River near Ventura.

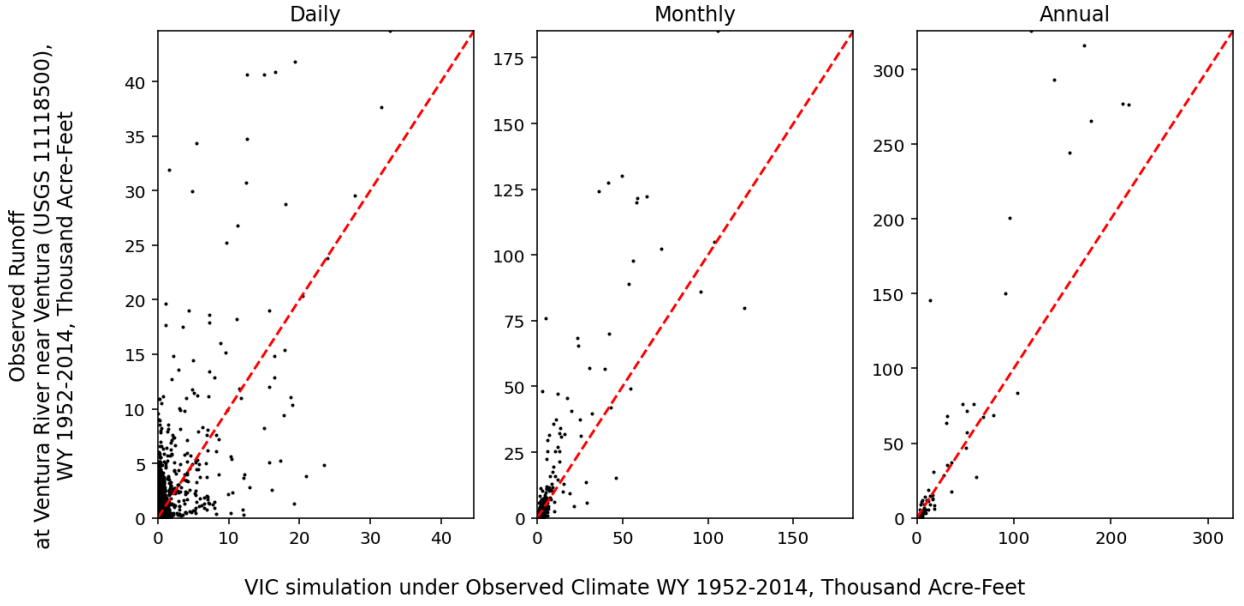
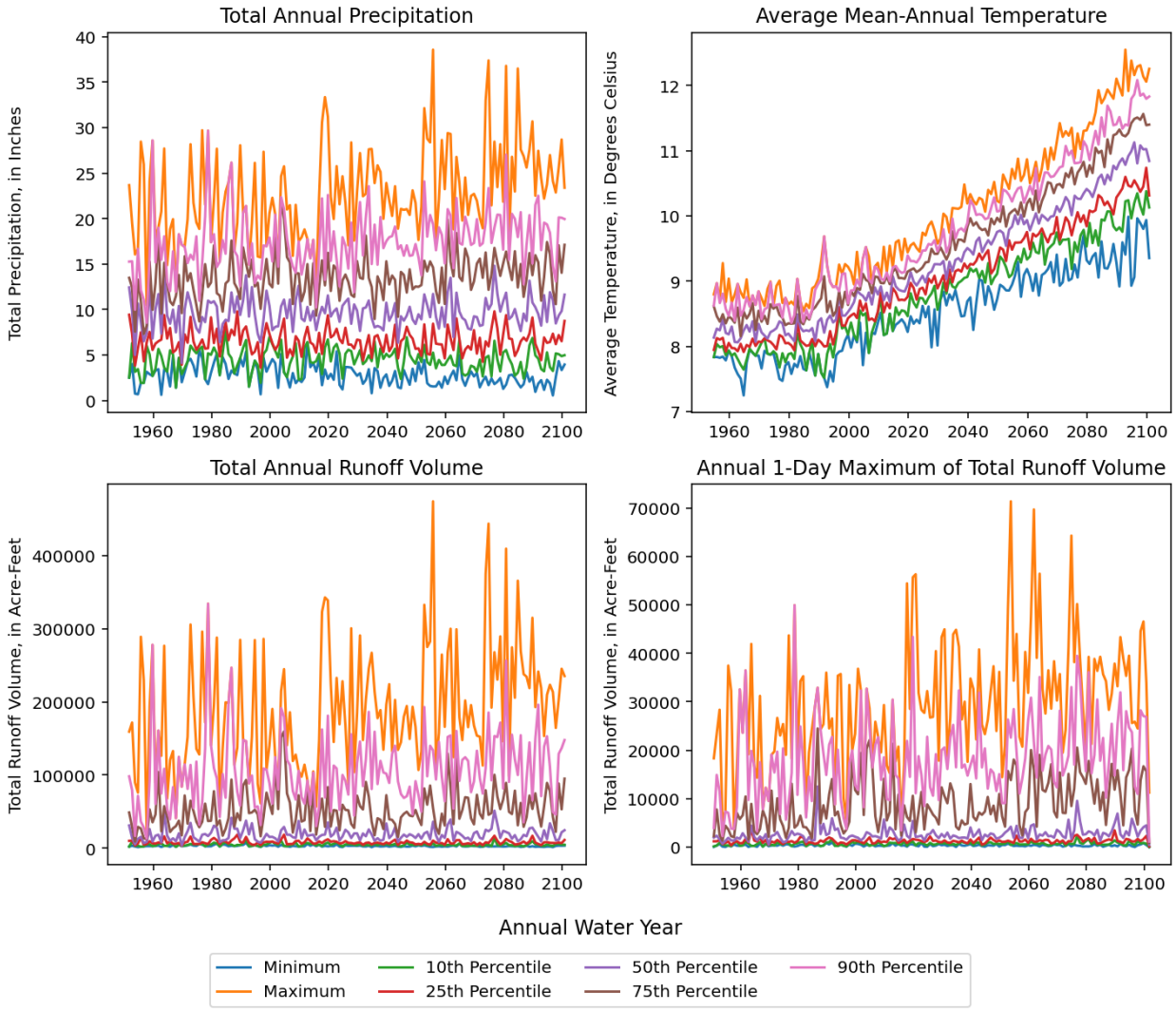


Figure 5 VIC-simulated Hydrology Projections in the Ventura River near Ventura.



Hydrologic Analysis

Acute high-runoff events from the upper watershed accumulate to stress lower watershed flood management systems. As noted, this hydrologic assessment considers the flood metrics Ann1DayMax and Ann3DayMax at multiple locations spanning upper to lower watershed as shown on Figure 2.

The flood vulnerability assessment involves characterizing Observed Climate flood metrics and then superimposing projected runoff changes to estimate Future Climate flood metrics. For discussing future conditions, several terms are used in this study:

- Future Climate – reflects a Future Climate having similar sequence as Observed Climate but perturbed by projected changes within projected climate information.
- Near-Future Climate and Distant-Future Climate – like Future Climate, but specific to future periods roughly representing middle- and late-21st century.
- projected climate – refers to localized climate and hydrology projections' simulated conditions during historical to future periods within the projections.

Generally, the evaluation involves the following steps:

1. Adopt climate periods to support flood vulnerability assessment, including Observed Climate, projected climate (historical to future), Near-Future Climate, and Distant-Future Climate.
2. Adopt data sources for Observed Climate and Future Climate flood hydrology (described in preceding section).
3. Estimate Ventura River flood hydrology metrics during Observed Climate.
4. Estimate Ventura River flood hydrology metrics during Future Climate as projected runoff changes imposed on Observed Climate values.

Select Climate Analysis Periods for Flood Metrics

Observed Climate

Several considerations informed the period selection for Observed Climate flood hydrology analysis:

- Over the past century, there has been significant warming over California.
- There has been little to no evidence of a clear century-scale trend in total annual precipitation, but precipitation variability appears to have been increasing since the 1980s (OEHHA 2022) reflecting intensifying wet periods balanced by longer dry spells.
- Heavy precipitation is dominant driver of historical flood occurrence in the Ventura River watershed. While temperature variability and historical warming affect the atmospheric moisture holding capacity and resultant water vapor supplying precipitation events (Martinkova and Kysely, 2020), this effect is only one of several factors determining heavy precipitation over the watershed, including large-scale ocean-atmosphere phenomena like El Niño-Southern Oscillation, synoptic-scale weather phenomena like Atmospheric Rivers, and watershed orographic effects where mountain topography interacts with weather systems to determine local rainfall.
- The World Meteorological Organization typically calculates climate normals over a 30-year period. However, longer analysis periods are preferred to characterize climate variability and extreme event statistics related to floods.
- For analysis of variability features like Ann1DayMax and Ann3DayMax, it is desirable to consider observed streamflow variability since Lake Casitas operations began in 1960, thereafter impairing runoff to the Ventura River.
- The VIC hydrology model application over California, used to develop Ventura River hydrology projections, was calibrated to reproduce runoff conditions during a period of observed historical weather variability (WY 1951-2014) at locations shown on Figure 2.
- LOCA2-Hybrid CMIP6 Localized climate projections were bias-corrected to reflect observed California climate variability during (WY 1951-2014).

Weighing these considerations, an Observed Climate period of WY 1960-2014 was selected for analyzing historical flood metrics Ann1DayMax and Ann3DayMax in the Ventura River watershed. Two primary considerations steered this selection. First, given that precipitation variability seems to be the dominant driver of watershed flood events, a longer period of analysis of desired to characterize historical flood statistics. Second, the selected period aligns with the intersection of the period used to both bias-correct localized climate projections and calibrate the VIC hydrology model application, and the period when Lake Casitas operations have impaired runoff to the Ventura River.

Future Climate

Future Climate periods for flood hydrology analysis were determined in similar fashion under similar considerations. Additional factors include:

- We seek to detect change in flood hydrology variability from historical to future periods, which differs from detecting change in climate averages and warrants longer analysis periods.
- While temperature variability has historically been a secondary flood driver relative to precipitation variability, additional warming could close that gap, as increased temperatures lead to increased atmospheric moisture holding capacity and water vapor supplying heavy precipitation events.

Given these interests, it was decided that three projected climate periods should be used in the analysis, fully spanning the projections' simulated historical to future period of localized climate and hydrology projection (WY 1951-2100 period):

- projections historical - defined as the projections' WY 1951-2014, aligned with the Observed Climate variance during that period but expressing different climate sequences in each of the 21 localized climate and hydrology projections (Table 1).
- Projections near future - defined as the projections' WY 2015-2057, which might be viewed to represent a near-term planning horizon where climate change adaptation strategies might involve more reliance on adjusted resource management approaches and less reliance on infrastructure investments that require decades to develop before bringing into service.
- Projections distant future - defined as the projections' WY 2058-2100, which might be viewed to represent a long-term planning horizon for vulnerability assessment to inform long-range infrastructure planning investment, and development.

When changes from projections historical to either projections future period are imposed upon Observed Climate conditions, the results are labeled Future Climate conditions, or Near Future Climate and Distant Future Climate conditions.

Example Analysis to Demonstrate Methods

Before presenting results and findings for hydrologic assessment locations shown on Figure 2, underlying methodologies are first demonstrated at the observed streamflow location Ventura River near Ventura, focusing on runoff from the watershed tributary to this location, reflecting the era since Lake Casitas came into operation.

Observed Climate

The example analysis location is the site of USGS gage 11118500 Ventura River near Ventura (Figure 6). This location reflects runoff from the upper watershed minus the subcatchment tributary to Casitas Dam. So, while USGS gage 11118500 has streamflow data dating back to WY 1930, this analysis only considers streamflow data starting WY 1960 when Lake Casitas started filling. To reflect these filling operations supplied by Robles Diversion volumes, the observed streamflow at USGS 11118500 was increased by the time series of Robles Diversion volumes to remove that impairment effect on watershed response to precipitation events. Consideration was also given to removing volumes at USGS 11118500 associated with Lake Casitas reservoir spill, where events occurred during WY 1978, 1090, and 1998 and 2024, but estimated volumes of these reservoir spills were unavailable.

The quantitative assessment relies on daily mean discharge data from the USGS stream gage 11118500 on the Ventura River at Foster Park. It is acknowledged that this site presents known measurement

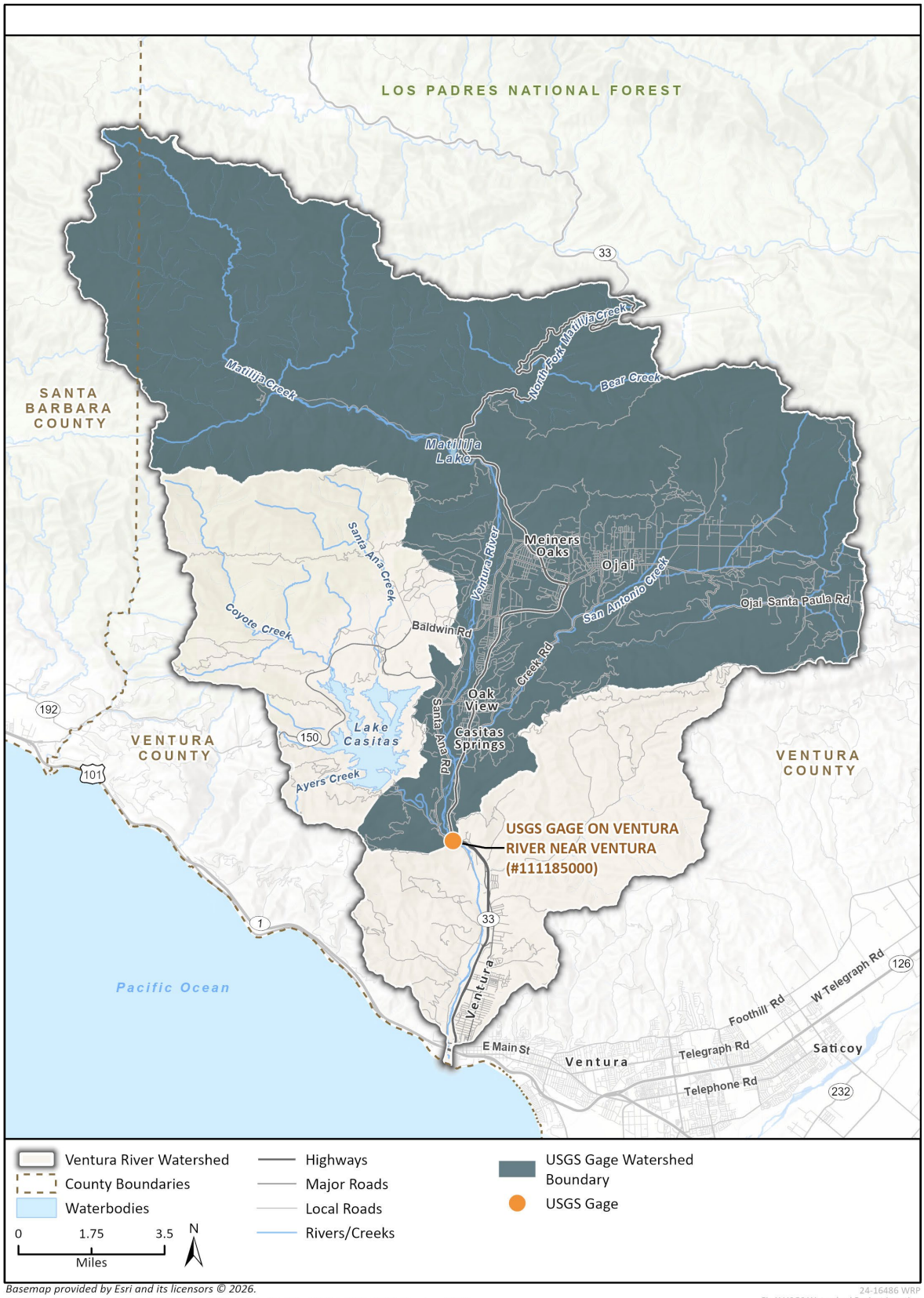
challenges that have been documented in recent VCRCD reports and UVRGA Board meetings. The Ventura River is inherently difficult to gage due to its highly dynamic channel conditions, rapid ascending and descending hydrographs during storm events, and frequent bed and bank adjustments that require periodic updates to the stage–discharge rating curve. These challenges occur under both low- and high-flow conditions. Coordination is ongoing to address and document these issues. Despite these constraints, gage 11118500 remains the best available and most complete source of both peak and daily flow data for the Ventura River. For the period of record used in this analysis, the USGS daily mean discharge values were relied upon rather than instantaneous peak flows; while rapidly changing hydrographs can introduce greater uncertainty in short-duration stage-discharge relations, these effects are generally less pronounced in daily mean values used to estimate runoff volumes. Annual USGS water-year summary reports for station 11118500 document data quality, note periods of potential uncertainty, and summarize field verification efforts. The gage is currently assigned an overall accuracy rating of “fair” (generally within 8 percent), and the relatively high frequency of field discharge measurements in recent years indicates active verification and adjustment of the rating curve where necessary. While the limitations of this site are recognized and transparently documented, the daily flow dataset is considered reliable and appropriate for the purposes of this quantitative assessment.

The resultant data were then analyzed each water year from 1960-2014 to identify the Ann1DayMax and Ann3DayMax events. The runoff volumes during these events were then pooled into cumulative distributions for the Observed Climate period shown on Figure 7. Historically these events typically occurred during December through March (Figure 8) with some events occurring during October-November and April.

Results show that under Observed Climate, Ann3DayMax events tend to involve runoff volumes passing Ventura River near Ventura that are roughly double the volume during Ann1DayMax events. On an average daily basis, this shows that Ann1DayMax events tend to be more acute, or intense, than Ann3DayMax events. In this sense, Ann1DayMax events may be thought of as indicators of stress on flood management systems during a single-day event (akin to peak flow but notably less and limited by the daily timestep of projected runoff information), and Ann3DayMax events might be thought of as indicators of stress during multi-day storm events where hydraulic load stresses on levee systems may accumulate.

From the cumulative distributions shown in Figure 7, statistics were sampled at the 0.5, 0.9, and 0.95 percentiles, or cumulative probabilities, and interpreted as roughly corresponding to 2-, 10-, and 20-year recurrence events (Table 3). Similar statistics sampling is described later in this methodology section for Future Climate distributions of Ann1DayMax and Ann3DayMax, supporting comparison against Observed Climate statistics (Table 3) to characterize climate change impacts on floods having more (2-year) to less (20-year) frequency.

Figure 6 Watershed tributary to Example Analysis Location – Ventura River near Ventura.



Basemap provided by Esri and its licensors © 2026.
Additional data provided by CPAD, 2025; NHD, 2024; US EPA, 2022; USGS, 2025; Stantec, 2026.

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Fig X USGS Watershed Project Location

Figure 7 Flood Hydrology Metrics on the Ventura River near Ventura during Observed Climate.

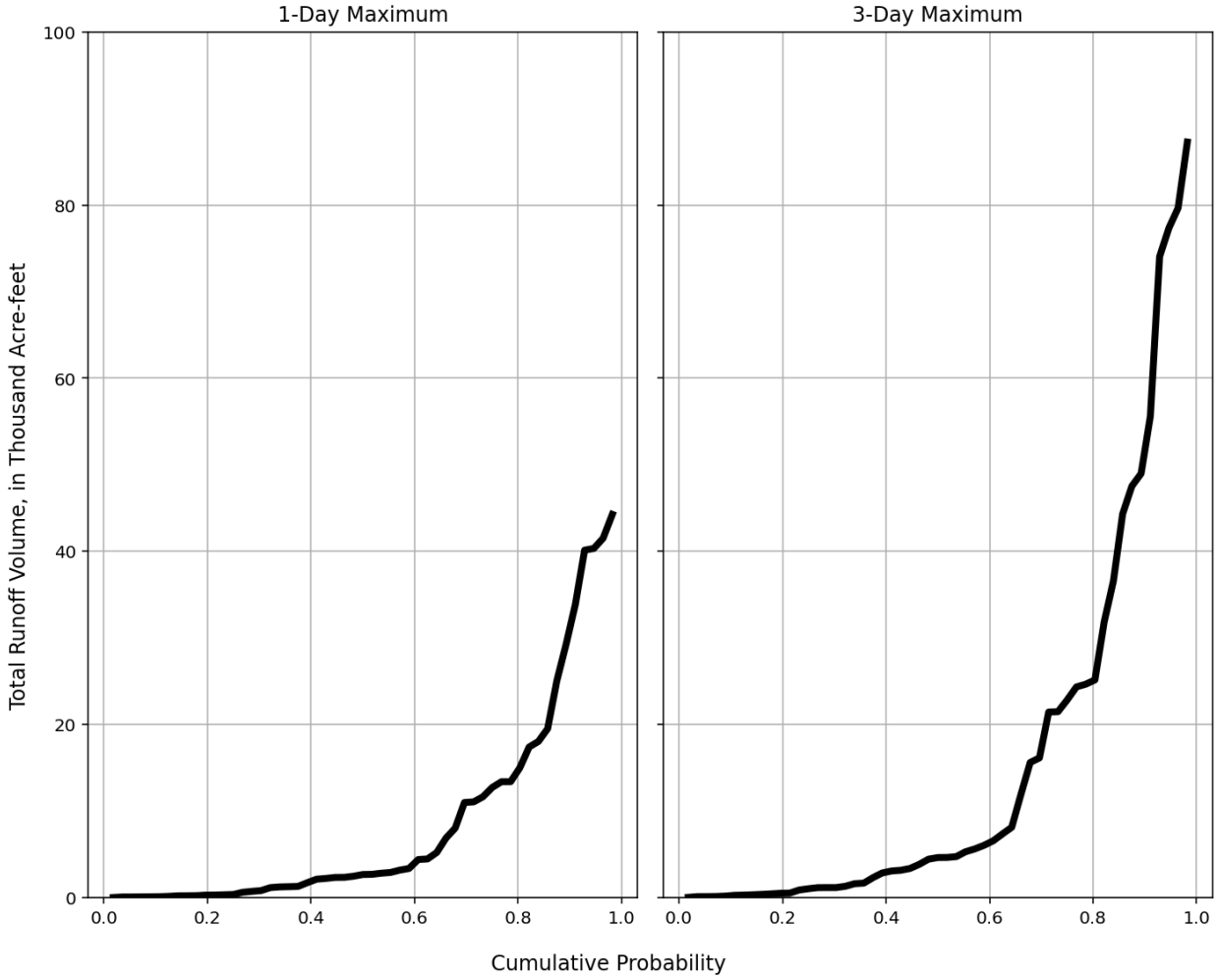


Figure 8 Water Year Timing of Flood Hydrology Metrics on the Ventura River near Ventura during Observed Climate.

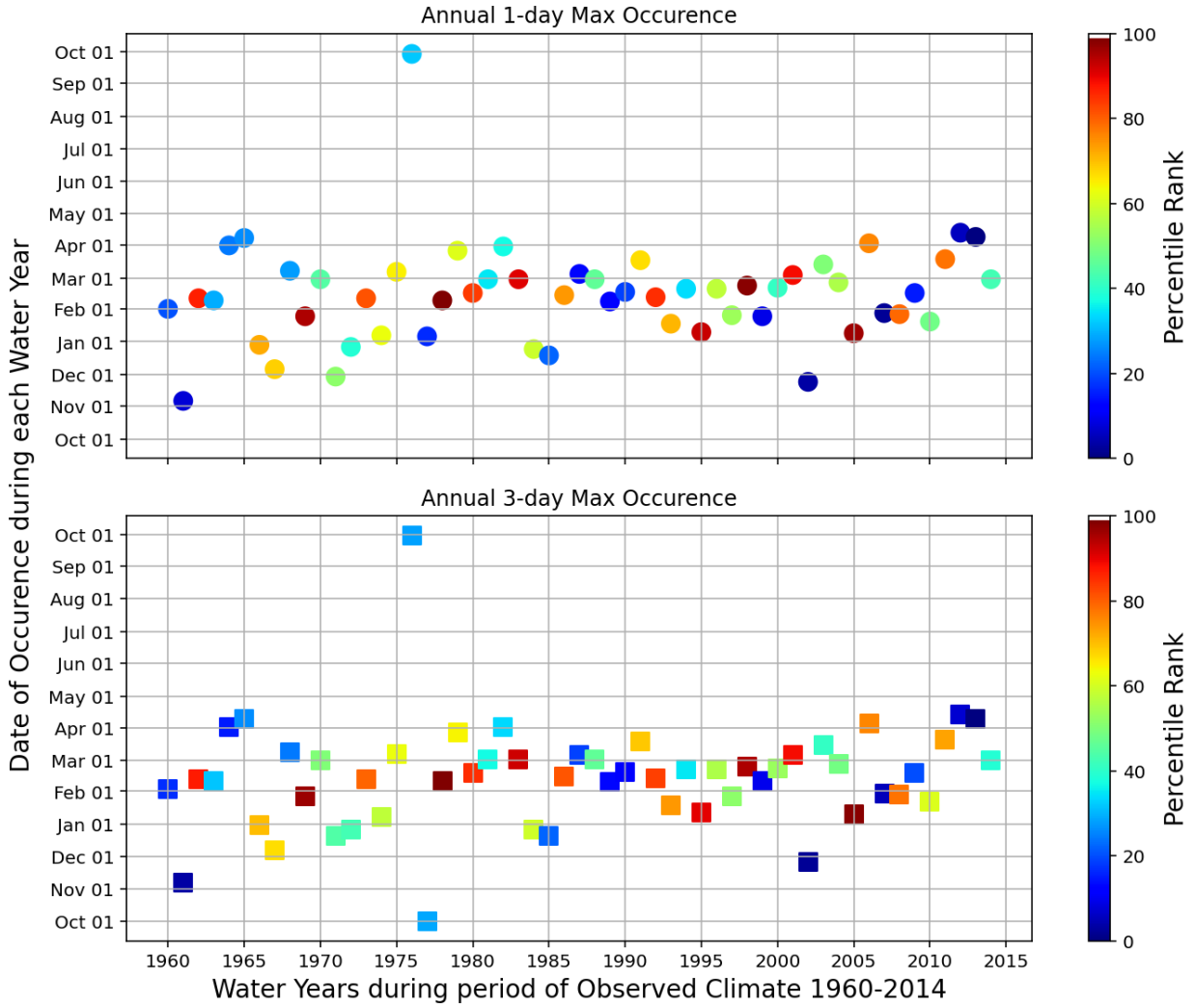


Table 3 Ventura River near Ventura Estimated 2-, 10-, and 20-year Return Ann1DayMax and Ann3DayMax Values under Observed Climate.

Percentile (Recurrence Interval, Years)	Annual 1-Day Max (Acre-Feet)	Annual 3-Day Max (Acre-Feet)
50 (2 yr)	2,675.7	4,667.3
90 (10 yr)	31,457.9	52,236.7
95 (20 yr)	41,057.9	78,819.2

Future Climate

Future Climate estimates of watershed runoff involve first combining hydrologic projections into scenario groups, sampling changes from projections historical to future periods, and applying those changes to the Observed Climate flood metric distributions to create Future Climate distributions. The sampling scheme is also revisited using a simpler alternative method to show how results are sensitive to this choice.

Scenario Groups of Projections

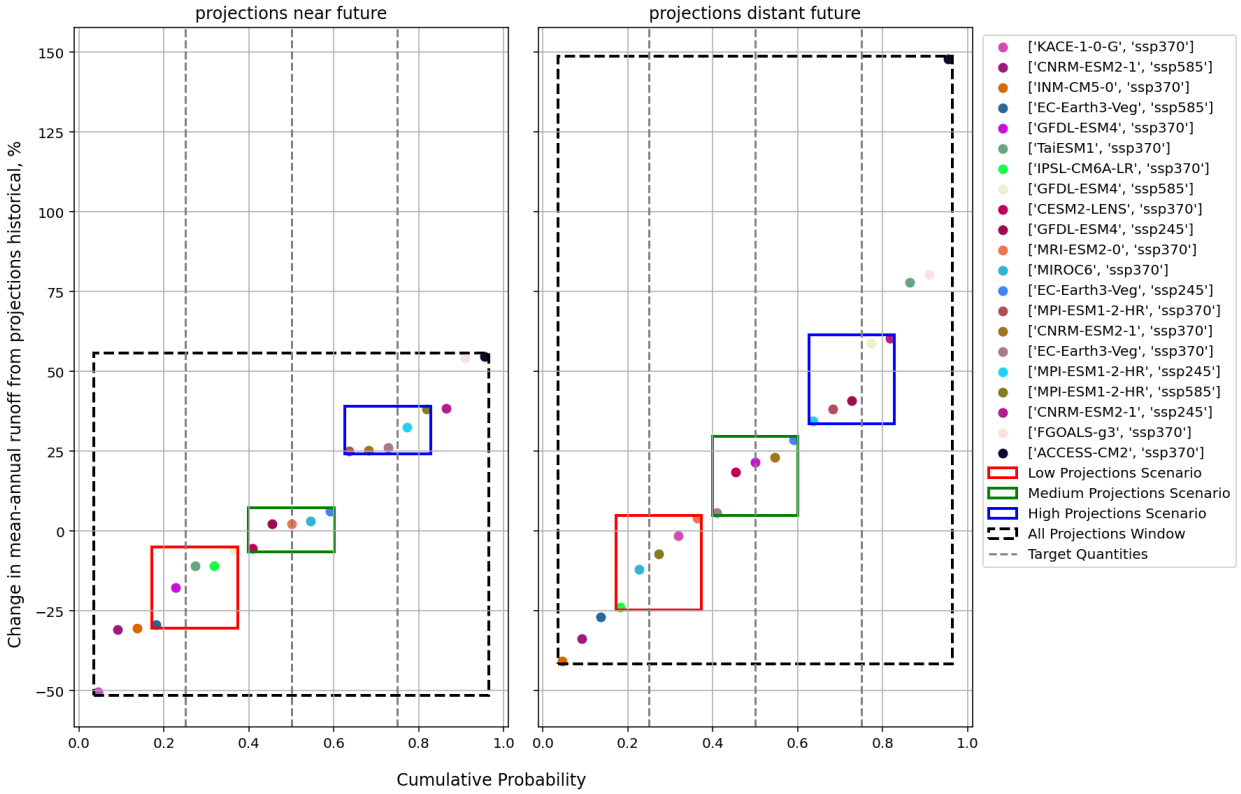
The motivation of identifying scenario groups of projections is to emphasize common features across the projections rather than artifacts unique to individual projections. This is enabled by pooling results from projections within scenario groups. The grouping basis was linked to trends in annual climate and runoff abundance in the watershed, indicated by change in mean-annual runoff to the Ventura River near Ventura (Figure 9). Subjectively, the 21 projections were grouped four ways.

- Three groups (Low, Medium, and High) to span the heart of the runoff change distribution, where each group centered on the 25th, 50th, and 75th percentile runoff changes, respectively, and involves grouping the nearest five projected runoff changes to each of those percentiles, resulting in 15 of the 21 hydrologic projections being assigned to these three scenarios. Membership assignments are free to vary from projections near future to distant future periods.
- One group to include all projections (All) within a single scenario to increase emphasis of prolific change across all projections, despite the risk of including climate artifacts stemming from the outlier projections in terms of mean-annual runoff change.

The rationale for grouping projections to emphasize prolific changes is based on the following:

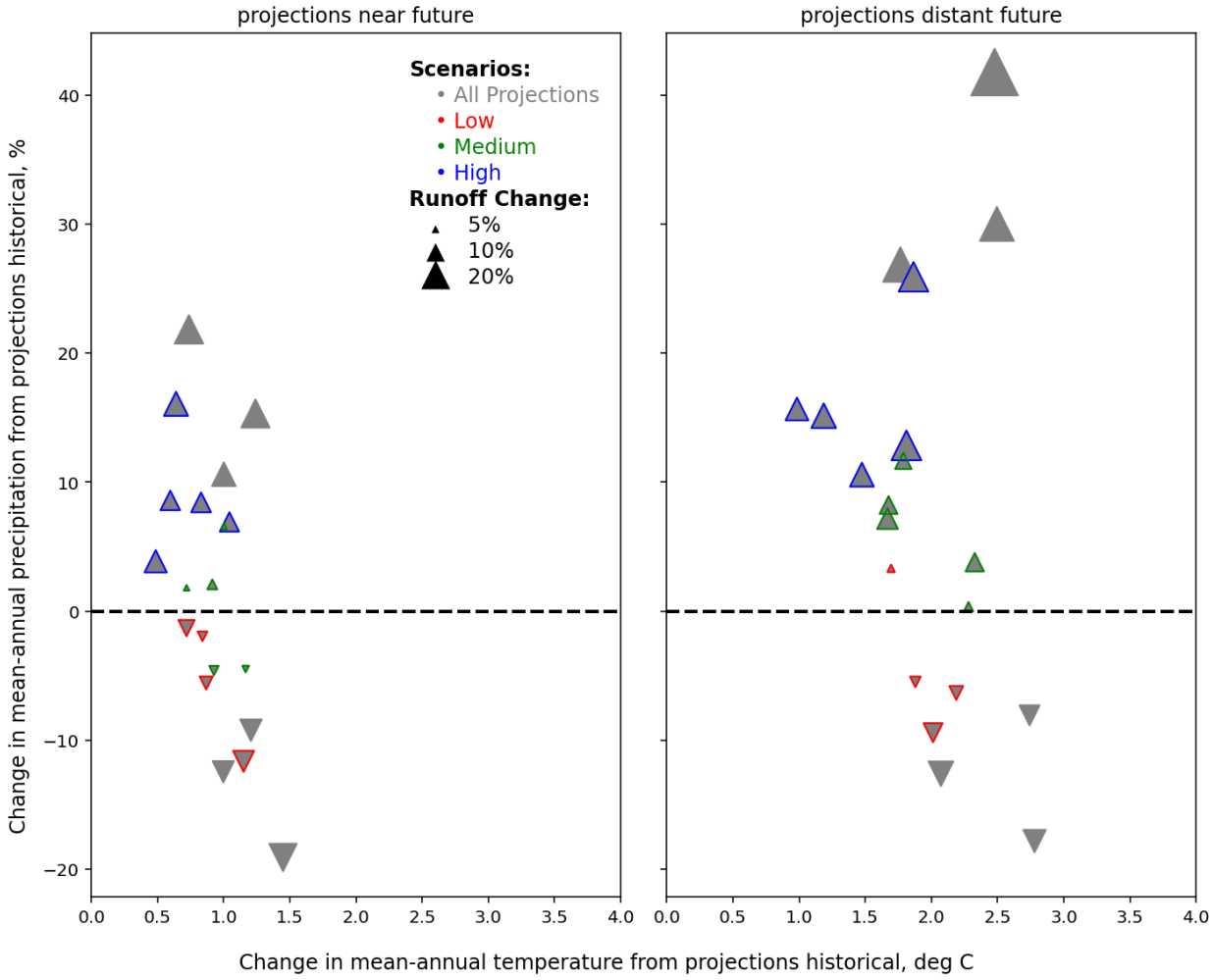
- Future climate and hydrology projections portray uncertain changes in precipitation, temperature, and runoff. Uncertainties stem from how projections reflect different scenarios for climate forcing (greenhouse gas emissions), approaches for simulating climate (global climate model structure, initial global climate system conditions), approaches for simulating hydrologic response, and observations for calibrating hydrologic models, among other factors.
- On simulating global climate underlying the Ventura River hydrology projections, the simulated internal variability sequences of the ocean-atmosphere-land systems are not constrained to match observations, leading to simulated climate variability through time that varies greatly by projection, spanning weather, seasonal, annual, and decadal time scales.
- Multi-decadal variations within climate projections are complex and can confuse climate change detection. It is possible that simulated climate changes at a location like the Ventura River watershed may bear more reflection of multi-decadal variability within the projection rather than forced climate change. This poses interpretation challenge for assessments seeking to focus on projected climate changes as real and relevant for resilience planning. This is particularly a challenge when applying precipitation projections.
- To deal with this challenge, it is helpful to group projections rather than focus on results from a single projection. This emphasizes prolific change across the projections and mutes out the inconsistent and offsetting climate variations across the projections. This approach is helpful in detecting projected changes in climate variability and extremes related to floods.

Figure 9 Projected Changes in Mean Annual Runoff to the Ventura River near Ventura from 21 LOCA2-Hybrid CMIP6 hydrology projections from projections historical to projections near future (left) and distant future periods (right).



The 21 projection-specific precipitation, temperature, and runoff changes are shown on Figure 10, highlighting scenario groups of projections. Results indicate that projected changes in mean-annual runoff align strongly with changes in mean-annual precipitation (i.e. for all projections and each future period, the sign of projected mean-annual runoff change was the same as the sign for mean-annual precipitation change). Further, most climate projections underlying the hydrology projections show increasing precipitation relative to simulated historical. Switching to runoff relationship with temperature, results also show projected changes in mean-annual runoff as being insensitive to the projected warming over the Ventura River watershed. For this latter insensitivity to be real, these results would imply that Observed Climate precipitation-evapotranspiration relationships are robust against the amount of projected warming, possibly buffered by how precipitation traditionally happens during the cold season and the amount of cold season warming may not appreciably increase evapotranspiration corresponding to runoff reduction. However, this insensitivity may also be a VIC-model artifact not replicated in the same manner by other hydrology models.

Figure 10 Projected Changes in Mean Annual Precipitation, Temperature, and Runoff to the Ventura River near Ventura from 21 LOCA2-Hybrid CMIP6 hydrology projections from projections historical to projections near future (left) and distant future periods (right).



Scenario patterns of projections-median change in mean-monthly minimum daily and maximum daily temperatures are shown on Figure 11 for the projections near future and distant future climate periods. Corresponding patterns for projections-median change in mean-monthly precipitation and runoff are shown on Figure 12 during the same periods. The scenarios portray warming in all months through the near future and distant future periods, with lesser magnitudes of warming during December through July, which encapsulates the traditional portion of the year when precipitation events occur. The scenarios also portray near-future increases in winter precipitation during January-February with decreases during March; these seasons appear to expand in the distant future showing increases during December-February and decreases during March-April. Monthly runoff changes generally track with monthly precipitation changes.

Figure 11 Projected Changes in Mean Monthly Minimum Daily Temperature (T_MAX) and Maximum Daily Temperature (T_MIN) in the tributary watershed above Ventura River near Ventura from 21 LOCA2-Hybrid CMIP6 hydrology projections from projections historical to projections near future (left panels) and distant future periods (right panels).

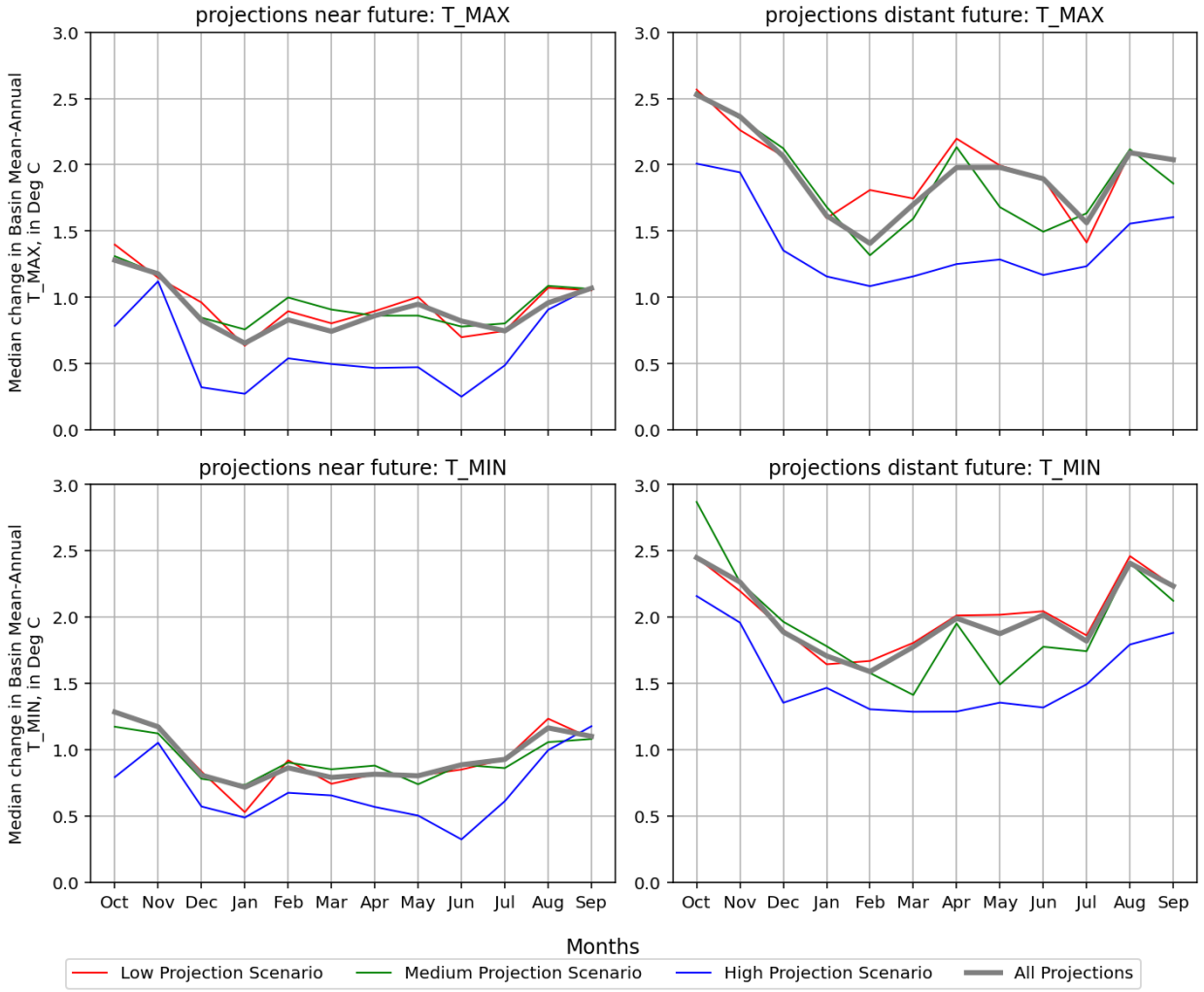
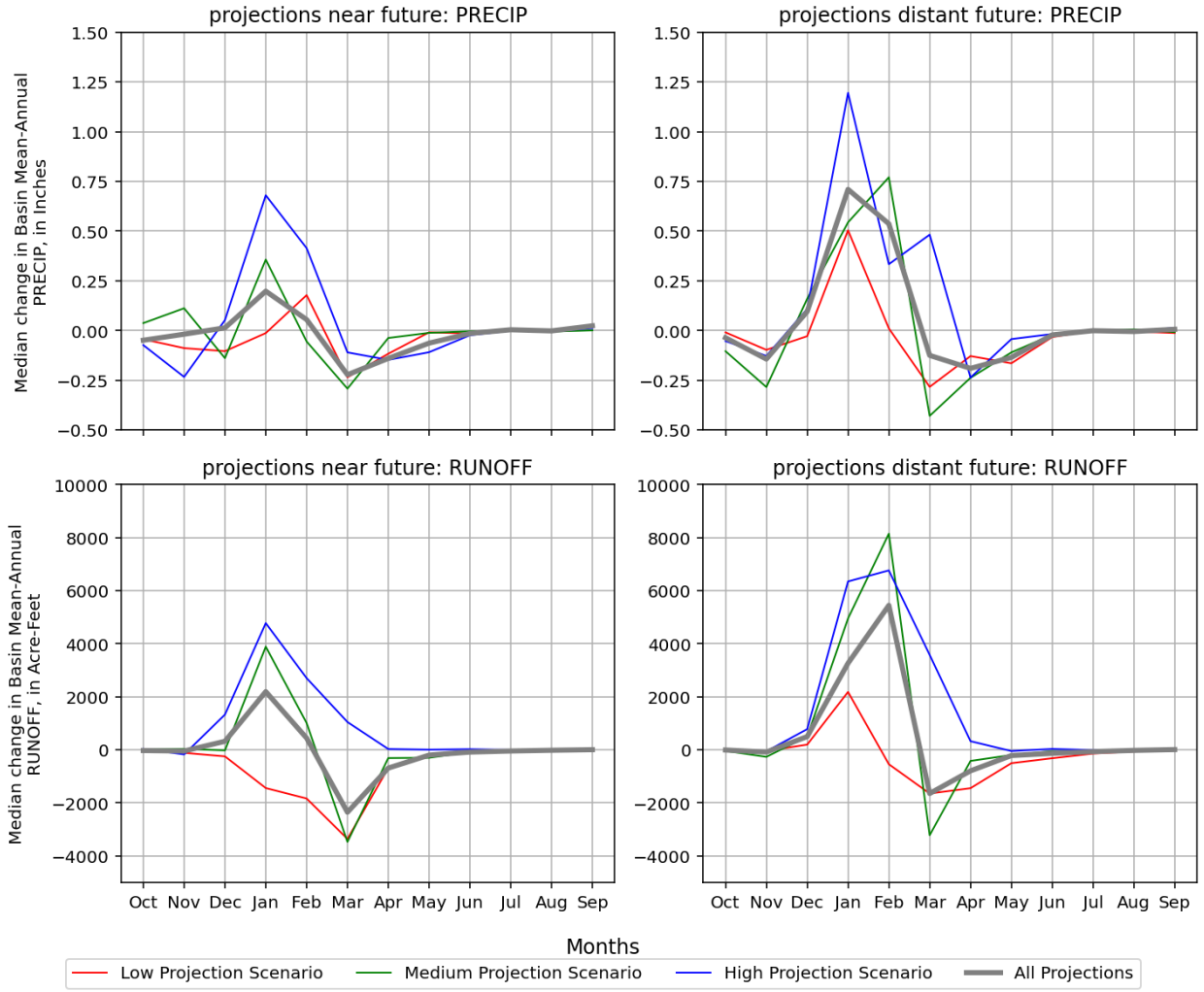


Figure 12 Projected Changes in Mean Monthly Precipitation (PRECIP) and Runoff at Chittenden (RUNOFF) in the tributary watershed above Ventura River near Ventura from 21 LOCA2-Hybrid CMIP6 hydrology projections from projections historical to projections near future (left panels) and distant future periods (right panels).



Applying Projected Changes to estimate Future Climate Flood Metrics

The Quantile-Delta Method, also known as Ensemble Hybrid-Delta method (Bureau of Reclamation 2010), is used to translate Observed Climate flood metrics and their projected changes into Future Climate flood metrics. The steps of this method are illustrated on Figure 13:

1. Create Observed Climate cumulative distributions of Ann1DayMax and Ann3DayMax (from Figure 7, reshown in left column on Figure 13).
2. Using the High projections scenario as an example, create cumulative distributions of projected historical, projected near future, and projected distant future annual runoff, pooling Ann1DayMax and Ann3DayMax estimates from all water years and all projections informing the High scenario.
3. Compute quantile delta factors for near future as the ratios of quantile values from the projections near future and projections historical distributions, respectively (i.e. near-future quantile map). Repeat for distant future.
4. Revisit the Observed Climate Distribution and at a given cumulative probability, use that value as the

lookup quantile in the near-future and distant-future quantile maps to identify the quantile delta factors for those future periods, respectively. Then multiply the Observed Climate value by those quantile delta factors to compute the corresponding Near Future and Distant Future Climate distribution values, respectively.

5. Repeat Step 4 for all unit quantiles in the Observed Climate Distribution to create the Near Future and Distant Future Climate Distribution, respectively.
6. Repeat Steps 2-5 for all four projections scenarios (Figure 14).

To follow the math through these steps, consider the distant future and the Ann1DayMax value at cumulative probability 0.8 in the Observed Climate cumulative distribution is 14821 acre-feet. The projections historical and distant future values at cumulative probability 0.8 in their distributions are 7510 and 16998 acre-feet, respectively, making the quantile delta at cumulative probability (quantile) 0.8 equal to the ratio of 16998 to 7510, or 2.3. We lastly apply this quantile delta factor at the Observed Climate's cumulative probability 0.8 to scale the Observed Climate value 14821 acre-feet into a Distant Future Climate value of 33767 acre-feet, as shown on Figure 13.

Using this approach, Figure 14 shows that flood metrics increase for common to rare floods in three of the four projections scenarios (Medium, High and All), and that increases are greater for the rare floods (i.e. higher cumulative probabilities within the Observed Climate distribution). The factor driving results variation across the projections group is change in precipitation abundance, likely fueling more intense precipitation during precipitation-runoff events as well as watershed soil moisture conditions that modulate runoff response to precipitation. The latter stems from how drier to wetter soil moisture conditions prior to a precipitation event aligns with lesser to greater runoff response to the event. Although this analysis did not quantify the role of catchment antecedent conditions in defining climate change impacts on watershed flood response, it would be possible to gain insights on this by evaluating VIC simulated soil moisture conditions prior to precipitation-runoff events within this family of projections.

Figure 13 Future Climate Distributions of Ann1DayMax at the Ventura River near Ventura location under the High projections scenario using Quantile Delta Method.

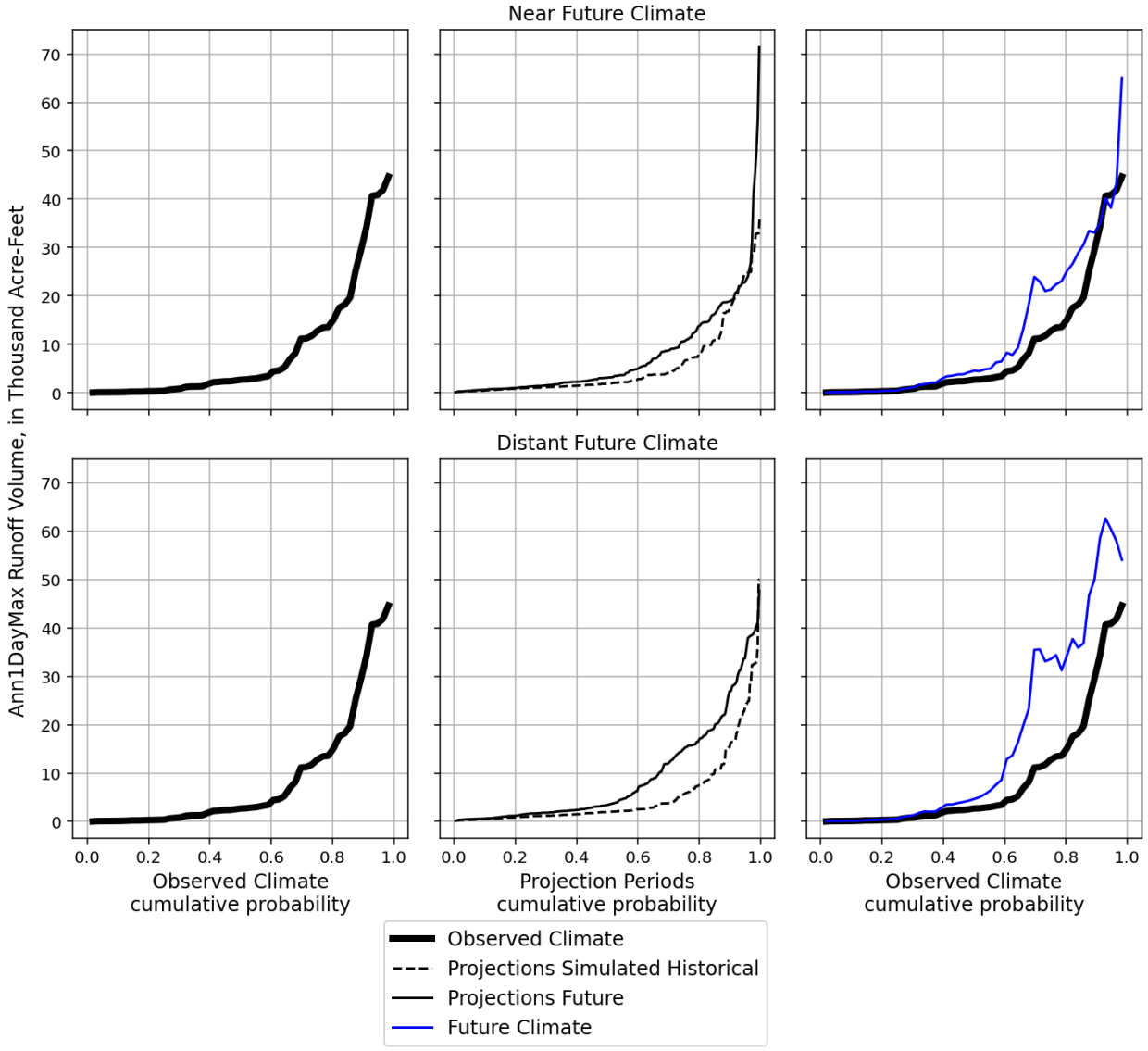
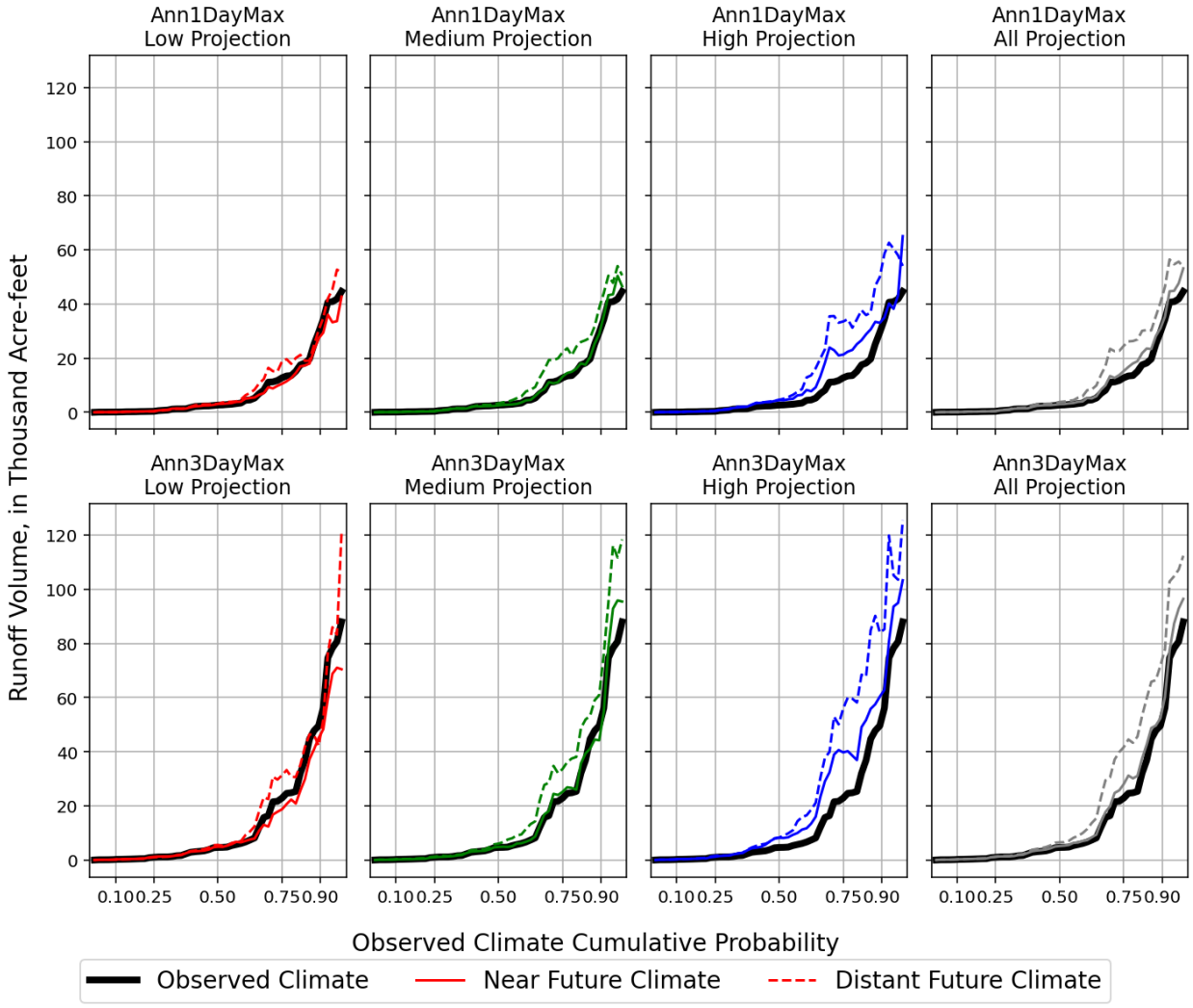


Figure 14 Future Climate Distributions of Ann1DayMax and Ann3DayMaxat the Ventura River near Ventura location under the four projections scenarios using Quantile Delta Method.



Lastly, metric values are sampled from each the Future Climate distributions (two future periods, four projections scenarios) at 0.5, 0.9, and 0.95 percentiles and compared against those sampled from the Observed Climate distribution to characterize climate change impacts on flood metrics (Table 4). Results show that Ann1DayMax and Ann3DayMax events typically increase for all projections scenarios, with variation across scenarios and future periods. Increases become greater from Near Future to Distant Future periods. This could relate to greater magnitude of warming leading to greater atmospheric moisture holding capacity in the distant future, translating into the increased precipitation conditions found in the 21 projections underlying this analysis. However, there is much uncertainty in projecting wet-weather extremes, and some of this variation in change from Near Future to Distant Future may be an artifact of projections variability from near future to distant future periods, 0despite efforts to mute such effects through scenario groupings.

Table 4 Ventura River near Ventura - Change in Flood Hydrology Metrics (Ann1DayMax and Ann3DayMax) estimated to have 2-, 10-, and 20-year recurrence considering two Future Climate periods (Near Future, Distant Future), four Projections Scenarios (Low, Medium, High, All), and the Quantile Delta method to sample projected changes.

	Annual 1-Day Max		Annual 3-Day Max	
Percentile (Recurrence Interval, Years)	Near Future Percent Difference from Observed, in %	Distant Future Percent Difference from Observed, in %	Near Future Percent Difference from Observed, in %	Distant Future Percent Difference from Observed, in %
Low Projections				
50 (2 yr)	15.2	18.6	5.8	19.5
90 (10 yr)	-10.5	2.2	-11.2	-11.7
95 (20 yr)	-18.8	14.0	-12.1	8.4
Medium Projections				
50 (2 yr)	-5.7	23.9	3.9	30.1
90 (10 yr)	0.6	29.7	-7.2	28.3
95 (20 yr)	9.4	19.4	18.6	46.3
High Projections				
50 (2 yr)	68.8	73.1	75.9	78.7
90 (10 yr)	7.5	69.8	17.5	61.7
95 (20 yr)	-4.5	45.9	19.2	33.0
All Projections				
50 (2 yr)	12.1	43.2	10.9	40.0
90 (10 yr)	4.0	36.1	6.3	42.0
95 (20 yr)	10.6	33.6	12.3	33.6

Notes:

- This analysis does not extrapolate findings to estimate change in Ann1DayMax and Ann3DayMax at greater recurrence intervals (e.g., once in 100 or 500 years). Doing so would warrant more detailed metric analysis to support fitting parametric distributions that might support such rare event estimation.
- This analysis does not isolate drivers of watershed flood response within the VIC simulation. Further investigation into drivers might focus on the coincidence of VIC-simulated antecedent, VIC weather inputs during precipitation events (both precipitation and temperature) and runoff response to better understand watershed runoff response mechanisms. Also, consideration may be given to hydrology models other than VIC having diverse runoff response characteristics.

Showing Results Sensitivity to how Projected Changes are Sampled

The Quantile Delta Method used to adjust Observed Climate metric distributions into Future Climate versions samples change in the metric's period variability from the projections' simulated historical to future periods. Doing so gives credibility to the projections' ability to portray local extreme events like the metrics used in this flood hydrology assessment, and to portray global climate change impacts on those extreme events. As such, the method reflects projections tendencies to portray different changes from lower to greater metric values, or from common to rare flood hydrologic events. At the same time, this may place too much trust in the projections' representation of uncertain processes related to wet weather extremes, stemming from uncertainties related to global climate projection, representing embedded weather processes, and simulating hydrologic response.

Alternative to the Quantile Delta Method, a more conservative Simple Delta Method can be used to estimate change in metrics, uniformly from lesser to greater values, or more common to rare flood hydrologic events. The method involves identifying a single period change factor as the ratio of mean

metric value in the projections future period relative to the projections historical period and applying that adjust the entire Observed Climate metric distribution into a Future Climate distribution. Doing so implies trust in projecting changes in the metric's period mean but not period variability.

To explore the sensitivity of results to this change in projections sampling, Steps 4 and 5 were repeated using the Simple Delta Method. Results are shown on Figure 15 and tabulated in Table 5. Compared to results on Table 4, Simple Delta Method results:

- show common changes for the three listed recurrence intervals (once in 2-, 10- and 20-year events), by method design, rather than varied changes using Quantile Delta Method.
- are consistent in that flood metric conditions are, in most sampled percentiles and projections scenarios, projected to increase under the future climate changes considered in this study.
- show more orderly changes than those from the Quantile Delta Method with respect to variation across the scenario groups of projections (Low, Medium, High, and All) and futures periods (Near Future and Distant Future).
- show slightly less variation in changes at common sampled percentiles and projections scenarios compared to results from the Quantile Delta Method. For example, Ann1DayMax under the High scenario's Near (Distant) Future shows 40.5 (75.5) percent increase at all recurrence intervals in the Simple Delta Method compared to 68.8 (73.1) to -4.5 (45.9) percent increases from 2- to 20-year recurrence intervals sampled in the Quantile Delta Method results. Likewise, Ann3DayMax results show 37.3 (68.3) percent increase at all recurrence intervals using Simple Delta Method and 75.9 (78.7) to 19.2 (33.0) percent increase from 2- to 20-year recurrence intervals using Quantile Delta Method.

Figure 15 Ventura River near Ventura Ann1Day Max and Ann3Day Max Distributions under Observed and Future Climates using Simple Delta Method

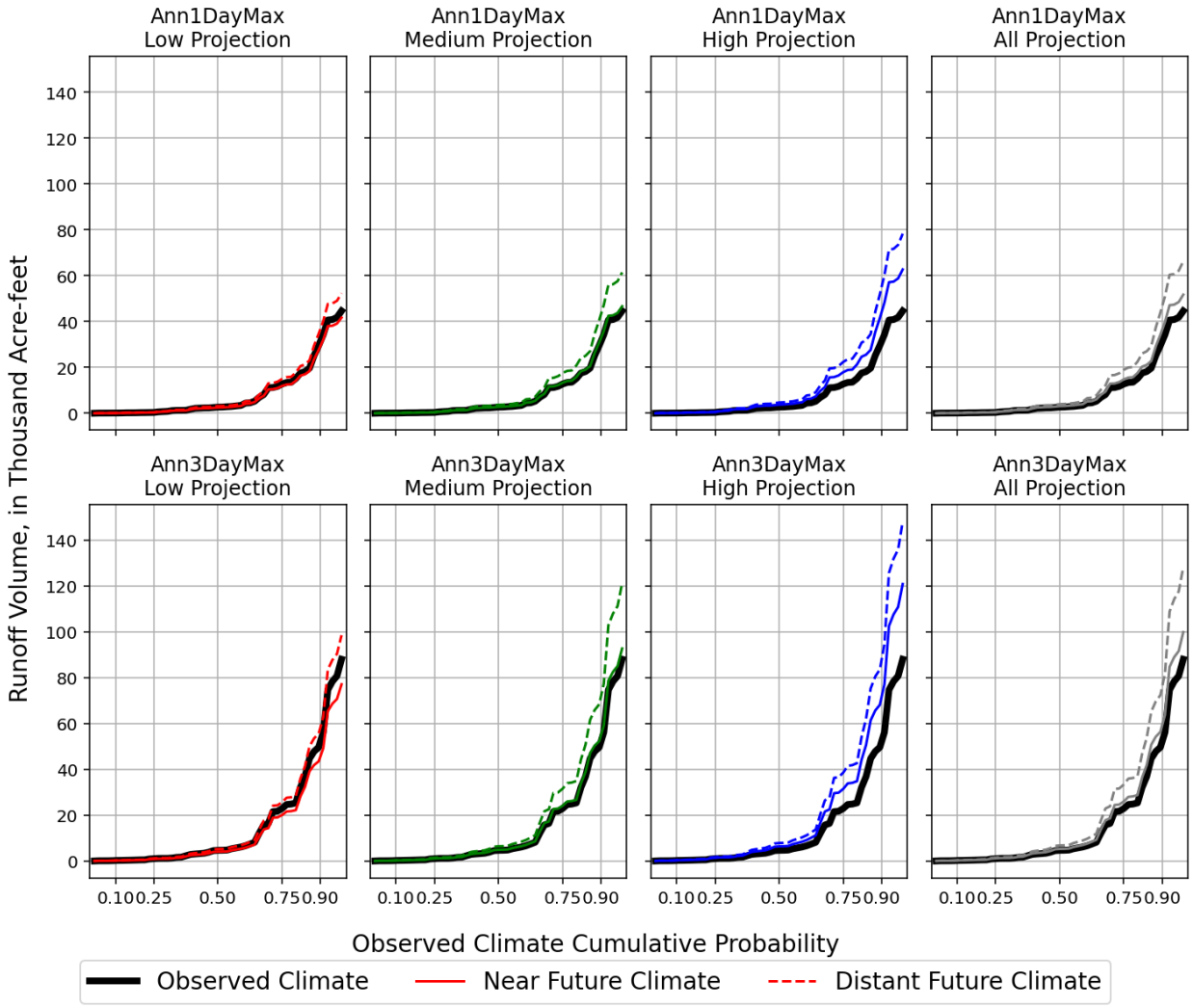


Table 5 Ventura River near Ventura - Change in Flood Hydrology Metrics (Ann1DayMax and Ann3DayMax) estimated to have 2-, 10-, and 20-year recurrence considering two Future Climate periods (Near Future, Distant Future), four Projections Scenarios (Low, Medium, High, All), and the Simple Delta method to sample projected changes.

	Annual 1-Day Max		Annual 3-Day Max	
Percentile (Recurrence Interval, Years)	Near Future Percent Difference from Observed, in %	Distant Future Percent Difference from Observed, in %	Near Future Percent Difference from Observed, in %	Distant Future Percent Difference from Observed, in %
Low Projections				
50 (2 yr)	-6.5	17.2	-12.4	11.9
90 (10 yr)	-6.5	17.2	-12.4	11.9
95 (20 yr)	-6.5	17.2	-12.4	11.9
Medium Projections				
50 (2 yr)	4.5	37.6	5.3	37.8
90 (10 yr)	4.5	37.6	5.3	37.8
95 (20 yr)	4.5	37.6	5.3	37.8
High Projections				
50 (2 yr)	40.5	75.5	37.3	68.3
90 (10 yr)	40.5	75.5	37.3	68.3
95 (20 yr)	40.5	75.5	37.3	68.3
All Projections				
50 (2 yr)	15.9	48.6	13.5	45.7
90 (10 yr)	15.9	48.6	13.5	45.7
95 (20 yr)	15.9	48.6	13.5	45.7

Hydrologic Assessment

Using the methods illustrated for the Ventura River near Ventura, changes in flood hydrologic metrics were next assessed at the six locations of interest shown on Figure 2:

- San Antonio Creek (near the Stewart Canyon Creek Confluence)
- San Antonio Creek near Ventura River Confluence
- Ventura River at Robles Diversion
- Ventura River at Santa Ana Blvd
- Ventura River near Casitas Springs
- Ventura River near W Stanley Ave

This section presents Observed Climate results for Ann1DayMax and Ann3DayMax at each location and then summarizes projected future changes in these metrics for flood events that vary from more common to rare (2- to 20-year recurrence intervals).

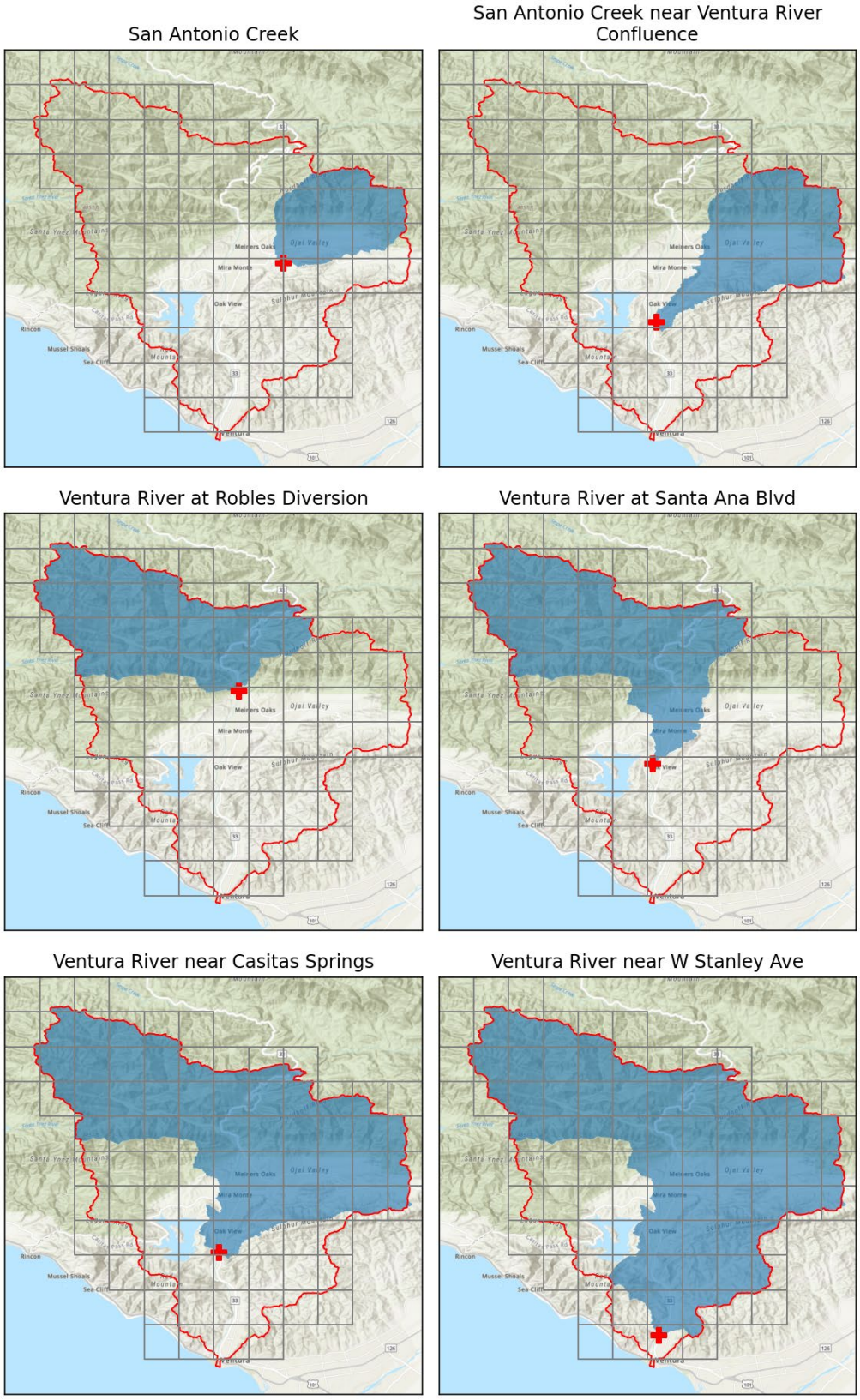
Observed Climate

To generate Observed Climate results at the six assessment locations, estimated streamflow had to first be estimated for these locations, overcoming the absence of streamflow observations covering the full Observed Climate period. The VIC hydrology model's historical calibration simulation under Observed

Climate weather was leveraged to generate “synthetic” stream gages at these locations, consistent with the flow variability observed at Ventura River near Ventura. The procedure is as follows.

1. Identify the intersection of VIC model domain (i.e. grid cells) with each area tributary to respective assessment locations of interest (Figure 16).
2. Aggregate gridded daily VIC runoff in each intersect area into daily runoff during the calibration simulation’s time slice overlapping with Observed Climate (WY 1960-2014).
3. Repeat steps 1 and 2 for the observed streamflow location Ventura River near Ventura.
4. For a given assessment location, and a given month (e.g., October 1959), compute the ratio of VIC-simulated runoff at the assessment location relative to Ventura River near Ventura (adjusted for Robles Diversion volume, as explained under Data Sources). Then multiply this ratio by the observed month runoff at Ventura River near Ventura to estimate the synthetic-observed runoff at the assessment location for that month. Repeat for all months and water years in the Observed Climate period.
5. Disaggregate the synthetic month runoff volume at the assessment location into a daily streamflow time series consistent with the Ventura River near Ventura daily runoff pattern, which is scaled to match the synthetic-observed runoff volume at the assessment location for that month. Repeat for all months and water years in the Observed Climate period.
6. Repeat steps 4 and 5 for all assessment locations.

Figure 16 Hydrologic Assessment Locations, Tributary Areas within the Ventura River Watershed, and overlaying VIC model domain.



Resulting synthetic streamflow estimates were used to generate Ann1DayMax and Ann3DayMax distributions under Observed Climate at each assessment location as shown on Figure 17. Like example results shown for Ventura River near Ventura (Figure 6) the Observed Climate three-day events tend to convey twice the volume of runoff passing assessment locations compared to one-day events. This also shows that Ann1DayMax events tend to be more intense than Ann3DayMax events in terms of average daily flow. In this sense, Ann1DayMax events may be thought of as indicators of stress on flood management systems during a single-day event (akin to peak flow but notably less and limited by the daily timestep of projected runoff information), and Ann3DayMax events might be thought of as indicators of stress during multi-day storm events where hydraulic load stresses on levee systems may accumulate.

Lastly, statistics are sampled at the 0.5, 0.9, and 0.95 percentiles from each distribution shown on Figure 17 corresponding to 2-, 10-, and 20-year recurrence events and listed in Table 6.

Figure 17 Flood Metrics for the Ventura River watershed hydrologic assessment locations.

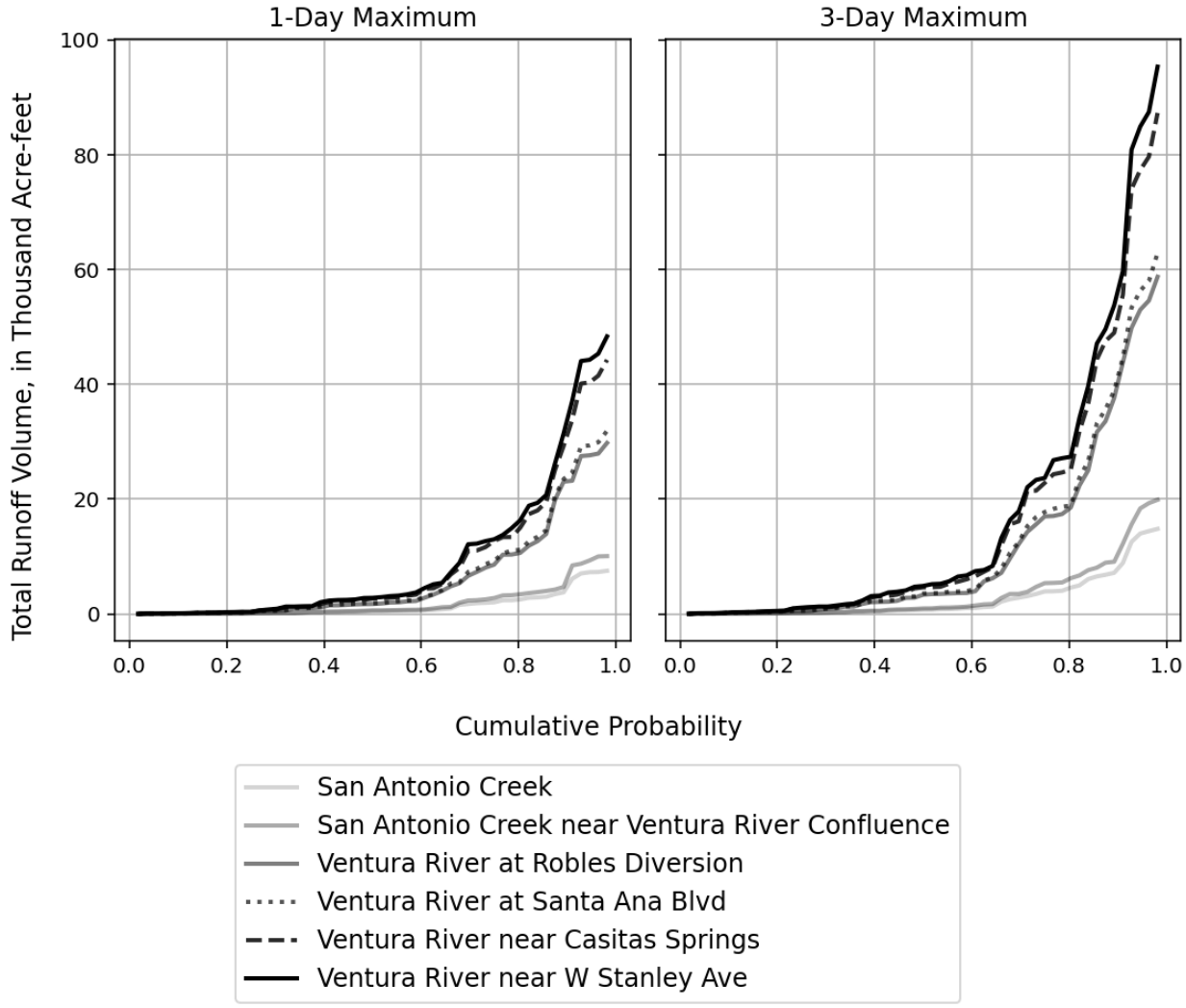


Table 6 Ventura River near Ventura Estimated 2-, 10-, and 20-year Return Ann1DayMax and Ann3DayMax Values under Observed Climate.

Percentile (Recurrence Interval, Years)		Annual 1-Day Max (Acre-Feet)	Annual 3-Day Max (Acre-Feet)
50 (2 yr)	San Antonio Creek	478	738
	San Antionio Creek near Ventura River Confluence	624	957
	Ventura River at Robles Diversion	1,727	3,347
	Ventura River at Santa Ana Blvd	1,852	3,548
	Ventura River near Casitas Springs	2,664	4,625
	Ventura River near W Stanley Ave	2,802	4,876
90 (10 yr)	San Antonio Creek	4,714	7,844
	San Antionio Creek near Ventura River Confluence	6,200	10,349
	Ventura River at Robles Diversion	23,108	40,093
	Ventura River at Santa Ana Blvd	23,954	41,165
	Ventura River near Casitas Springs	31,102	51,625
	Ventura River near W Stanley Ave	33,734	56,155
95 (20 yr)	San Antonio Creek	7,273	14,085
	San Antionio Creek near Ventura River Confluence	9,461	18,564
	Ventura River at Robles Diversion	27,694	53,308
	Ventura River at Santa Ana Blvd	29,468	56,632
	Ventura River near Casitas Springs	40,563	77,792
	Ventura River near W Stanley Ave	44,487	85,406

Future Climate

Using the methods demonstrated for Ventura River near Ventura, Future Climate flood metric distributions were estimated for each projections scenario and at all assessment locations. Results vary by:

- hydrologic assessment location (order from least to most tributary area: San Antonio Creek, San Antonio Creek near Ventura River Confluence, Ventura River at Robles Diversion, Ventura River at Santa Ana Blvd, Ventura River near Casitas Springs, Ventura River near W Stanley Ave).
- future period (Near Future (*NF*), Distant Future (*DF*)).
- projections scenario (Low, Medium, High, All).
- projections sampling method (Quantile Delta (*QD*), Simple Delta (SD*)).*
- flood metric (Ann1DayMax, Ann3DayMax).
- flood metric recurrence indicated by sampling metric distributions within a climate period at 50th, 90th, and 95th percentiles (*50*, *90*, *95*) to represent 2-, 10-, and 20-year recurrence under the given climate.

Results found at the six hydrologic assessment locations are shown on Figure 18 through Figure 23 and summarized in Table 7 through Table 12. Figures and tables are ordered by locations' tributary areas, from least (San Antonio Creek) to most (Ventura River near W Stanley Ave), or generally upstream to downstream locations.

Overall, changes in flood hydrology vary considerably depending on method choices. For changes specific to method combinations (e.g., single location, Near Future, Quantile Delta 20-year recurrence, High projections scenario, etc.), refer to the location of interest in Table 7 through Table 12.

Summary findings by Assessment Location:

- *San Antonio Creek.* For this location, changes vary between -28 and +98 percent, averaging +33 percent. Focusing just on the All Projections scenario, pooling results across flood metrics, flood metric recurrence, and projections sampling method, and then splitting results between Near Future and Distant Future, the average change is +12 and +61 percent for those futures respectively, with range of change being -3 to +23 and +35 to +83 for those futures respectively. Visually inspecting Figure 18 shows that variation in results is influenced by method choices ordered from seemingly most to least influential: projections scenario, future period, projections sampling method, flood metric recurrence (for Quantile Delta method results only), and flood metric.
- *San Antonio Creek near Ventura Confluence.* Results at this location show similar variations and method dependencies as those for San Antonio Creek. Changes vary between -23 and +104 percent, averaging +34 percent. While the range of changes is like that found at the San Antonio Creek, Figure 19 shows that if the High Projections scenario is excluded, the variation across the other projection scenarios is relatively less compared to that found at San Antonio Creek. However, like San Antonio Creek, variation in results is influenced by method choices ordered similarly to results found at San Antonio Creek.
- *Ventura River at Robles Diversion.* Switching to the Upper Ventura Watershed, results at this location vary between -21 and +96 percent, averaging +22 percent. The range's sensitivity to including the High Projections scenario is similar to that found for San Antonio Creek near Ventura Confluence, as shown on Figure 20, and sensitivities to methods choices are also similar, with the two most critical choices being projections scenario and future period.
- *Ventura River at Santa Ana Blvd.* Proceeding downstream to Santa Ana Blvd, Ventura River flood metric changes were found to be like those found at Robles Diversion, varying between -19 and +94 percent, averaging +22 percent. The range's sensitivity to method choices, as shown on Figure 21, was also like the sensitivity at Robles Diversion, with the two most critical choices being projections scenario and future period.
- *Ventura River near Casitas Springs.* Moving to the lower watershed, below the confluence with San Antonio Creek, changes were found to be slightly less varied, ranging between -19 and +79 percent and averaging +24 percent. The range's sensitivity to method choices is indicated by results shown on Figure 22, indicating the most critical choice being projections scenario followed by future period.
- *Ventura River near W Stanley Avenue.* This location is the most downstream and integrates hydrologic response from the largest tributary area among the six locations assessed. At this location, changes vary between -16 and +79 percent, averaging +23 percent. Focusing on the All Projections scenario, pooling results across flood metrics, flood metric recurrence, and projections sampling method, and splitting results between Near Future and Distant Future, the average change is +11 and +40 percent for those futures respectively, with range of change being +4 to +16 and +34 to +48 for those futures respectively. Visually inspecting Figure 23 shows that variation in results is primarily dominated by projections scenario and future period choices, followed by (in order of apparent influence) projections sampling method, flood metric recurrence (for Quantile Delta method results only) and flood metric.

Additional findings in how changes are sensitive to method choices:

- *How do changes vary by location?* Based on these results, upstream to downstream trends in change seem apparent for Ann1DayMax, with changes being generally greater for upstream locations having smaller tributary area and lesser for downstream areas having greater tributary area. This may align with the concept from Sharma et al. 2018 that as catchment size decreases relative to storm extent, potential flood response to heavy precipitation increase may be greater. Specifically for the Ventura River watershed and these six assessment locations, the possible explanation is that tributary areas from downstream to upstream locations vary enough relative to storm extent and 1-day durations that flood response is more pronounced in the smaller catchments (e.g., San Antonio Creek) compared to larger catchments (e.g., Ventura River near W Stanley Ave). However, results for Ann3DayMax do not show a clear upstream to downstream trend, potentially indicating that as storm duration increases, the fraction of watershed becoming fully saturated and contributing to flood response also increases, perhaps explaining similar metric changes found from upstream to downstream locations.
- *How do these changes vary by flood metric?* While metric-specific differences are more apparent at individual locations, aggregating results across all locations and other method choices shows similar changes for Ann1DayMax and Ann3DayMax. For Ann1DayMax, changes vary -27 to +104 percent, averaging 27 percent, and for Ann3DayMax these values were -28, +96, and +25 percent, respectively. Overall, percent changes for the two flood metrics are generally comparable when all other method choices are equal.
- *How do changes vary by future period?* Dividing results by future period and pooling changes across locations, it was found that flood hydrology changes generally increased through the 21st century as changes varied from -28 to +82 percent by Near Future and between -12 and +104 percent by Distant Future, with average change being +11 and +41 percent for Near Future and Distant Future, respectively. This reflects the underlying precipitation projections getting wetter from projections near future to distant future periods.
- *How do changes vary across projections scenarios and future periods?* Changes vary substantially across projections scenarios and future periods. To illustrate, consider two contrasting scenarios: early 21st century drier conditions (i.e. Near Future Low projections scenarios across all other method choices) showing changes between -28 and +16 percent, averaging -8 percent, and late 21st century wetter conditions (i.e. Distant Future High projections scenarios across all other method choices) showing changes between +25 and +104 percent, averaging +68 percent. Change variation across projections scenarios within a given future period are often on par with change variation across future periods from Near Future to Distant Future.
- *How do these changes vary by projections sampling method and flood metric recurrence?* Using San Antonio Creek as an example and visually inspecting Figure 18, the range of changes produced using the Quantile Delta Method are broader than those produced using the Simple Delta Method, with no clear trend in changes being lesser or greater relative to flood recurrence rarity. For example, for the Medium Near Future scenario, use of the Quantile Delta method of projections sampling produces flood metrics changes that vary in a band of roughly 40 percent, with the 10-year recurrence flood changes being the lowest and the 2- and 20-year recurrence changes being the highest (showing no clear trend through recurrences). By comparison, use of the Simple Delta Method produces a change that's relatively centered in the range of changes produced by the Quantile Delta Method. This is similarly found for other projections scenarios, future periods, and location combinations. In summary, the Quantile Delta Method used in this study reveals uncertain change at different recurrence intervals but not a clear trend in change across those intervals. Given that, it might be reasoned to focus on the changes produced using the Simple Delta Method, or pool and average changes produced using both projections sampling methods.

Figure 18 San Antonio Creek - Change in Flood Hydrology Metrics (Ann1DayMax and Ann3DayMax) estimated to have 2-, 10-, and 20-year recurrence considering two Future Climate periods (Near Future (NF), Distant Future (DF)), four Projections Scenarios (Low, Medium, High, All), and two methods to sample changes from projections (Quantile Delta, Simple Delta).

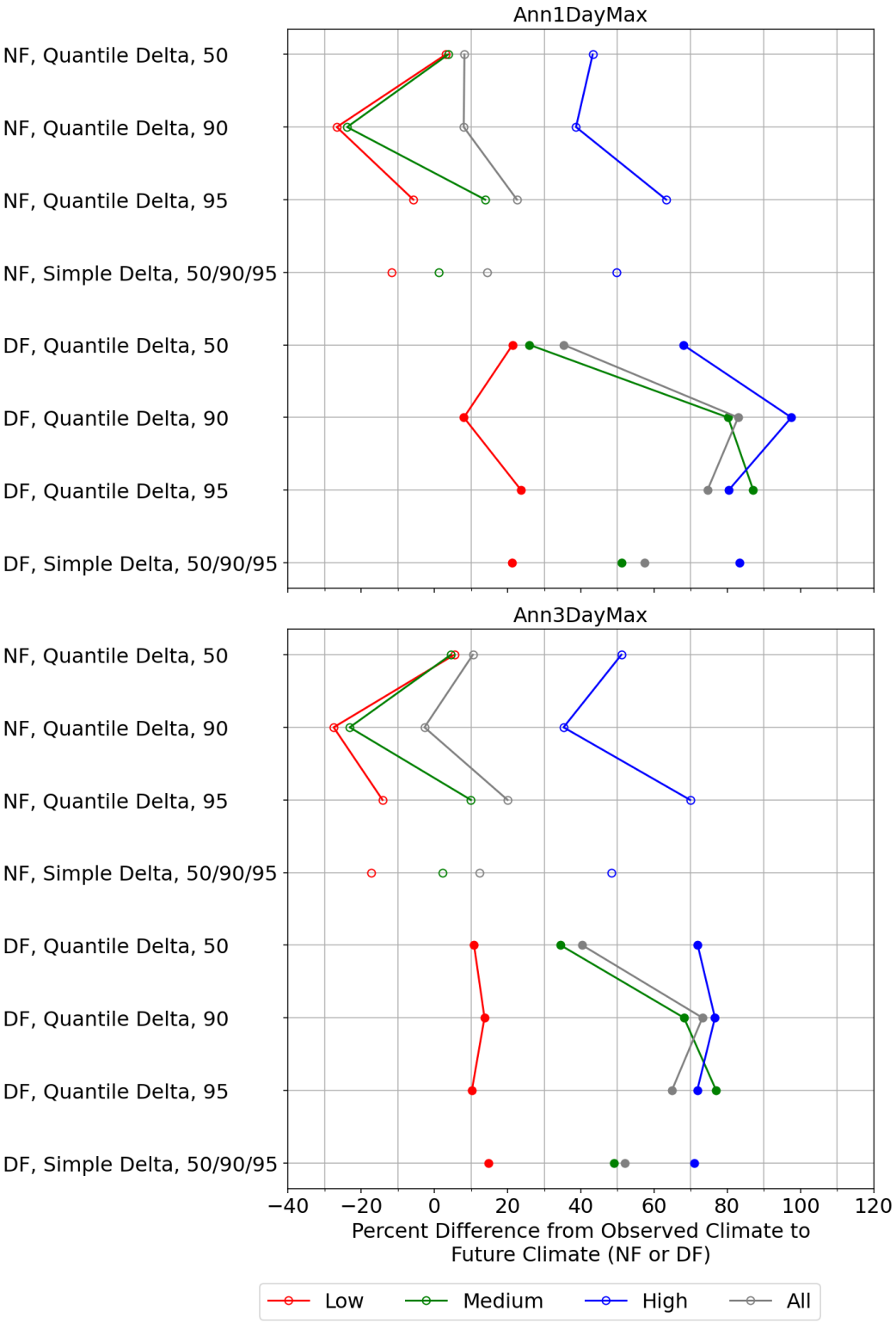


Table 7 San Antonio Creek - Change in Flood Hydrology Metrics (Ann1DayMax and Ann3DayMax) estimated to have 2-, 10-, and 20-year recurrence considering two Future Climate periods (Near Future (NF), Distant Future (DF)), four Projections Scenarios (Low, Medium, High, All), and two methods to sample changes from projections (Quantile Delta, Simple Delta).

	Annual 1-Day Max		Annual 3-Day Max	
Percentile (Recurrence Interval, Years)	Near Future Percent Difference from Observed, in %	Distant Future Percent Difference from Observed, in %	Near Future Percent Difference from Observed, in %	Distant Future Percent Difference from Observed, in %
Low Projections				
QD 50 (2 yr)	3	21	5	11
QD 90 (10 yr)	-27	8	-28	14
QD 95 (20 yr)	-6	24	-14	10
SD 50/90/95 (2/10/20 yr)	-12	21	-17	15
Medium Projections				
50 (2 yr)	4	26	4	34
90 (10 yr)	-24	80	-23	68
95 (20 yr)	14	87	10	77
SD 50/90/95 (2/10/20 yr)	1	51	2	49
High Projections				
50 (2 yr)	43	68	51	72
90 (10 yr)	39	98	35	77
95 (20 yr)	63	80	70	72
SD 50/90/95 (2/10/20 yr)	50	83	48	71
All Projections				
50 (2 yr)	8	35	11	40
90 (10 yr)	8	83	-3	73
95 (20 yr)	23	75	20	65
SD 50/90/95 (2/10/20 yr)	14	57	12	52

Figure 19 San Antonio Creek near Ventura River Confluence- Change in Flood Hydrology Metrics (Ann1DayMax and Ann3DayMax) estimated to have 2-, 10-, and 20-year recurrence considering two Future Climate periods (Near Future (NF), Distant Future (DF)), four Projections Scenarios (Low, Medium, High, All), and two methods to sample changes from projections (Quantile Delta, Simple Delta).

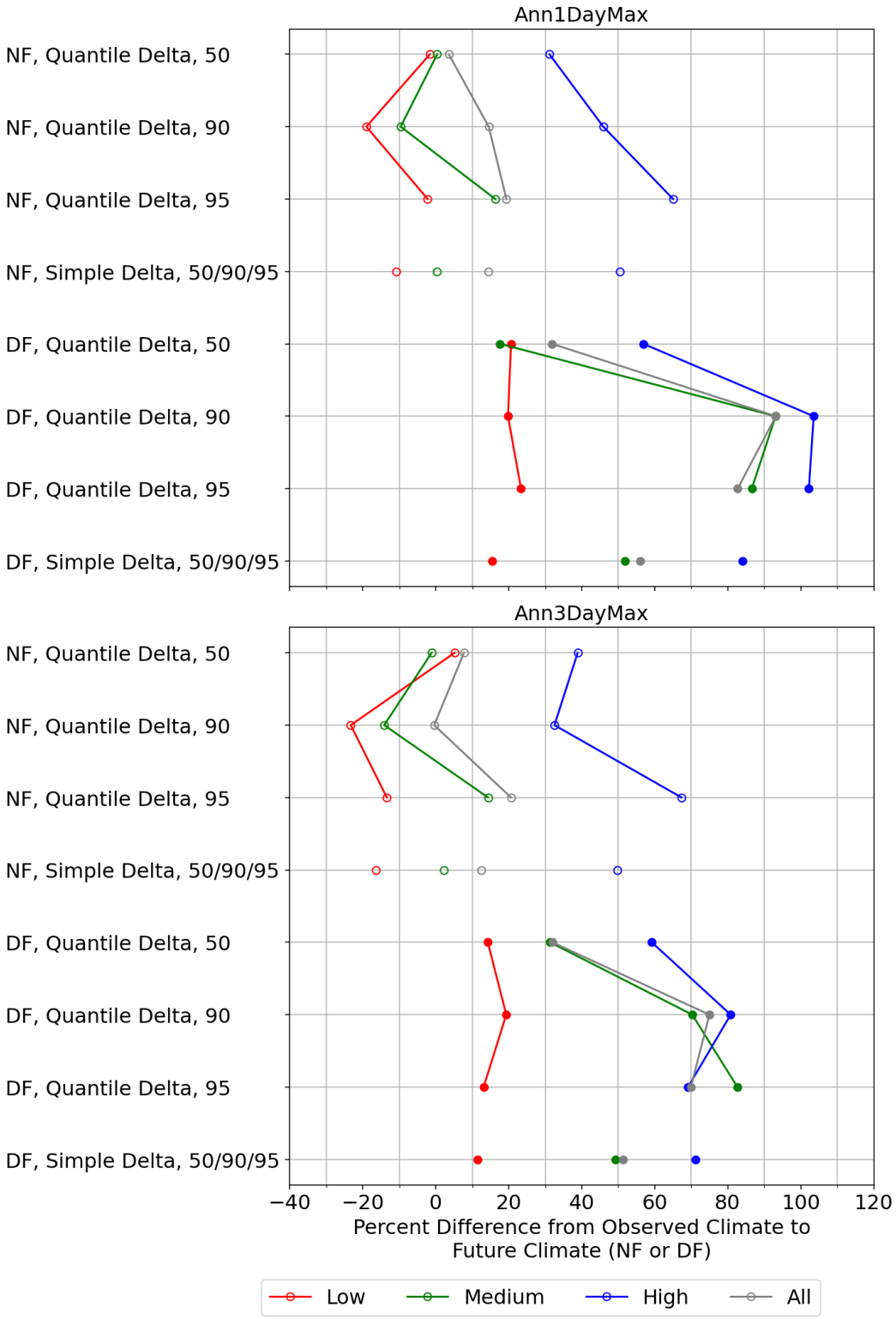


Table 8 San Antonio Creek near Ventura River Confluence - Change in Flood Hydrology Metrics (Ann1DayMax and Ann3DayMax) estimated to have 2-, 10-, and 20-year recurrence considering two Future Climate periods (Near Future (NF), Distant Future (DF)), four Projections Scenarios (Low, Medium, High, All), and two methods to sample changes from projections (Quantile Delta, Simple Delta).

	Annual 1-Day Max		Annual 3-Day Max	
Percentile (Recurrence Interval, Years)	Near Future Percent Difference from Observed, in %	Distant Future Percent Difference from Observed, in %	Near Future Percent Difference from Observed, in %	Distant Future Percent Difference from Observed, in %
Low Projections				
QD 50 (2 yr)	-2	21	5	14
QD 90 (10 yr)	-19	20	-23	19
QD 95 (20 yr)	-2	23	-13	13
SD 50/90/95 (2/10/20 yr)	-11	15	-16	11
Medium Projections				
50 (2 yr)	0	18	-1	31
90 (10 yr)	-10	93	-14	70
95 (20 yr)	16	87	14	83
SD 50/90/95 (2/10/20 yr)	0	52	2	49
High Projections				
50 (2 yr)	31	57	39	59
90 (10 yr)	46	104	33	81
95 (20 yr)	65	102	67	69
SD 50/90/95 (2/10/20 yr)	50	84	50	71
All Projections				
50 (2 yr)	4	32	8	32
90 (10 yr)	15	93	0	75
95 (20 yr)	19	83	21	70
SD 50/90/95 (2/10/20 yr)	14	56	13	51

Figure 20 Ventura River at Robles Diversion - Change in Flood Hydrology Metrics (Ann1DayMax and Ann3DayMax) estimated to have 2-, 10-, and 20-year recurrence considering two Future Climate periods (Near Future (NF), Distant Future (DF)), four Projections Scenarios (Low, Medium, High, All), and two methods to sample changes from projections (Quantile Delta, Simple Delta).

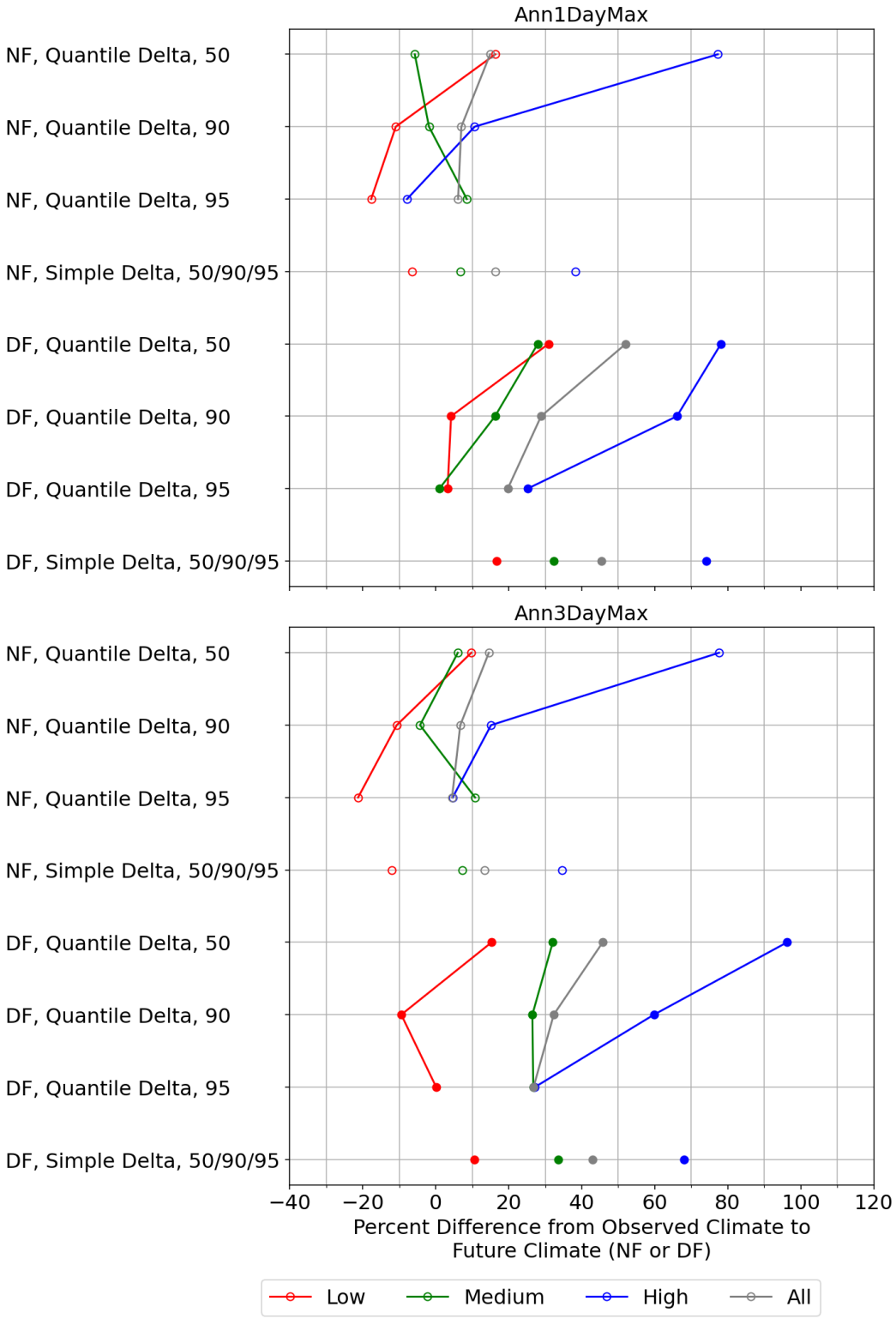


Table 9 Ventura River at Robles Diversion - Change in Flood Hydrology Metrics (Ann1DayMax and Ann3DayMax) estimated to have 2-, 10-, and 20-year recurrence considering two Future Climate periods (Near Future (NF), Distant Future (DF)), four Projections Scenarios (Low, Medium, High, All), and two methods to sample changes from projections (Quantile Delta, Simple Delta).

	Annual 1-Day Max		Annual 3-Day Max	
Percentile (Recurrence Interval, Years)	Near Future Percent Difference from Observed, in %	Distant Future Percent Difference from Observed, in %	Near Future Percent Difference from Observed, in %	Distant Future Percent Difference from Observed, in %
Low Projections				
QD 50 (2 yr)	16	31	10	15
QD 90 (10 yr)	-11	4	-11	-9
QD 95 (20 yr)	-18	3	-21	0
SD 50/90/95 (2/10/20 yr)	-6	17	-12	11
Medium Projections				
50 (2 yr)	-6	28	6	32
90 (10 yr)	-2	16	-4	26
95 (20 yr)	9	1	11	27
SD 50/90/95 (2/10/20 yr)	7	32	7	34
High Projections				
50 (2 yr)	77	78	78	96
90 (10 yr)	11	66	15	60
95 (20 yr)	-8	25	5	27
SD 50/90/95 (2/10/20 yr)	38	74	35	68
All Projections				
50 (2 yr)	15	52	15	46
90 (10 yr)	7	29	7	32
95 (20 yr)	6	20	4	27
SD 50/90/95 (2/10/20 yr)	16	45	13	43

Figure 21 Ventura River at Santa Ana Blvd - Change in Flood Hydrology Metrics (Ann1DayMax and Ann3DayMax) estimated to have 2-, 10-, and 20-year recurrence considering two Future Climate periods (Near Future (NF), Distant Future (DF)), four Projections Scenarios (Low, Medium, High, All), and two methods to sample changes from projections (Quantile Delta, Simple Delta).

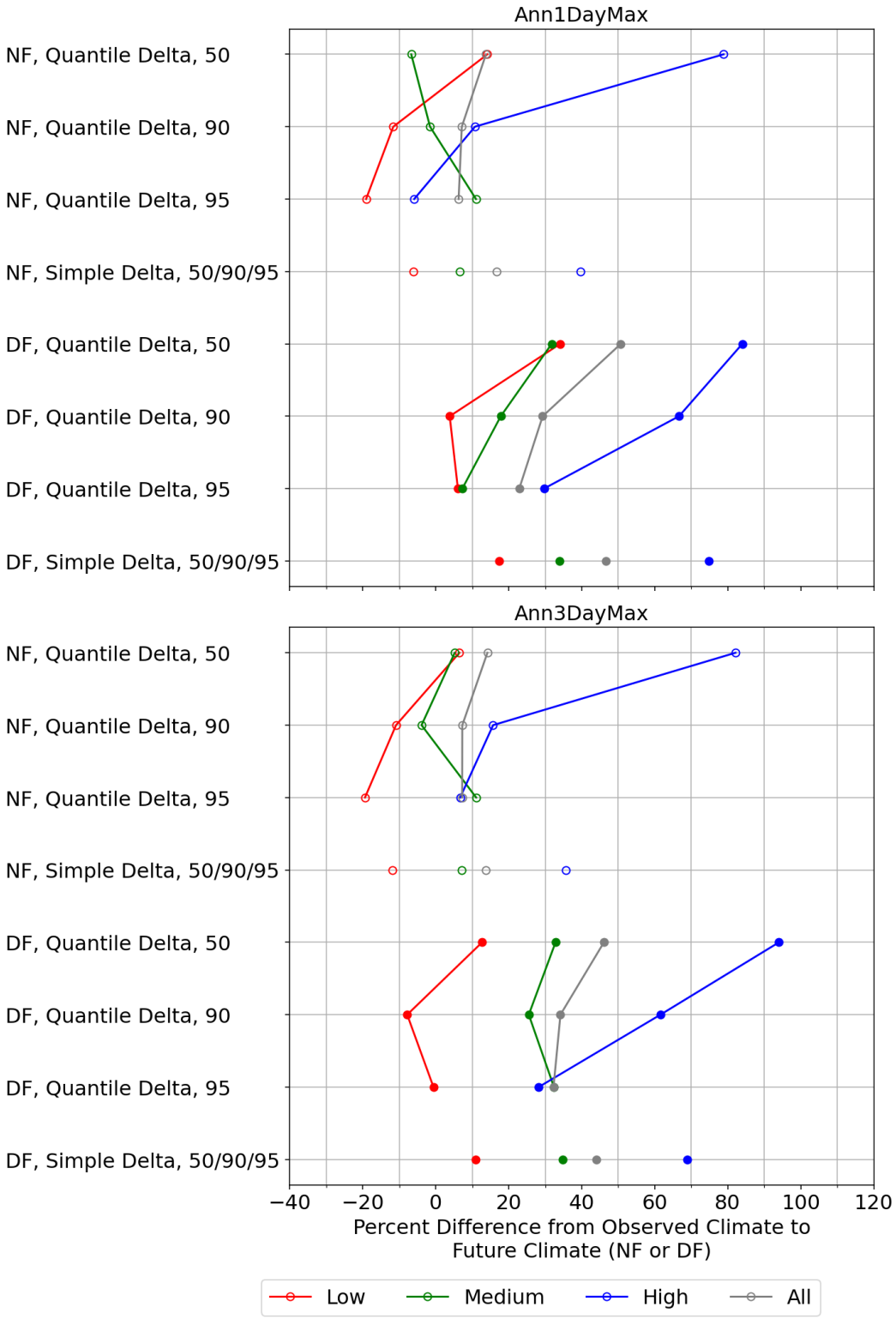


Table 10 Ventura River at Santa Ana Blvd - Change in Flood Hydrology Metrics (Ann1DayMax and Ann3DayMax) estimated to have 2-, 10-, and 20-year recurrence considering two Future Climate periods (Near Future (NF), Distant Future (DF)), four Projections Scenarios (Low, Medium, High, All), and two methods to sample changes from projections (Quantile Delta, Simple Delta).

	Annual 1-Day Max		Annual 3-Day Max	
Percentile (Recurrence Interval, Years)	Near Future Percent Difference from Observed, in %	Distant Future Percent Difference from Observed, in %	Near Future Percent Difference from Observed, in %	Distant Future Percent Difference from Observed, in %
Low Projections				
QD 50 (2 yr)	14	34	6	13
QD 90 (10 yr)	-12	4	-11	-8
QD 95 (20 yr)	-19	6	-19	-1
SD 50/90/95 (2/10/20 yr)	-6	17	-12	11
Medium Projections				
50 (2 yr)	-7	32	5	33
90 (10 yr)	-2	18	-4	25
95 (20 yr)	11	7	11	32
SD 50/90/95 (2/10/20 yr)	7	34	7	35
High Projections				
50 (2 yr)	79	84	82	94
90 (10 yr)	11	67	16	62
95 (20 yr)	-6	30	7	28
SD 50/90/95 (2/10/20 yr)	40	75	36	69
All Projections				
50 (2 yr)	14	51	14	46
90 (10 yr)	7	29	7	34
95 (20 yr)	6	23	7	32
SD 50/90/95 (2/10/20 yr)	17	47	14	44

Figure 22 Ventura River near Casitas Springs - Change in Flood Hydrology Metrics (Ann1DayMax and Ann3DayMax) estimated to have 2-, 10-, and 20-year recurrence considering two Future Climate periods (Near Future (NF), Distant Future (DF)), four Projections Scenarios (Low, Medium, High, All), and two methods to sample changes from projections (Quantile Delta, Simple Delta).

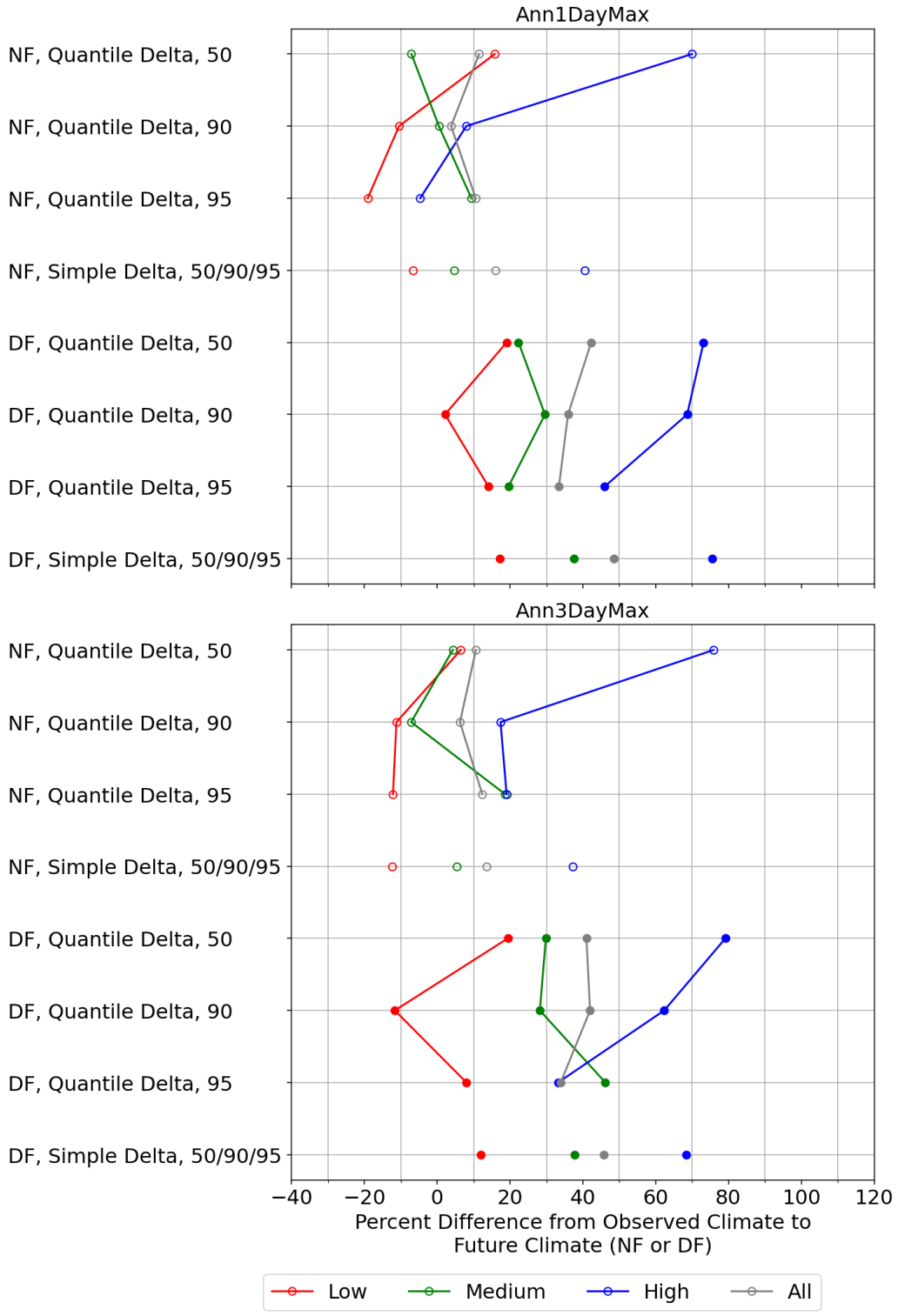


Table 11 Ventura River near Casitas Springs - Change in Flood Hydrology Metrics (Ann1DayMax and Ann3DayMax) estimated to have 2-, 10-, and 20-year recurrence considering two Future Climate periods (Near Future (NF), Distant Future (DF)), four Projections Scenarios (Low, Medium, High, All), and two methods to sample changes from projections (Quantile Delta, Simple Delta).

	Annual 1-Day Max		Annual 3-Day Max	
Percentile (Recurrence Interval, Years)	Near Future Percent Difference from Observed, in %	Distant Future Percent Difference from Observed, in %	Near Future Percent Difference from Observed, in %	Distant Future Percent Difference from Observed, in %
Low Projections				
QD 50 (2 yr)	16	19	6	19
QD 90 (10 yr)	-10	2	-11	-12
QD 95 (20 yr)	-19	14	-12	8
SD 50/90/95 (2/10/20 yr)	-7	17	-12	12
Medium Projections				
50 (2 yr)	-7	22	4	30
90 (10 yr)	0	30	-7	28
95 (20 yr)	9	20	19	46
SD 50/90/95 (2/10/20 yr)	5	38	5	38
High Projections				
50 (2 yr)	70	73	76	79
90 (10 yr)	8	69	17	62
95 (20 yr)	-5	46	19	33
SD 50/90/95 (2/10/20 yr)	41	76	37	68
All Projections				
50 (2 yr)	12	42	11	41
90 (10 yr)	4	36	6	42
95 (20 yr)	11	33	12	34
SD 50/90/95 (2/10/20 yr)	16	49	13	46

Figure 23 Ventura River near W Stanley Avenue - Change in Flood Hydrology Metrics (Ann1DayMax and Ann3DayMax) estimated to have 2-, 10-, and 20-year recurrence considering two Future Climate periods (Near Future (NF), Distant Future (DF)), four Projections Scenarios (Low, Medium, High, All), and two methods to sample changes from projections (Quantile Delta, Simple Delta).

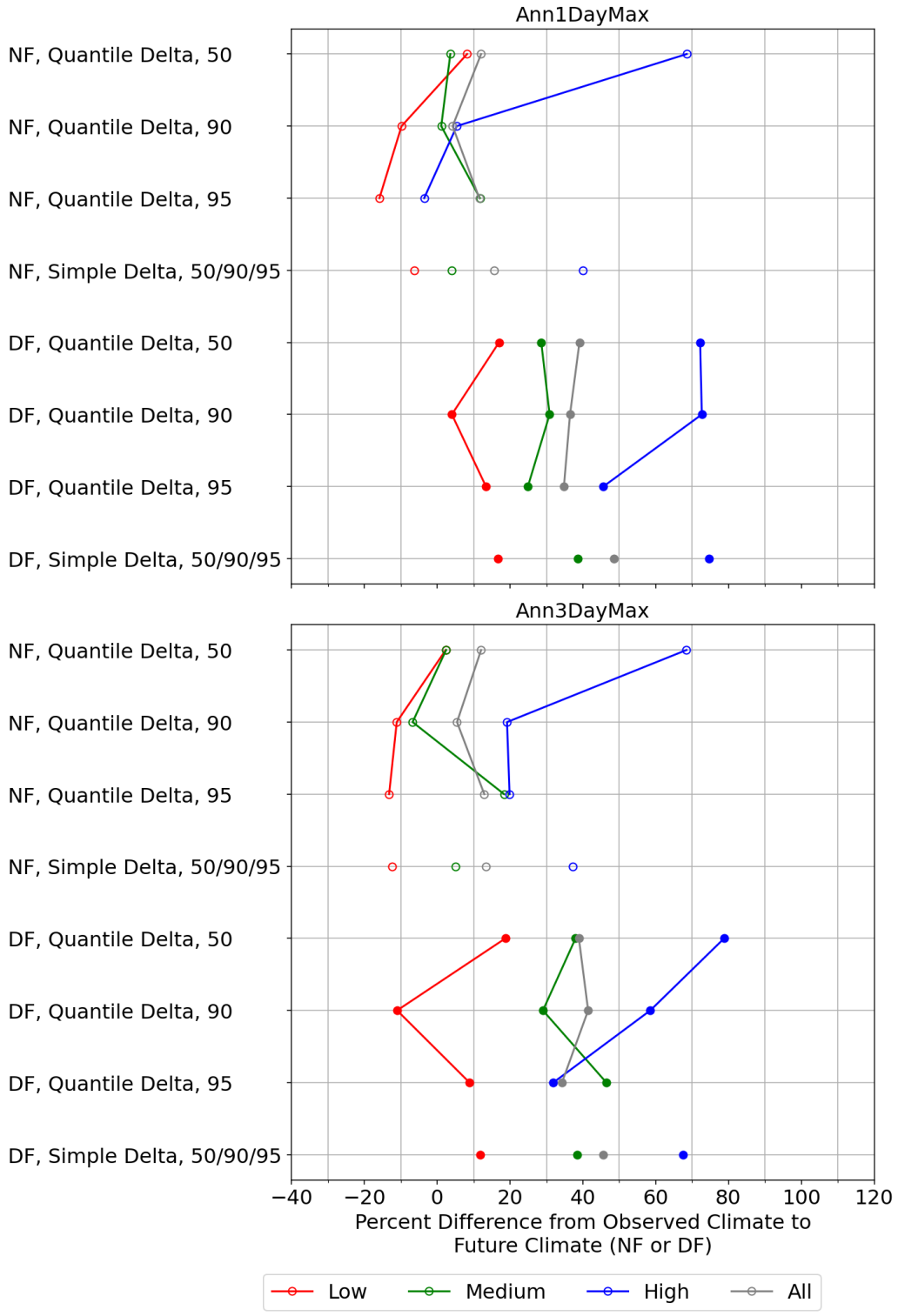


Table 12 Ventura River near W Stanley Ave - Change in Flood Hydrology Metrics (Ann1DayMax and Ann3DayMax) estimated to have 2-, 10-, and 20-year recurrence considering two Future Climate periods (Near Future (NF), Distant Future (DF)), four Projections Scenarios (Low, Medium, High, All), and two methods to sample changes from projections (Quantile Delta, Simple Delta).

	Annual 1-Day Max		Annual 3-Day Max	
Percentile (Recurrence Interval, Years)	Near Future Percent Difference from Observed, in %	Distant Future Percent Difference from Observed, in %	Near Future Percent Difference from Observed, in %	Distant Future Percent Difference from Observed, in %
Low Projections				
QD 50 (2 yr)	8	17	2	19
QD 90 (10 yr)	-10	4	-11	-11
QD 95 (20 yr)	-16	13	-13	9
SD 50/90/95 (2/10/20 yr)	-6	17	-12	12
Medium Projections				
50 (2 yr)	4	29	2	38
90 (10 yr)	1	31	-7	29
95 (20 yr)	12	25	18	46
SD 50/90/95 (2/10/20 yr)	4	39	5	38
High Projections				
50 (2 yr)	69	72	68	79
90 (10 yr)	5	73	19	59
95 (20 yr)	-4	46	20	32
SD 50/90/95 (2/10/20 yr)	40	75	37	67
All Projections				
50 (2 yr)	12	39	12	39
90 (10 yr)	4	36	5	41
95 (20 yr)	12	35	13	34
SD 50/90/95 (2/10/20 yr)	16	48	13	46

Key Findings

Overall, changes in flood hydrology vary considerably and depend on method choices related to assessment location in the watershed, future period, projections scenario, projections sampling method, flood metric, and flood metric recurrence interval. Summary findings by Assessment Location:

- *San Antonio Creek.* For this location, changes vary between -28 and +98 percent, averaging +33 percent. Focusing just on the All Projections scenario, pooling results across flood metrics, flood metric recurrence, and projections sampling method, and then splitting results between Near Future and Distant Future, the average change is +12 and +61 percent for those futures respectively, with range of change being -3 to +23 and +35 to +83 for those futures respectively. Visually inspecting

Figure 18 shows that variation in results is influenced by method choices ordered from seemingly most to least influential: projections scenario, future period, projections sampling method, flood metric recurrence (for Quantile Delta method results only), and flood metric.

- *San Antonio Creek near Ventura Confluence.* Results at this location show similar variations and method dependencies as those for San Antonio Creek. Changes vary between -23 and +104 percent, averaging +34 percent. While the range of changes is like that found at the San Antonio Creek, Figure 19 shows that if the High Projections scenario is excluded, the variation across the other projection scenarios is relatively less compared to that found at San Antonio Creek. However, like San Antonio Creek, variation in results is influenced by method choices ordered similarly to results found at San Antonio Creek.
- *Ventura River at Robles Diversion.* Switching to the Upper Ventura Watershed, results at this location vary between -21 and +96 percent, averaging +22 percent. The range's sensitivity to including the High Projections scenario is similar to that found for San Antonio Creek near Ventura Confluence, as shown on Figure 20, and sensitivities to methods choices are also similar, with the two most critical choices being projections scenario and future period.
- *Ventura River at Santa Ana Blvd.* Proceeding downstream to Santa Ana Blvd, Ventura River flood metric changes were found to be like those found at Robles Diversion, varying between -19 and +94 percent, averaging +22 percent. The range's sensitivity to method choices, as shown on Figure 21, was also like the sensitivity at Robles Diversion, with the two most critical choices being projections scenario and future period.
- *Ventura River near Casitas Springs.* Moving to the lower watershed, below the confluence with San Antonio Creek, changes were found to be slightly less varied, ranging between -19 and +79 percent and averaging +24 percent. The range's sensitivity to method choices is indicated by results shown on Figure 22, indicating the most critical choice being projections scenario followed by future period.
- *Ventura River near W Stanley Avenue.* This location is the most downstream and integrates hydrologic response from the largest tributary area among the six locations assessed. At this location, changes vary between -16 and +79 percent, averaging +23 percent. Focusing on the All Projections scenario, pooling results across flood metrics, flood metric recurrence, and projections sampling method, and splitting results between Near Future and Distant Future, the average change is +11 and +40 percent for those futures respectively, with range of change being +4 to +16 and +34 to +48 for those futures respectively. Visually inspecting Figure 23 shows that variation in results is primarily dominated by projections scenario and future period choices, followed by (in order of apparent influence) projections sampling method, flood metric recurrence (for Quantile Delta method results only) and flood metric.

Additional findings in how changes are sensitive to method choices:

- *How do changes vary by location?* For Ann1DayMax, changes were found to be generally greater and more varied for upstream locations having smaller tributary area and lesser for downstream areas having greater tributary area. For Ann3DayMax, this location trend was less apparent.
- *How do these changes vary by flood metric?* Overall, percent changes for the two flood metrics are generally comparable when all other method choices are equal.
- *How do changes vary by future period?* It was found that flood hydrology changes generally increased through the 21st century, reflecting that the underlying precipitation projections getting wetter from projections near future to distant future periods.

- *How do changes vary across projections scenarios and future periods?* Changes vary substantially across projections scenarios and future periods. Change variation across projections scenarios within a given future period are often on par with change variation across future periods from Near Future to Distant Future.
- *How do these changes vary by projections sampling method and flood metric recurrence?* The Quantile Delta Method used in this study reveals uncertain change at different recurrence intervals but not a clear trend in change across those intervals. Given that, it might be reasoned to focus on the changes produced using the Simple Delta Method, or pool and average changes produced using both projections sampling methods.

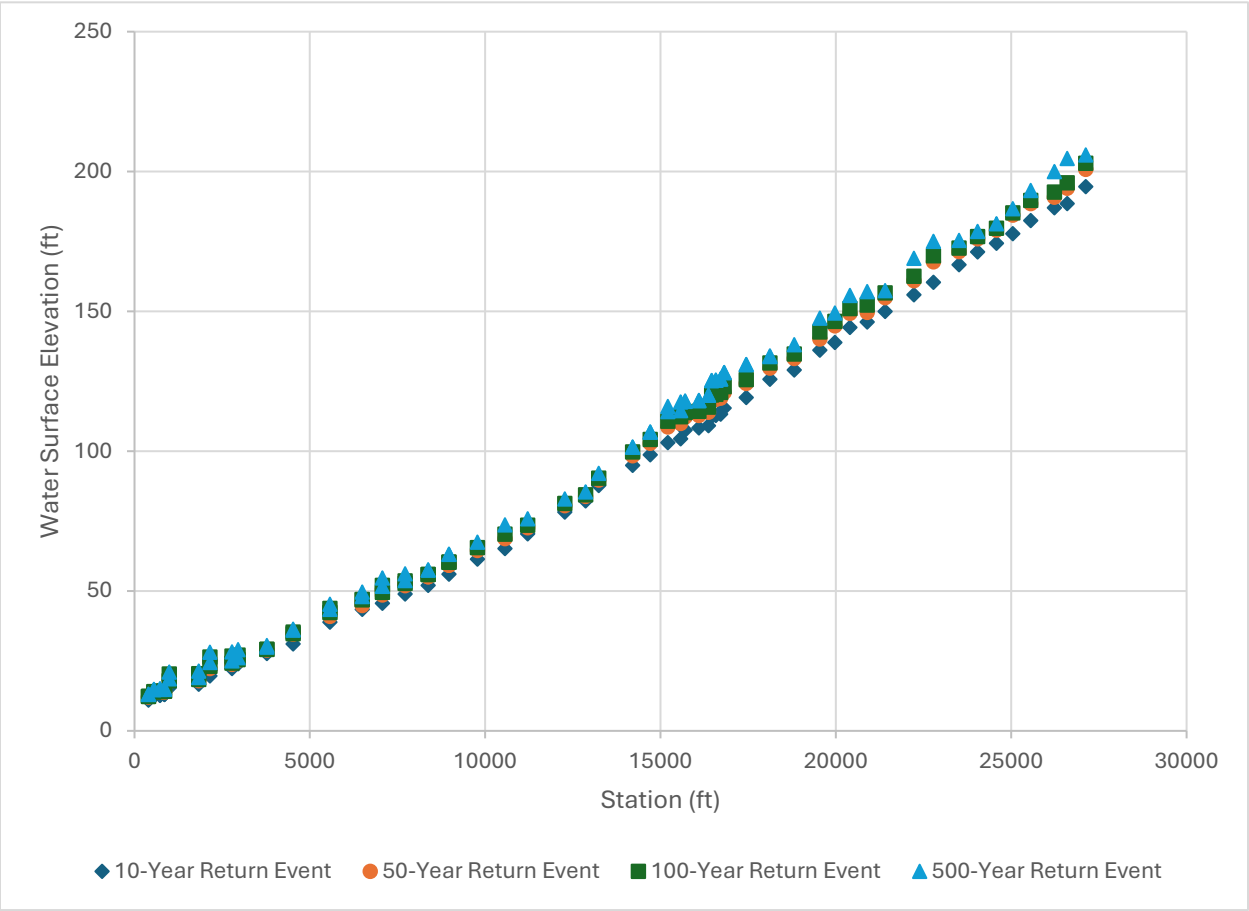
Hydraulic Analysis

The hydraulic assessment interprets projected changes in hydrologic conditions under future climate scenarios into actionable benchmarks for flood planning and adaptation within the Ventura River Watershed. Building on the hydrologic analysis, which quantifies changes in key runoff metrics under Observed and Future Climate contexts, this section evaluates how those changes manifest as hydraulic loading and floodplain response at selected assessment locations. By linking watershed-scale hydrologic projections to site-specific hydraulic behavior, the assessment establishes a quantitative basis for understanding how climate-driven changes in flood magnitude may affect water resource systems and community assets. The results are intended to support the Watershed Network and asset managers in prioritizing adaptation strategies and integrating updated flood management benchmarks into ongoing and future adaptation planning efforts.

Observed Climate Hydraulics

Hydraulic analysis of peak flow events has been completed by FEMA (2024). Documented in the Flood Insurance Study for Ventura County, California, water surface elevations for the 10, 50, 100, and 500-year events are available for the waterways in the Ventura River Watershed, developed with standard methods (FEMA 2024). Figure 24 depicts example flood profile data for the most downstream reach of the Ventura River showing water surface elevation versus cross section station along the analyzed reach.

Figure 24 Water Surface Elevation Profiles of the Ventura River near the City of Ventura



Utilizing the FEMA Flood Profiles along the Ventura River near the City of Ventura and San Antonia Creek near the City of Ojai, the average difference in water surface elevation (WSE) was computed along the assessed reaches between the documented flood profiles. For San Antonio Creek, differences in flood depths were calculated between the Grand Avenue crossing and the confluence of San Antonio Creek with Stewart Canyon Creek. For the Ventura River, differences in flood depths were calculated between the Shell Road crossing and the Ventura River's outlet to the Pacific Ocean. The flood profiles' water surface elevations for respective peak runoff events represent the baseline, observed climate hydraulics.

Future Climate Hydraulics

Projected hydrologic changes in peak flow result in increased flood depths. Utilizing the projected change of all analyzed climate projections in the distant-future climate period, the increases in flow depth were estimated at the two example locations: San Antonio Creek near City of Ojai and Ventura River near City of Ventura. This was accomplished by linearly interpolating observed climate stage-discharge relationships to identify water surface elevations expected at projected peak flows with climate change. To demonstrate the range of uncertainty associated with the potential change in peak flow represented by the 21 climate projections, the average is presented alongside the upper and lower bounds of the projected ranges.

Stage-discharge relationships are influenced by channel geometry, roughness, natural processes (e.g. sedimentation, wildfire debris flow), and projects (e.g. dam removal). Therefore, this analysis reports only relative change in stage, rather than absolute water surface elevation.

San Antonio Creek

At the furthest upstream hydrologic assessment location along San Antonio Creek, hydrology projections indicate variable change (-3 to +23 percent) in peak flow for near-future climate (2015-2057) and a significant (+35 to +83 percent) increase in peak flow for the distant-future climate (2058-2100) conditions. Figure 25 illustrates the average +60% increase in annual peak flow. Table 13 provides for the range of project changes in peak flow and a comparison of depth changes.

Figure 25 Return Period-Discharge Relationship along San Antonio Creek near City of Ojai

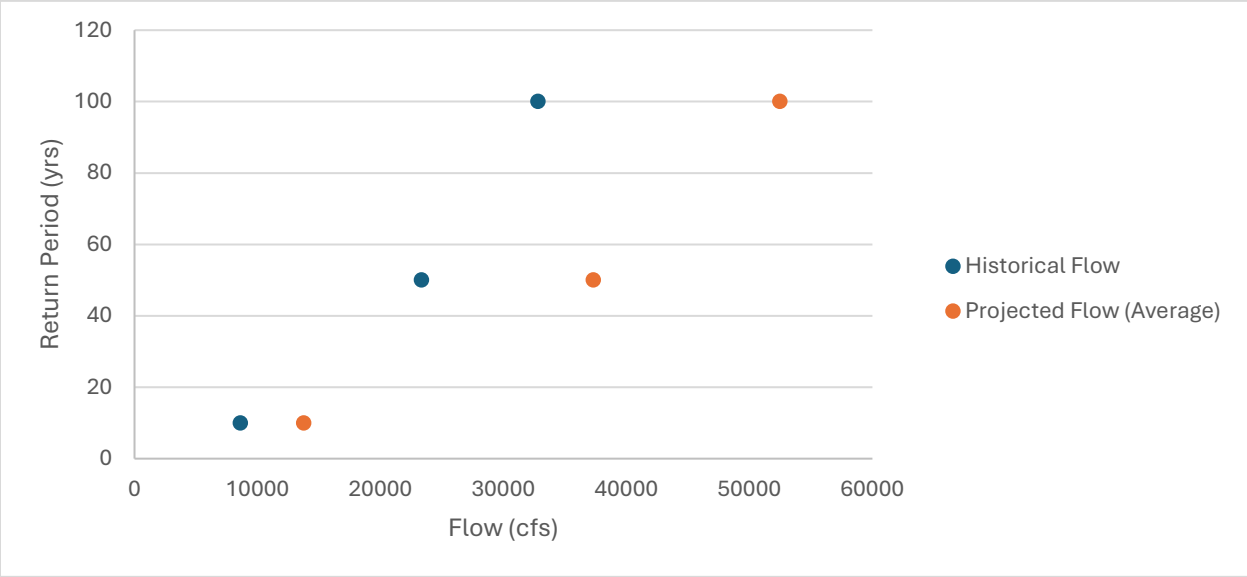


Table 13 Comparison of Historical and Projected Distant-future Climate Peak Flow and Stage Change along San Antonio Creak near City of Ojai

Return Event	10-year	50-year	100-year	500-year
Observed Climate Peak Flow	8,590 cfs	23,320 cfs	32,800 cfs	64,030 cfs
Distant Climate Peak Flow	**13,740 cfs** (11,600-15,700 cfs)	**37,310 cfs** (31,500-42,700 cfs)	**52,480 cfs** (44,300-60,000)	Not Estimated***
Depth Change from Historical	**+1.4 ft WSE** (1.1-1.7 ft)	**+1.7 ft WSE** (0.8-2.5 ft)	**+2.1 ft WSE** (0.9-3.1 ft)	Not Estimated***

Key:
cfs = cubic feet per second
sq. mi = square miles
WSE = water surface elevation

Notes:
*10-year, 50-year, and 100-year information refers to 10-year, 50-year, and 100-year recurrence internal flood events.
**Source: FIS 2024

***500-year peak flow rates and associated depth changes were not estimated because the analysis is based on trend relationships derived from 10-, 50-, and 100-year events. Extrapolating beyond data range introduces significant uncertainty.

Ventura River

At the furthest downstream hydrologic assessment location along Ventura River (W. Stanley Ave.), hydrology projections indicate a relatively small (+4 to +16 percent) increase in peak flow for near-future climate (2015-2057) and a significant (+34 to +48 percent) increase in peak flow for the distant-future climate (2058-2100) conditions. Figure 26 illustrates the average +40% increase in annual peak flow. Table 14 provides for the range of project changes in peak flow and a comparison of depth changes.

Figure 26 Return Period-Discharge Relationship along the Ventura River near City of Ventura

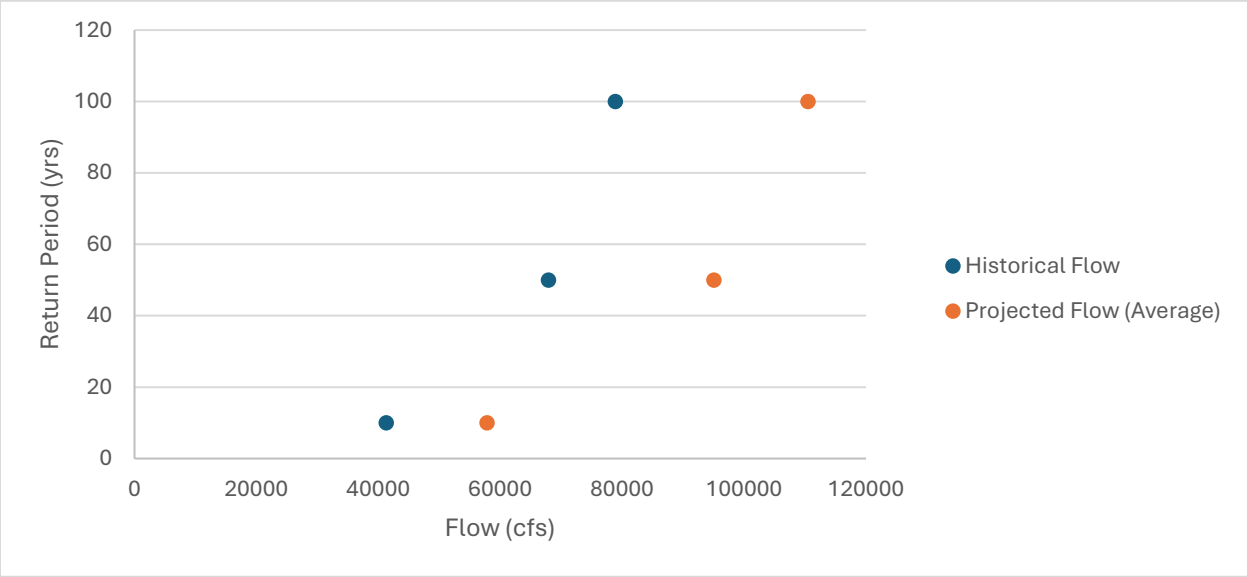


Table 14 Comparison of Historical and Projected Distant-future Climate Peak Flow and Stage Change along the Ventura River near City of Ventura

Return Event	10-year	50-year	100-year	500-year
Observed Climate Peak Flow	41,300 cfs	67,900 cfs	78,900 cfs	105,500 cfs
Distant Climate Peak Flow	**57,820 cfs** (55,300-61,100 cfs)	**95,060 cfs** (91,000-100,500 cfs)	**110,460 cfs** (105,700-116,800 cfs)	Not Estimated***
Depth Change from Historical	**+2.1 ft WSE** (1.8-2.4 ft)	**+2.7 ft WSE** (2.2-3.3 ft)	**+3.3 ft WSE** (2.8-4.0 ft)	Not Estimated***

Key:
cfs = cubic feet per second
sq. mi = square miles
WSE = water surface elevation

Notes:
*10-year, 50-year, and 100-year information refers to 10-year, 50-year, and 100-year recurrence internal flood events.
**Source: FIS 2024

***500-year peak flow rates and associated depth changes were not estimated because the analysis is based on trend relationships derived from 10-, 50-, and 100-year events. Extrapolating beyond data range introduces significant uncertainty.

Key Findings

The hydraulic analysis translates projected increases in peak flows into site-specific flood elevation changes at representative upstream and downstream locations in the Ventura River Watershed. Analysis

at San Antonio Creek reflect upper watershed response, while analysis at the Ventura River near W. Stanley Avenue capture the integrated response of the full watershed, together framing the range of projected flood elevation increases across return periods. Results indicate that future peak flows may shift (e.g. the magnitude of floods may increase so that what was once the 100-yr flood becomes the 50-yr or smaller), and other design storms could also increase in magnitude (see Tables 13 and 14). This shift highlights the potential vulnerability of the watershed and the additional measures that may be needed to maintain current levels of flood protection, including the effort associated with returning to today's 100- or 500-year design standards.

- *San Antonio Creek.* This location is the most upstream hydraulic assessment location, providing an example of upper watershed and smaller catchment areas' response to changing hydrologic conditions. Changes in water surface elevation vary by location and return period. Utilizing the average projected hydrologic change for annual peak flow across all projections of +60%, the predicted water surface elevations on average across the assessment region are expected to be between 1.1-1.7 ft for the 10-year return period, between of 0.8-2.5 ft for the 50-year return period, and between 0.9-3.1 ft for the 100-year return period.
- *Ventura River near W Stanley Avenue.* This location is the most downstream and integrates hydrologic response to changing conditions across the entire watershed. Changes in water surface elevation vary by location and return period. Utilizing the average projected hydrologic change for annual peak flow across all projections of +40%, the predicted water surface elevations on average across the assessment region are expected to be between 1.8-2.4 ft for the 10-year return period, between 2.2-3.3 ft for the 50-year return period, and between 2.8-4.0 ft for the 100-year return period.

Vulnerability Reduction

This section assesses flood vulnerability within the Ventura River watershed and evaluates potential measures to reduce vulnerability. Using the climate-informed hydrologic and hydraulic analyses, this assessment estimates how changes in runoff magnitude and resultant alterations in flood depth and extent exacerbate the exposure of flooding at representative locations. Findings provide a quantitative foundation for confirming priority vulnerabilities identified through stakeholder engagement and for informing climate-resilient flood management and infrastructure planning across the watershed.

The adaptation strategies presented herein focus on non-structural approaches, including active floodplain management measures such as removing structures from the floodplain and promoting flood-proofing of existing structures. These measures are intended to reduce flood damages, rather than to alter flood peaks, water surface elevations, or the physical extent of flooding. Implementation would likely occur on a parcel-by-parcel basis, with minimal impact on floodplain storage or conveyance. The purpose of these non-structural strategies is not to reduce the flood extent or magnitude, but rather to mitigate the consequences of flooding on people and property. There are negligible benefits to the modeling of these adaptation strategies due to the lack of structural changes in post-adaptation strategy conditions.

Flood Vulnerability

The floodplain mapping includes the designated flood hazard areas of the 100-year and 500-year events and areas designated as having reduced risk due to levee. Since the annual peak flow events are projected to increase substantially in magnitude in the distant-future climate, the designated flood hazard zones are likely to experience flooding at a more frequent rate than was analyzed in the observed climate conditions.

Parcels and state bridge locations within and near the Cities of Ojai and Ventura are utilized to represent social exposure and critical infrastructure exposure to flooding. Though parcels may be owned and utilized by various representatives of society and sensitivity to flooding would vary, the parcels are identified to represent the number of directly impacted community members. State bridges, representing bridges on major roadways, identify one high-consequence system component where failure or reduced access would result in community-wide consequences. Major bridge failure could result in the disconnection of an entire community from the rest of the watershed.

Parcels contained within observed climate FEMA designated flood hazard zones (floodplains) are enumerated in Table 15. Approximately 1000 parcels are located within the FEMA Flood Hazard Zones in each city. As shown in Figures 27 and 28, state bridges are in and near flood hazard zones in both hydraulic assessment locations. Figure 28 also depicts the locations of vulnerable communities, as defined by the Governor's Office of Land Use and Climate Innovation's Vulnerable Communities Platform (VCP), relative to the FEMA floodplains. There are no VCP-identified vulnerable communities in the modeled region of Ojai, thus is not included in Figure 27.

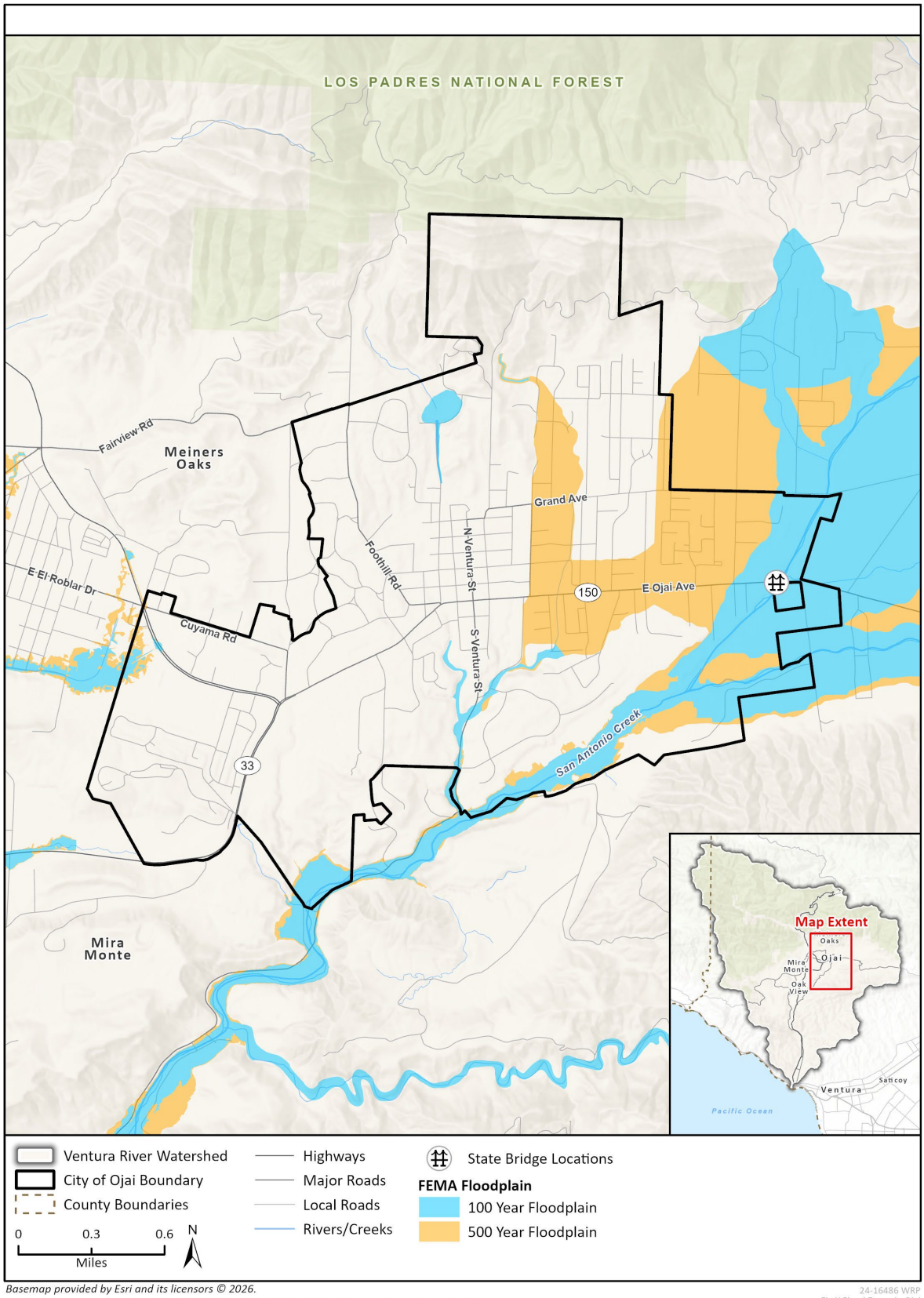
Table 15 Number of Parcels within Designated Flood Hazard Zones, or Floodplains, for San Antonio Creek near City of Ojai and Ventura River near City of Ventura Assessment Areas

Location	FEMA 100-Year Flood Hazard Zone	FEMA 500-Year Flood Hazard Zone	Levee-Protected Areas
San Antionio Creek Floodplain near City of Ojai	133	952	N/A
Ventura River Floodplain near City of Ventura	16	20	923

Key:
FEMA = Federal Emergency Management Agency

Note: Parcel count constrained to city limits of City of Ojai and City of Ventura, respectively.

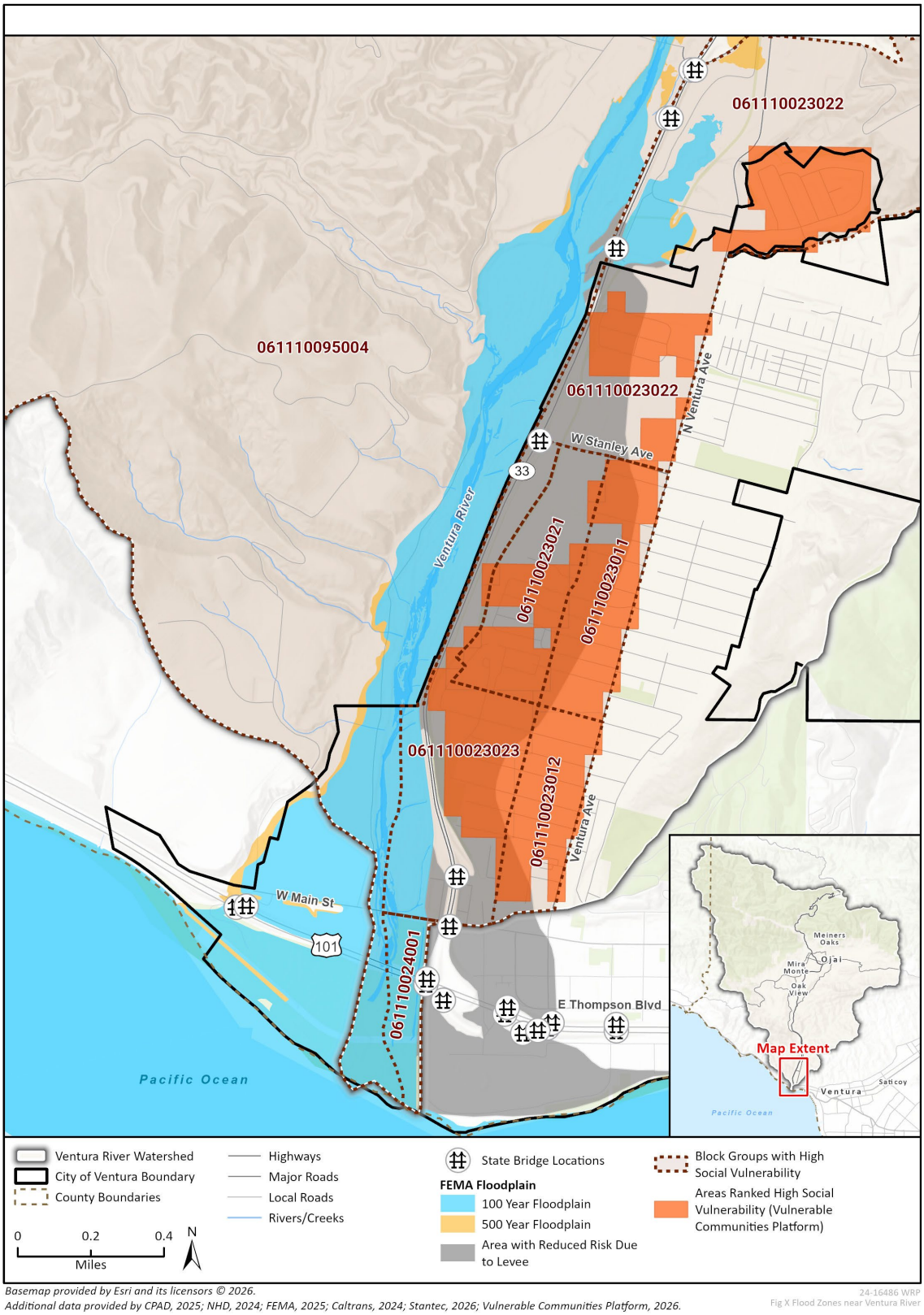
Figure 27 Flood Hazard Zones for San Antonio Creek near City of Ojai Area Assessment Site



Basemap provided by Esri and its licensors © 2026.
Additional data provided by CPAD, 2025; NHD, 2024; FEMA, 2025; Caltrans, 2024; Stantec, 2026.

24-16486 WRP
Fig X Flood Zones in Ojai

Figure 28 Flood Hazard Zones for Ventura River near City of Ventura Assessment Site



Basemap provided by Esri and its licensors © 2026.
Additional data provided by CPAD, 2025; NHD, 2024; FEMA, 2025; Caltrans, 2024; Stantec, 2026; Vulnerable Communities Platform, 2026.

24-16486 WRP
Fig X Flood Zones near Ventura River

Adaptation Measures

Various adaptation measures may be implemented to reduce vulnerability identified in this assessment. Table 16 summarizes key vulnerability-reduction measures and cross-references relevant strategies discussed in Chapter 6: Adaptation Strategies, Actions, and Implementation Roadmaps. These measures vary by application, suitability to site conditions, and alignment with planning goals and implementation timelines.

Table 16 Vulnerability Reduction Measures to Adapt to Projected Future Hydrology

Vulnerability Reduction Measure	System / Region	Designation	Adaptation Strategy
Flood Easements	Ventura River mainstem & tributaries	Priority	Strategy 4.2
Zoning	Floodplain areas (Ojai Valley, Ventura River communities)	Priority	Strategy 4.2
Development Controls	FEMA SFHA zones	Priority	Strategy 4.2
Land Buy-Back	Repetitive loss properties	Priority	Strategy 4.2
Open Space in Flood Zones	River corridor & coastal plain	Priority	Strategy 4.2
Building Code Updates (e.g. Raised Floor Levels or Flood-Compatible Ground Floors)	New/redeveloped structures in flood zones	Priority	Strategy 4.2
Wetland/Floodplain Restoration	River mouth & upper and lower floodplains	Complementary	Strategy 4.2
Channel Improvements and Natural Processes Restoration	Ventura River & San Antonio Creek	Complementary	Strategy 4.2
Levee/Floodwall Construction/Improvements	Upper and Lower Ventura River	Complementary	Strategy 4.1
Detention and Retention Basins	Upper watershed & urban tributaries	Complementary	Strategy 4.1
Stormwater Improvements	Urbanized areas (Ventura, Ojai)	Complementary	Strategy 4.1
Evacuation Routes	Flood-prone communities	Complementary	Strategy 7.2
Emergency Plans	Watershed-wide	Complementary	Strategy 7.2

Recommended priority vulnerability reduction measures focus on non-structural measures, which would complement structural improvements implemented by infrastructure managers at various locations throughout the watershed. For example, as part of the Matilija Dam Ecosystem Restoration Project, the County is planning improvements for the Casitas Springs and Live Oak Acres to account for deposition following dam removal and to provide 100-yr flood protection in the near term (within the next 30 years).

To prepare for the increased vulnerability over the long term (in the distant-future climate period), non-structural measures could be gradually implemented to remove structures and properties from the floodplain. Implementation of these measures would reduce vulnerability by relocating assets out of the floodplains and ensuring that critical infrastructure will be operable during flood events. As the science of predicting climate change impacts improves and predictions become more certain, the scale and necessity for additional structural solutions could be reassessed to provide appropriate protection against flood vulnerability in the distant-future. Priority adaptation measures for the analyzed areas include:

- In the San Antonio Creek basin, nonstructural adaptation measures are most appropriate to reduce flood vulnerability within the City of Ojai. Since extreme flood events are a combination of pluvial and fluvial flooding within the alluvial fan, structural measures alone may be insufficient.
- Along the Ventura River adjacent to the City of Ventura, a combination of structural and non-structural measures would be appropriate to protect communities and maintain critical infrastructure functionality. Planned levee improvements address near-term vulnerability, with additional actions to be evaluated as climate projections evolve to prepare for distant-future flood projections.
- Critical infrastructure (watershed-wide) should be analyzed to ensure sufficient hydraulic capacity and ensure reliability during extreme flood events as means of evacuation or emergency response.

Uncertainties and Limitations

This analysis was based on choices and assumptions that introduce uncertainty and limit the interpretation and application of results. This section highlights uncertainties related to flood management assumptions as well as climate and hydrology representations. The list of uncertainties is not exhaustive but does represent key uncertainties stemming from these choices.

Flood Management

Indicating flood hydrology vulnerability using total flow volume over 1- to 3-day periods rather than peak flow rate: The metrics Ann1DayMax and Ann3DayMax reflect total flow volume over 1- and 3-day periods, respectively. These metrics contrast from peak flow rate. The latter indicates peak instantaneous water levels and hydraulic stresses on a flood control management system. The former offers similar indication, but less directly. Focusing on climate change impacts on flood hydrology vulnerability, it is assumed that the Ann1DayMax and Ann3DayMax are sufficient metrics for assessing changes in vulnerability from historical to future climate (i.e. that percent changes in these metrics would be like percent changes found for a peak flow rate metric had it been analyzed). Use of total flow volume over 1- and 3-day periods rather than peak flow rate was driven by data availability (i.e. 1- and 3-day runoff volume metrics could be computed at hydrologic assessment locations of interest during both Observed Climate and Future Climate periods, and peak flow rate information was not available for Future Climate periods).

The Lake Casitas tributary area is not managed for flood control purposes. It is uncertain whether Lake Casitas would have uncontrolled releases during extreme precipitation events under future climate conditions. If uncontrolled releases were to occur, downstream areas below the reservoir could experience elevated flood levels and the Ventura River would receive tributary flows that are currently attenuated by Lake Casitas storage operations (i.e. amplified downstream peak flows). This study does not evaluate hydraulic conditions associated with potential uncontrolled reservoir release, overtopping, or structural failure. While an increase in Casitas uncontrolled release could amplify downstream flood peaks, the reservoir would continue to provide significant attenuation of flood flows. The magnitude of any potential increase in peak flows due to uncontrolled release is highly uncertain. The analysis does not include consideration of future Casitas uncontrolled release events, which may result in a conservative estimate of climate-driven increases in downstream peak flows.

Climate and Hydrology

Assumed Observed Climate is indicated by (1) observed runoff at USGS gage Ventura River near Ventura adjusted for upstream river withdrawals at Robles Diversion, and (2) simulated runoff using the VIC

hydrology model. Both items (1) and (2) are used to characterize Observed Climate flood hydrology metrics at the six hydrology assessment locations.

- Item (1) is developed using observed streamflow at USGS 11118500 and simulated upstream diversion under historical hydrologic variability to create adjusted-observed streamflow at USGS 11118500. Using a model to simulate Robles Diversions and then backing those volumes out of USGS observed streamflow to remove diversion impairment creates uncertainty. Ideally, actual historical diversions would be identified and removed. However, simulated diversion was used because it reflects current diversion criteria rather than the sets of evolving diversion criteria at play during the actual history of diversion. This creates uncertainty in estimating (1). Other watershed flow impairments (e.g., Lake Casitas reservoir spill, withdrawals for upstream water use and their return flows, groundwater extraction effects on surface water runoff) were not accounted for in estimating adjusted-observed streamflow at USGS 11118500. On reservoir spills, it is understood that spill events occurred during WY 1978, WY 1980, and WY 1998 within the Observed Climate period, and that these events are coincident with the Ann1DayMax and Ann3DayMax events in the Ventura River below Lake Casitas found for those water years. This adds volume to the flood metrics in those years and creates a positive error in the Observed Climate flood metric distributions at locations below Lake Casitas.
- Item (2) and associated uncertainties come into play during the estimation of synthetic streamflow observations at the six hydrologic assessment locations. Since USGS observations are not directly available at those locations for the Observed Climate period, VIC simulated runoff and adjusted-observed runoff at USGS 11118500 were used to develop synthetic observed streamflow at the six assessment locations. This approach aligns the six locations' resultant streamflow with adjusted-observed streamflow at USGS 11118500. However, this approach is limited by use of the VIC hydrology model and its uncertain representation of watershed hydrology (e.g., surface waters and shallow soils, no groundwater, no impairments).

Assumed natural runoff response to climate change (e.g., from Observed Climate to Future Climate periods) is reasonably simulated by the VIC hydrology model. The VIC model is one of many types of hydrologic models that might have been applied, and models have shown a range of runoff sensitivity to climate change (Vano 2013, Vano et al. 2014, Gosling et al. 2017)) stemming from diverse portrayals of key hydrologic processes controlling runoff such as evapotranspiration, precipitation-infiltration-runoff, soil moisture dynamics, snow accumulation and melt, etc. While calibrating a selected hydrologic model to reproduce historical runoff when forced by historical weather helps to promote simulation of a correct runoff sensitivity to climate change, it does not guarantee such an outcome given these process portrayal uncertainties. Even if an integrated groundwater-surface water hydrologic model had been used, as discussed under the previous item, this uncertainty about hydrologic process portrayal driving runoff sensitivity to climate change would still be present because an integrated hydrologic model must still reflect such process assumptions.

Assumed future changes in climate over the Ventura River watershed might be indicated by the global climate projections represented in this study. Generation of watershed climate projections requires first projecting future global climate and then translating those results into Ventura River watershed climate. Along the way, a series of assumptions and modeling choices are made. At the global level, assumptions are made about future global economic activity that leads to future climate forcings (e.g., greenhouse gas emissions), how to model the global climate system (e.g., land, atmosphere, oceans), and how to initialize simulations giving rise to simulation variants (Taylor et al. 2018). The global climate projections represented in this study (Table 2) are meant to be representative of the broader collection of climate projections available through CMIP6, with curation informed by desire to focus on climate models that

do relatively better at projecting precipitation in California (Krantz et al. 2021). Despite these intentions, uncertainties of global climate projection and sampling from available projections in CMIP6 should be considered when interpreting study findings.

Assumed future changes in climate over the Ventura River watershed might be indicated by using the LOCA2-Hybrid method to translate global climate projections into localized climate projections. In addition to the climate projection uncertainties at the global level, uncertainties at the local level stem from choices in how to bias-correct and translate, or downscale, coarse-scale global climate model results in finer scale, localized projections of climate (e.g., daily minimum temperature, daily maximum temperature, precipitation). The LOCA2-Hybrid method is one of many statistical techniques, and there are other dynamical techniques featuring process-based translation. Statistical and dynamical techniques have been shown to have advantages and disadvantages. The LOCA2-Hybrid technique used in this study aligns this effort with the method used most prolifically in support of the forthcoming 5th California Climate Change Assessment.

Assumed the 21 VIC hydrology projections offer a representative collection of hydrologic responses under climate change in the context of LOCA2-Hybrid CMIP6 localized climate projections over California. As indicated, this analysis leveraged 21 hydrology projections over the Ventura River watershed stemming from a 21-member subset of the 129-member LOCA2-Hybrid CMIP6 localized climate projections ensemble over California, which represents a subset of available global climate projections and 1 of 2 downscaling techniques informing the 5th California Climate Change assessment (i.e. statistical downscaling using LOCA2-Hybrid, dynamical downscaling using a WRF application). Compared to the 129-member LOCA2-Hybrid CMIP6 ensemble, the 21-member subset's temperature and precipitation projections during the Near Future and Distant Future periods are generally representative, but the larger parent ensemble has more variability of changes, which creates uncertainty.

Grouping the 21 VIC hydrology projections and their corresponding 21 LOCA2-Hybrid CMIP6 localized climate projections into four projection scenarios (Low, Medium, High, and All) emphasizes prolific future climate changes amid simulated climate variability. Climate projections portray future drift in global climate variability in response to future climate forcings (i.e. greenhouse gas emissions). For air temperature, it is feasible to detect the future trend amid future temperature variations. For precipitation, it is more difficult as both real and simulated variability are large and can conceal presence of potential trends. Lower frequencies of variability on multidecadal timescales are particularly challenging to address. For example, it is difficult to judge whether an individual projection's portrayal of future change in precipitation at a location like the Ventura River watershed as being climate change or sampling of crests and troughs within multi-decadal precipitation variations. Some studies mitigate this by averaging results from the simulation variants of projections from a given global climate model or model and emissions scenario combination, meaning to emphasize prolific climate change among the simulation variants (e.g., DWR 2025). In this study, variant averaging wasn't an option due to the small ensemble size. To achieve a similar effect of emphasizing prolific change, projections were grouped based on similar expressions of mean-annual runoff change and then results from a projections group were pooled for drought and flood variability analyses.

Quantitative Modeling Frameworks in the Ventura River Watershed

Table 17 Summary of Existing Ventura River Watershed Models

Model Name	Lead Agency/Sponsor	Model Type	Model Platform	Developer (Consultant)	Watershed Extent	Period of Analysis (WY)	Comment
Ventura River Watershed Groundwater and Surface-Water Flow Model (VRW GW-SW Model)	State Water Resources Control Board	Groundwater/ Surface water	GSFLOW (PRMS + MODFLOW)	USGS (DBS&A, Geosyntec)	Entire Watershed	1994-2017	Used in development of VRWRP historical water budget
Upper Ventura River Basin Modular Finite-Difference Flow	Upper Ventura River Groundwater Agency	Groundwater	MODFLOW	USGS (INTERA, Bondy Groundwater Consulting)	Upper Ventura River Groundwater Basin	2005–2019	Not used; model domain encompassed by VRW GW-SW Model domain
Ojai Valley Basin Modular Finite-Difference Flow	Ojai Basin Groundwater Management Agency	Groundwater	MODFLOW	USGS (DBS&A)	Ojai Valley Groundwater Basin	1971-2019	Not used; model domain encompassed by VRW GW-SW Model domain
Ventura Surface Water Hydrology Model	Ventura County Watershed Protection District	Surface Water	HSPF	US EPA (Tetra Tech)	Entire Watershed	1997-2007	Not used; model domain encompassed by VRW GW-SW Model domain
Ventura Water Allocation Model	State Water Resources Control Board	Water Allocation Model	WEAP	SEI/State Water Resources Control Board (SEI)	Entire Watershed	1994-2017	Not used; water operations were not the focus of the quantitative analyses
Sustainable Water Use (Bren School) Model	Ventura Watershed Council	Water Allocation Model	WEAP	SEI (UCSB)	Entire Watershed	2004-2009	Not used; water operations were not the focus of the quantitative analyses
Future Scenarios Model for Water Plan Update 2023	DWR	Water Allocation Model	WEAP	SEI/DWR (SEI)	Entire Watershed	TBD	Not used; water operations were not the focus of the quantitative analyses
Matilija Dam Ecosystem Restoration Project Models	USACE, Ventura County, Reclamation	Surface water, Sediment transport, Physical models	HEC-HMS, HEC-RAS, SRH-1/2D, others	USACE, Reclamation, USDA, others (Various)	Various	Various	Not used; complimentary study
Estuarine Coastal Models	Ventura County, Coastal Conservancy	Surface water, Sediment transport, Coastal processes	DELFT 3D, SWAN, SRH-2D, HEC-RAS others	USACE, Reclamation, TU Delft, others (Various)	Coastal	Various	Not used; complimentary study
Lake Casitas Water Supply Analysis	Casitas Municipal Water District	Surface water, Reservoir yield	Excel-based Yield Model	Casitas Municipal Water District (Stantec)	Upper Watershed, Lake Casitas	Various	Not used; complimentary study
CCA5 Hydrologic Projections	California Climate Assessment 5 (Statewide)	Watershed-scale Hydrologic Model	VIC	University of Washington / Princeton University	Statewide California	Multi-decadal, future scenarios	Used in VRWRP assessment of future climate conditions, qualitative and quantitative assessments
Ventura County Flood Insurance Study	FEMA	Surface water	HEC-RAS	USACE (Various)	Entire Watershed	Various	Used in VRWRP quantitative assessment
Coastal Storm Modeling System	California Ocean Protection Council	Coastal, Storm simulation	CoSMoS	USGS (Scripps Institution of Oceanography, California Ocean Protection Council)	Coastal	Multi-decadal, future scenarios	Used in VRWRP assessment of future climate conditions

Key:
FEMA = Federal Emergency Management Agency
Reclamation = U.S. Department of the Interior, Bureau of Reclamation
TBD = to be determine
UCSB = University of California, Santa Barbara
USACE = U.S. Army Corps of Engineer
USDA = U.S. Department of Agriculture
USGS = U.S. Geological Survey
VRWRP = Ventura River Watershed Resilience Plan

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