

# Ventura River Watershed Resilience Plan

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# Acknowledgements

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The Ventura River Watershed Resilience Plan (VRWRP) reflects the commitment, collaboration, and deep local knowledge of the many partners who contributed their time, expertise, and lived experience throughout this multi-year planning process.



## **Funding Acknowledgement: California Department of Water Resources**

Funding for this project has been provided in full or in part from the Budget Act of 2022 and through an agreement with the California Department of Water Resources (DWR).



## **Ventura County Resource Conservation District**

The Ventura County Resource Conservation District (VCRCD) served as the grant recipient and project administrator for the VRWRP, managing the agreement with DWR, overseeing project coordination, and guiding the VRWRP planning process.



## **Ventura River Watershed Council**

The planning process was overseen by the Ventura River Watershed Council, the long-standing collaborative network that supports watershed coordination, shared learning, and inclusive engagement across more than 500 partners. The Council's ongoing leadership, public meetings, and guidance were foundational to this Plan.

## **Tribal Government Partnership and Engagement**

We extend deep appreciation to the Barbareño/Ventureño Band of Mission Indians (BVBMI) for their thoughtful review, cultural guidance, and sustained engagement throughout the planning process, including co-hosting the final public forum. Their leadership enriched the VRWRP's approach to cultural resources and watershed stewardship.

## **Community Members**

Thank you to the community members who participated in public forums, focus groups, and surveys. Your experiences and perspectives shaped the priorities and solutions reflected in the VRWRP. Community-identified needs and observations directly informed the vulnerability assessment and adaptation strategies.

## **Project Team**

The VCRCD team provided leadership, coordination, and communication support throughout the planning process. We extend special thanks to the VCRCD staff whose sustained efforts were critical to advancing this work:

- Jamie Whiteford – Executive Director
- Lauren Zaragoza – Resource Conservation Specialist
- Mary Reyes – Conservation Education and Outreach Coordinator

The VRWRP is a coordinated effort led by the VCRCD, in partnership with:

- Lynn Rodriguez – Project Manager
- Lara Shellenbarger – Project Manager
- Rincon Consultants, Inc. – Technical Lead

- Eagle Rock Analytics – Technical Support
- Stantec, Inc. – Technical Support
- BVBMI – Tribal and Cultural Resources Advisor
- Native Coast Action Network – Tribal and Cultural Resources Support
- Central Coast Alliance United for a Sustainable Economy – Community Engagement Support
- California State University Northridge; Center for Geospatial Science & Technology – Network Mapping Lead
- California State University San Bernardino; Institute for Watershed Resiliency – Network Mapping Lead
- Loyola Marymount University; Center for Urban Resilience – Network Mapping Lead

Each team member brought complementary expertise in water resources, climate science, facilitation, engagement, Tribal partnership, vulnerability assessment, and planning.

### **Advisory Group (AG)**

The AG, a subset of the Watershed Council, played a central role in shaping the VRWRP. This diverse group convened regularly to provide technical knowledge, review draft chapters, and ensure that local priorities and lived experience guided the VRWRP’s direction. AG members included:

- Barbareño/Ventureño Band of Mission Indians – Julia Samaniego
- Central Coast Alliance United for a Sustainable Economy – 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 – Rocío Lozano-Knowlton
- Native Coast Action Network – Carlie Domingues
- Ojai Basin Groundwater Management Agency – Cece Vandermeer
- Ojai Valley Fire Safe Council – Chris Danch, Kalli O’Conner
- Ojai Valley Land Conservancy – Tom Maloney, Vivon 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 Land Trust – Melissa Baffa, Laura Pavliscak, Dan Hulst
- Ventura River Water District – Alma Quezada, Bruce Kuebler





# Executive Summary

## A Watershed-Scale Approach to Climate Resilience

The Ventura River Watershed Resilience Plan (VRWRP) is a comprehensive, watershed-scale effort designed to strengthen long-term climate resilience, water reliability, and ecosystem function throughout the Ventura River Watershed. Spanning forested headwaters, agricultural valleys, and coastal communities, the watershed is stewarded by numerous agencies, Tribes, non-profits, and other landowners whose decisions intersect across hydrology, infrastructure, and cultural landscapes.

Climate change is affecting the watershed in dramatic ways and will continue to disrupt the Ventura River Watershed’s communities, ecosystems and economies in the coming years and decades. This plan establishes a baseline for understanding how future climate hazards may affect water resources, ecosystems, infrastructure, and communities. It provides an integrated look at the watershed’s physical setting, summarizes the key vulnerabilities caused by extreme climate hazards, and presents solutions to address these challenges.

Interconnected water resource systems – water supply, flood management, groundwater management, ecosystems, water quality and cultural resources – face intensifying climate pressures that require cross-disciplinary and multisector responses. These systems are examined through the lens of historical, future, and observed climate hazards, including drought, extreme heat, wildfire, flooding, sea level rise, and declining marine fog, to illustrate how climate hazards translate into impacts to people, the environment, and critical services. The VRWRP provides a data-informed and locally grounded framework that aligns regional priorities, assesses climate vulnerabilities, and identifies pathways to action shaped by the watershed’s unique hydrology and high level of community engagement.

The VRWRP builds upon the existing regulatory and planning landscape, including the Integrated Regional Water Management (IRWM) Plan, the Ventura River Watershed Management Plan, Groundwater Sustainability Plans (GSPs), habitat conservation and resource protection programs, County and City hazard mitigation plans, local coastal programs, general plans, and capital improvement programs.

## Guided by the State – Informed by Local Conditions

The VRWRP was developed within the California Department of Water Resources’ Regional Resilience Framework, which supports watershed-scale planning across the state. While informed by statewide guidance and other pilot efforts across the state, the VRWRP is deeply tailored to the Ventura River Watershed’s conditions: highly variable instream flows, localized water supplies, limited surface- and groundwater storage, strong agricultural presence, and tight linkages between ecological health and water supply reliability. For an overview of watershed’s current conditions, see **Chapter 3: State of the Watershed**.

The planning process integrated current climate science data, qualitative and quantitative vulnerability and risk assessment findings, overburdened community<sup>1</sup> and Tribal insights, and development of implementation plans to generate realistic and practical climate adaptation strategies that will result in positive on-the-ground outcomes. Together, these methods provide a comprehensive picture of where vulnerabilities exist, what drives them, and which assets warrant priority attention.

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<sup>1</sup> Overburdened Community can be defined as 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. (CalEPA 2021)



## Climate Adaptation Goals and Action Framework

The VRWRP’s climate adaptation framework is organized around eight goals that translate identified vulnerabilities into coordinated areas of action:



### Goal 1

Ecosystem Health is Strengthened  
Watershed Wide



### Goal 2

Water Supply is More Reliable and Water  
Infrastructure is More Climate-Resilient



### Goal 3

Communities, Infrastructure, and  
Ecosystems are Protected from Erosion,  
Flooding, and Shoreline Change Driven by  
Sea Level Rise and Storm Surge



### Goal 4

Flood and Erosion Risks to Communities,  
Infrastructure, Water Quality, and  
Ecosystems from Extreme Precipitation  
are Minimized



### Goal 5

Recreational Access for Community  
Enjoyment is Protected and Enhanced



### Goal 6

Agricultural Practices Are Adapted to the  
Effects of Climate Change and Sustains  
a Thriving Local Economy and Ag-Based  
Livelihoods



### Goal 7

Coordinated Watershed Resilience is  
Strengthened Through the Improvement of  
Governance, Funding, and Monitoring Tools



### Goal 8

Native Leadership and Indigenous  
Knowledge Lead to Resilient Cultural  
Resources, Sacred Sites, Subsistence  
Areas and Heritage Assets

## Collaborative Process Grounded in Local Expertise

Engagement was central to the VRWRP. The planning process leveraged the existing Ventura River Watershed Council and convened a multi-sector Advisory Group drawn from water agencies, local jurisdictions, resource managers, environmental organizations, agricultural representatives, Tribal partners, and community-based organizations. The Advisory Group provided strategic direction, reviewed technical findings, and helped develop strategies, actions, and implementation roadmaps. Broader public engagement through watershed

forums, community meetings, and partnerships with active community groups and advocates resulted in meaningful input from overburdened communities. As a result, major project outcomes were shaped and informed by lived experience and local knowledge.

Close collaboration with Tribal partners was integral throughout the process, with dedicated meetings and co-development of strategies, actions, and implementation roadmaps, culminating in a co-hosted final public forum centered on Tribal leadership and partnership.

Read more about the engagement process and the watershed network that supported this collaboration in **Chapter 2: Watershed Network**.

As with all planning efforts, participants held differing views on how projected impacts would be felt by communities, sectors, and places within the watershed. There were also nuances specific to certain water sector resources that were often lost when speaking to impacts in a watershed-wide

context. As the grant administrator on this effort, the Ventura County Resource Conservation District recognizes that, in some instance, consensus could not always be reached across all perspectives. For transparency, differing viewpoints have been incorporated where feasible to support improved collaboration, mutual understanding, and data sharing in future planning efforts.

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## Impacts from Climate Change

The VRWRP evaluated climate impacts on the six water resource systems from a range of climate hazards that are expected to intensify under future conditions, including:

- **Extreme heat:** increasing water demand, stressing ecosystems, and worsening water quality
- **Wildfire:** particularly in upper watershed areas, with downstream consequences for sedimentation, water quality, and flood risk
- **Extreme precipitation and flooding:** including post-fire debris flows and constrained channel capacity
- **Sea level rise and storm surge:** affecting coastal infrastructure, water quality, and habitat
- **Drought:** affecting surface water reliability, groundwater recharge, and ecosystem health, especially considering increasing hydrologic variability
- **Decreasing marine fog:** impacting ecosystems, cultural and recreational practices, and agricultural lands that have adapted to the coastal cooling effects

These hazards may occur in rapid succession or interact over time, creating compounding impacts that amplify overall risk. As the climate warms, hydroclimate variability is intensifying. Across the state landscapes are experiencing more pronounced swings between very wet and very dry periods (California Department of Water Resources, 2026). These sharper swings increase the likelihood that one extreme event will compound the effects of another, amplifying impacts across interconnected systems. For example, a very wet year can drive rapid vegetation growth that, when followed by extreme heat, creates abundant wildfire fuel; the resulting burn scar then leaves soils destabilized and hydrophobic, so that subsequent storms trigger amplified runoff, debris flows, and downstream flooding. The VRWRP explicitly considered cascading impacts that informed both the vulnerability assessment and the development of integrated strategies across key water resource systems.

Read more about the climate modeling conducted for this effort in **Chapter 4: Future Climate Conditions**.



## Key Vulnerabilities

Findings from the VRWRP climate vulnerability assessment revealed that the watershed’s most critical vulnerabilities include:

- Wildfire, debris flows, and extreme storms are expected to damage water and wastewater systems, cultural resources, access roads, and downstream communities
- Drought, extreme heat, and declining fog may reduce water availability, elevate stream temperatures, and intensify demand
- Water-quality degradation is likely to occur from the interplay of drought, wildfire, and storm-driven runoff
- Ecosystem and cultural-resource degradation due to drought-induced altered flows, invasive species, and loss of cold-water refugia can occur as extreme heat events increase, droughts become more pronounced, and extreme precipitation leads to increased flooding
- Sea level rise and storm surge is expected to impact coastal ecosystems, the Ventura River Estuary, and shoreline infrastructure
- Problems tied to legacy land-use and governance gaps may be exacerbated by successive climate disasters, which can limit floodplain function, groundwater recharge, recreation access, emergency response, and proactive climate adaptation.

Review the full climate vulnerability assessment and list of detailed key vulnerabilities in **Chapter 5: Climate Change Vulnerability**.

## From Vulnerabilities to Action

Adaptation strategies and actions were developed to directly respond to key vulnerabilities and a subset of actions are supported by implementation roadmaps. Themes that cut across the actions include equitable access to watershed resources and benefits, multi-benefit integration, inter-jurisdictional coordination, and variability in watershed hydrology. Implementation roadmaps offer more detail on critical steps to complete actions, and provide suggestions on roles and responsibilities, potential funding considerations and pathways, and opportunities to advance coordinated action across agencies and communities. These roadmaps transform high-level action concepts into actionable pathways for on-the-ground resilience. In addition, a set of performance indicators are introduced, designed to track watershed-scale outcomes over time and provide a transparent way to measure progress toward the VRWRP's goals.

See detailed information about adaptation strategies and actions, along with the implementation roadmaps, in **Chapter 6: Adaptation Strategies, Actions, and Implementation Roadmaps**, and performance indicators in **Chapter 7: Performance Indicators for Watershed Resilience**.

## Recommendations and Next Steps

Successful implementation of the VRWRP will rely on strong collaboration across agencies, Tribes, and community organizations. The Ventura River Watershed Council is well-positioned to serve as the long-term convener and coordinator of this work, helping maintain alignment on shared goals, steward collaborative tools, and support collective progress. The following recommendations outline priority actions to strengthen the watershed network and advance implementation.





## **Strengthen Multi-Agency Coordination Through the Watershed Council**

Strengthen the position of the Watershed Council as the central forum for watershed-wide coordination, ensuring consistent communication across jurisdictions, sectors, and organizations. Distributing leadership roles, identifying shared priorities and strengthening partnerships will reduce over-reliance on a small set of partners and improve the network’s ability to address shared climate challenges. Continued support for collaborative planning efforts like the VRWRP will help maintain a common foundation of goals.

## **Maintain and Evolve Network Tools as Living Resources**

Utilize and reference the watershed’s collaborative tools, including the Kumu network map and organizational profiles, to supplement existing collaboration and partnerships. Update and maintain these tools, as needed. These tools can support information-sharing, partner matching, and cross-sector coordination. Regular updates to the tools will ensure they reflect current partnerships, data, capacities, and needs.

## **Expand Inclusive Participation and Strategic Partnerships**

Expand the watershed network by better engaging underrepresented and less-connected organizations (including Tribal governments, small community-based groups, farms, and domestic well users) and supporting their participation through targeted training, technical assistance, and funding navigation. At the same time, deepen partnerships with Tribal governments and representatives, private landowners, land conservancies, grassroots groups, youth initiatives, research institutions, and state and federal agencies to broaden implementation capacity and incorporate diverse knowledge systems.

## Coordinate Funding Strategies and Pursue Large-Scale Resilience Investments

Develop a coordinated, multi-agency funding strategy that positions the watershed to compete effectively for Proposition 4 and other large-scale state and federal investments. Align priority actions with upcoming solicitations, identify joint funding opportunities, and support readiness for multi-benefit project proposals. Investing in both key anchor organizations and smaller, less-connected partners will strengthen overall network resilience and reduce funding disparities.

## Establish an Annual Progress Reporting Process for Adaptive Management

Following adoption of the VRWRP, convene an annual progress (convened through the Watershed Council) reporting meeting to review progress on strategy and action implementation, provide an update on performance indicators, and recalibrate priorities based on emerging conditions. This regular touchpoint will provide transparency, reinforce collaboration, and help partners adjust strategies as climate, ecological, and community needs evolve. The Watershed Council can maintain a simple public-facing dashboard to track watershed-scale conditions and communicate progress year over year.

## Follow a Clear Near-Term Timeline for Plan Adoption and Early Implementation

In the immediate term, complete public review, finalize the VRWRP, and update the Council Charter to reflect implementation roles. Convene working groups to refine early action priorities, assess funding opportunities, and prepare near-term implementation roadmaps. By June 2026, the Council will vote on plan adoption, updated governance structures, and initial implementation priorities.

## Maintain the Watershed Resilience Plan as a Dynamic Resource

The VRWRP is a valuable resource reflecting a comprehensive, collaborative and intentional planning process made possible through the Watershed Resilience Pilot Program grant from the State. To help ensure long-term relevance and successful implementation of the strategies and actions outlined in the VRWRP, engage targeted working groups focused on achieving and monitoring specific actions. These groups will support the work of the Coordinator and the Council's Leadership Committee in monitoring the ongoing performance of the VRWRP.



# Acronyms

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Acronyms	Definition
AEWQA	Agricultural Environmental Water Quality Assistance
AF	Acre-foot (volume of water)
AG	VRWRP Technical Advisory Group
BMP	Best Management Practice
BRIC	Building Resilient Infrastructure and Communities
BVBMI	Barbareño/Ventureño Band of Mission Indians
Cal OES	California Governor’s Office of Emergency Services
Caltrans	California Department of Transportation
CAUSE	Central Coast Alliance United for a Sustainable Economy
CCA5	California’s Fifth Climate Change Assessment
CDFW	California Department of Fish and Wildlife
CHRIS	California Historical Resources Information System
CIP	Capital Improvement Plan/Program
CNRA	California Natural Resources Agency
CoSMoS	Coastal Storm Modeling System (USGS)
CRWQCB	California Regional Water Quality Control Board
CSU	California State University
CW3E	Center for Western Weather and Water Extremes
CWSRF	Clean Water State Revolving Fund
DWR	California Department of Water Resources
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program (NRCS)
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
GDE	Groundwater-Dependent Ecosystem
GIS	Geographic Information System
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GWL	Global Warming Level
HUC	Hydrologic Unit Code
IPCC	Intergovernmental Panel on Climate Change
JJA/DJF/MAM/SON	Seasonal abbreviations used in figures: Jun–Aug; Dec–Feb; Mar–May; Sep–Nov
LARWQCB	Los Angeles Regional Water Quality Control Board
LCP	Local Coastal Program
LID	Low Impact Development
LiDAR	Light Detection and Ranging
MAR	Managed Aquifer Recharge

Ventura County Resource Conservation District  
**Ventura River Watershed Resilience Plan**

Acronyms	Definition
MDERP	Matilija Dam Ecosystem Restoration Project
MOWD	Meiners Oaks Water District
MS4	Municipal Separate Storm Sewer System
MWD	Municipal Water District
NAHC	Native American Heritage Commission
NCAN	Native Coast Action Network
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
OBGMA	Ojai Basin Groundwater Management Agency
OVLC	Ojai Valley Land Conservancy
OVSD	Ojai Valley Sanitary District
RALI	Resilient Agricultural Lands Initiative
RCD	Resource Conservation District
RWQCB	Regional Water Quality Control Board
SAFER	Safe and Affordable Funding for Equity and Resilience
SGMA	Sustainable Groundwater Management Act
SLR	Sea Level Rise
SPI	Standardized Precipitation Index
SSP	Shared Socioeconomic Pathway (IPCC)
SWP	State Water Project
TEK	Traditional Ecological Knowledge
TMDL	Total Maximum Daily Load
UCCE	University of California Cooperative Extension
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UVRGA	Upper Ventura River Groundwater Agency
VCWPD	Ventura County Watershed Protection District
VLT	Ventura Land Trust
VRWD	Ventura River Water District
VRWRP	Ventura River Watershed Resilience Plan
WEAP	Water Efficiency and Allocation Program (Casitas MWD)
WPD	Watershed Protection District (also called VCWPD)
WRP	Watershed Resilience Plan

For definitions and a full glossary of terms, please see **Appendix A: Glossary of Terms.**

## Chapter 1

# Introduction

This chapter introduces the Ventura River Watershed Resilience Plan and outlines why a coordinated, watershed-scale approach is needed as climate impacts intensify. It provides an overview of the watershed's unique character, its longstanding culture of stewardship, and the goals of this resilience planning effort.

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## 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 (closest English translation is ‘Mother Earth’). 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.

## Plan Purpose and Objectives

The Ventura River Watershed Resilience Plan (VRWRP) provides a coordinated framework to assess climate risks and strengthen watershed resilience within the Ventura River Watershed (see Figure 1). The VRWRP evaluates how projected climate hazards may affect interconnected water resource systems – including water supply, groundwater, flood management, ecosystems, water quality and cultural resources – and identifies strategies to reduce vulnerabilities and enhance adaptive capacity.

The Ventura River Watershed is a place defined by its rugged terrain, diverse habitats, rural character, and a long-standing culture of collaboration and local water stewardship. Its independence from imported water supplies has shaped a strong and resilient community of dedicated water and watershed managers with a deep commitment to environmental stewardship. Since the time of the watershed’s first inhabitants, resilience has been rooted in adapting land and water management practices to evolving conditions.

Accelerating climate change introduces new and compounding challenges. Climate-driven impacts such as intense storm events, prolonged droughts, rising temperatures, and severe wildfires will likely challenge the ability of water managers to meet the needs of the watershed’s natural and built communities. Drought specifically is a central climate vulnerability for the watershed, with intertwined ecological, economic, infrastructure, and equity consequences. Strategic coordination of multiple adaptation measures will be required for the watershed to remain resilient under a rapidly warming climate.

The resilience of the watershed’s interconnected water resource systems reflects both natural watershed processes and a century of infrastructure development, land use decisions, and water management practices. The VRWRP evaluates how climate change may affect these systems and identifies vulnerabilities and risks associated with climate hazards. In addition to prioritizing collaboration and engagement with Tribes and overburdened communities, the VRWRP relies on analysis of future climate projections, climate hazards, and system vulnerabilities to recommend adaptation strategies and implementation actions that mitigate risks to water systems and overall watershed resilience.

Importantly, the development of the VRWRP reflects the community’s proactive approach and builds off the momentum of past and ongoing actions. These ongoing and existing efforts, including the Ventura River Watershed Management Plan, the Groundwater Sustainability Plans (GSPs), and the Matilija Dam Ecosystem Restoration Plan, among others, have helped shape the current state of the watershed. The

VRWRP takes stock of that progress while acknowledging that the dynamic nature of the watershed invokes us to identify and evaluate future actions appropriate for an uncertain climate future.

While the VRWRP focuses primarily on assets, infrastructure, and resources located within the Ventura River Watershed boundary, some critical systems that serve watershed communities extend just beyond it, particularly along the Ventura coastline, where wastewater, transportation, and flood-management facilities are exposed to sea level rise and coastal hazards. These cross-boundary dependencies were considered qualitatively in the vulnerability assessment and strategy development, and assets with direct functional influence on watershed resilience (such as the Seaside Wastewater Transfer Station) were included. However, the VRWRP remains a watershed-based plan, and therefore does not comprehensively evaluate climate impacts on infrastructure located outside the watershed unless those impacts directly affect conditions within it.



Figure 1 Ventura River Watershed Overview



Basemap provided by Esri and its licensors © 2026.  
 Additional data provided by CPAD, 2025; NHD, 2024.

24-16486 WRP  
 Fig 1 Ventura River Watershed

## VRWRP Vision Statement and Guiding Principles

The Vision Statement and Guiding Principles were developed to align the watershed network around a shared understanding of what resilience means for the Ventura River Watershed and to guide how partners work together throughout the project. Established at the outset, they were designed to unify participants behind a common vision and shared expectations for collaboration and outcomes. They were developed over a 10-month period through a public forum and a series of meetings with the Advisory Group and Watershed Council—two bodies that convene local agencies, Tribes, nonprofits, and community partners. The Vision and Guiding Principles were later presented to participants in the West Ventura focus groups led by the Central Coast Alliance United for a Sustainable Economy, where they were affirmed by community members.

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### 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.

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### Guiding Principles:

This vision is supported by guiding six guiding principles that will shape our collective action. These articulate the core values and overarching approach that shape decision-making throughout the planning process. The VRWRP's guiding principles include:

1. **Restore and Protect Ecosystem Health:** Support the resilience of the watershed by restoring habitat, removing invasive species, and protecting native biodiversity. Promote land stewardship that sustains natural functions and strengthens healthy soils, water, and ecosystems in a changing climate.
2. **Safeguard and Sustain Local Water Resources:** Protect and enhance local surface and groundwater by building on existing integrated watershed planning and implementing sustainable strategies. Support improved water reliability and quality and strengthen resilience to drought and other climate stressors that impact both people and the environment.
3. **Advance Climate Resilience through Action and Innovation:** Identify and implement proactive, place-based strategies and innovative solutions to address climate risks. Promote nature-based solutions, climate-resilient infrastructure, and land use decisions that reduce risk and support long-term adaptability.
4. **Promote Equity and Cultural Connection:** Ensure that Tribal and overburdened communities are meaningfully included in watershed planning and decision-making, and that investments reflect community-identified priorities and honor cultural relationships to land and water.

5. **Foster Stewardship and Education:** Promote community stewardship, connection to the river, and shared responsibility through access, education, and opportunities for meaningful participation in watershed resiliency efforts.
6. **Support Collaborative, Informed Decision Making:** Leverage local knowledge, Indigenous practices, and data-supported approaches to guide adaptive management, strengthen integrated land and water use planning, and build strong regional partnerships.

## Statewide Watershed Resilience Initiative and Funding Program

To address increasing climate risks to water resources and to support inclusive, watershed-scale collaboration, the California Department of Water Resources (DWR) established the Watershed Resilience Pilot (WRP) Program. This program aligns with the three key priorities identified in the 2023 California Water Plan: climate resilience, watershed resilience, and equity. The program recognizes that climate hazards affect interconnected water resource systems across jurisdictional and sector boundaries. The WRP Program supports identification and prioritization of adaptation strategies and tracking progress toward long-term water resource resilience.

With funding authorized in the Budget Acts of 2021 and 2022, DWR launched the WRP Program in 2024, awarding funds to five regions across California. These pilots 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 WRPs that take a headwaters-to-outlets approach. These plans aim to center equity in all water decisions, assess current water conditions and climate risks, analyze vulnerabilities, and develop adaptation strategies to reduce them.

The Ventura River Watershed was selected as one of the five pilot regions, each receiving approximately \$2 million in grant funding, with the Ventura County Resource Conservation District (VCRCD) serving as the grantee. The watershed provides a valuable setting to pilot the program due to its reliance on local water supplies, strong collaborative planning history, diverse ecological and cultural resources, and repeated exposure to climate threats. Together, these characteristics and the resulting adaptation strategies will inform future WRP efforts statewide.

## Plan Organization

The VRWRP is organized around DWR's Watershed Resilience Framework which provided guidance for each chapter in the VRWRP. Following this introduction, the VRWRP describes the **watershed network**, including the organizations, partnerships, and engagement efforts taken that informed this Plan's content. The following section then describes the **watershed's characteristics and current challenges**. Subsequent chapters discuss **climate vulnerabilities** and water sector risks, identify and evaluate **adaptation strategies**, and outline **implementation pathways** and performance-tracking approaches that support long-term resilience. For readability, and to conform with suggested page limits, supporting technical analyses, data summaries, and methods are mostly provided in supporting appendices.

## Planning History and Context in the Watershed

The VRWRP builds on a long history of collaborative watershed planning that has shaped water management, ecological restoration, hazard mitigation, and community resilience efforts across the Ventura River Watershed. Foundational efforts include the 2015 Ventura River Watershed Management Plan and the 2019 Integrated Regional Water Management (IRWM) Plan, both of which established

shared goals, documented watershed conditions, and supported coordinated project development across numerous agencies, land managers, Tribes, nonprofits, and community-based organizations. Additional related or relevant reports, programs, and planning efforts are listed in **Appendix B: Related Reports, Resources, and Programs**.

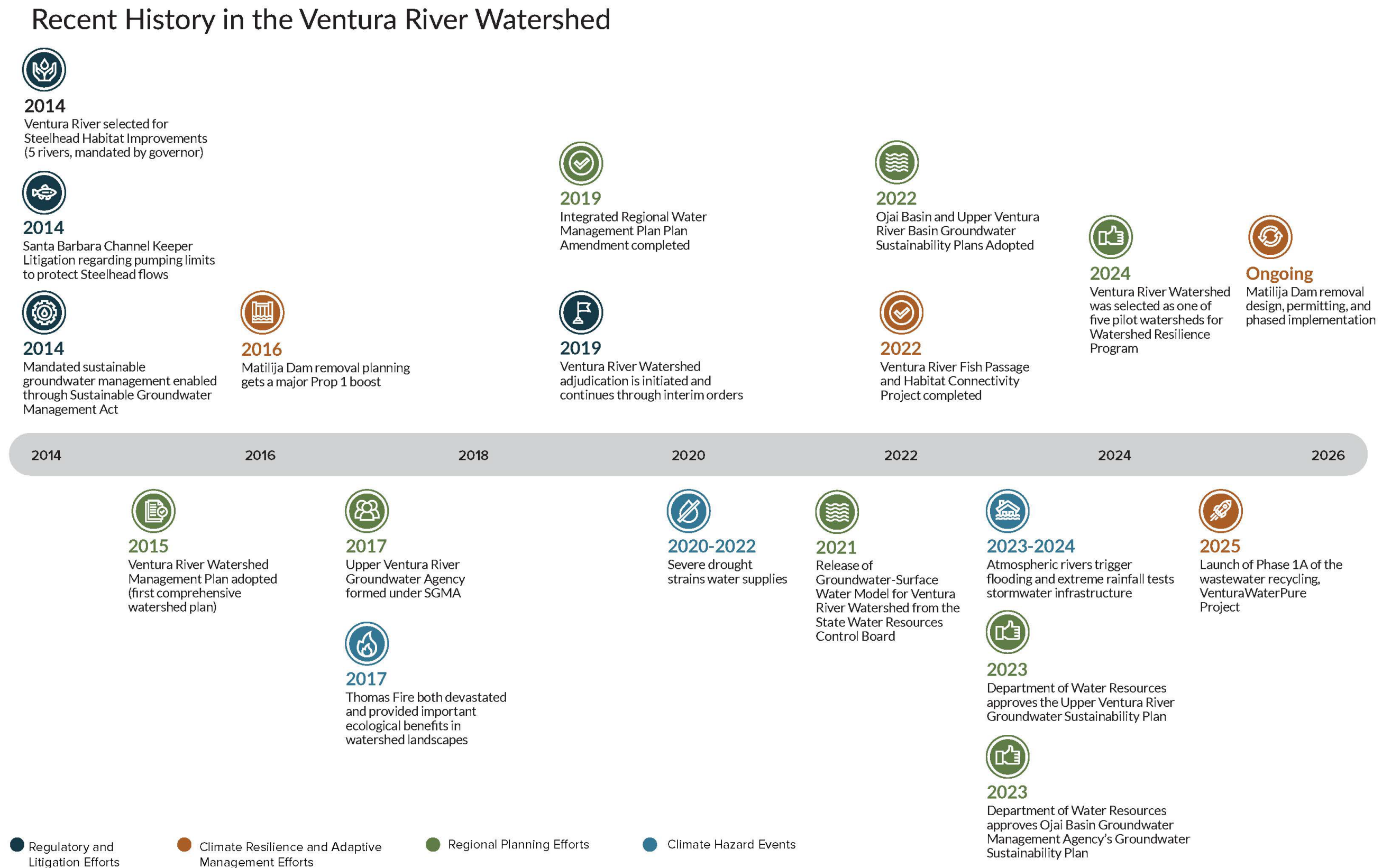
Since the completion of these earlier plans, the watershed has experienced significant changes—both in terms of climate pressures and in the policy, regulatory, and technical landscape guiding watershed decision-making. State and federal climate-science updates, evolving regulatory requirements, and improved engagement practices have strengthened expectations for inclusive, transparent, and science-informed water and land-use planning. At the same time, climate-driven hazards such as wildfire, post-fire erosion, extreme heat, extended drought, and high-intensity storm events have increased in frequency and severity, underscoring the need for a more integrated and forward-looking approach.

Several major developments since 2015 are now shaping watershed conditions and informing the need for the VRWRP:

- Large-scale ecological and geomorphic restoration efforts, most notably the Matilija Dam Ecosystem Restoration Project (MDERP), which is advancing major infrastructure, habitat, and sediment-management improvements designed to restore more natural hydrologic and ecological function.
- Watershed-wide *Arundo* (*Arundo donax*) removal and riparian restoration efforts, which have expanded substantially in recent years in response to *Arundo*'s impacts on hydrology, wildfire behavior, habitat quality, and channel capacity. These coordinated programs involve public agencies, local organizations, and landowners and represent a significant ongoing restoration investments in the watershed.
- Accelerated work to improve fish passage and aquatic connectivity, including recent multi-benefit projects designed to enhance habitat conditions, remove barriers, and support recovery of sensitive aquatic species.
- Development of improved groundwater–surface water analytical tools, including State Water Board modeling efforts intended to support long-term adaptive management and provide greater clarity on surface-water/groundwater interactions.
- A watershed-wide water-rights adjudication initiated to clarify water-rights allocations and establish a coordinated framework for long-term water-management operations across the Ventura River Watershed basins. This basin-wide legal process involves groundwater and surface-water users throughout the watershed. While independent from the VRWRP, the adjudication may influence future coordination, governance, and water-management responsibilities. The VRWRP is therefore designed to remain flexible and compatible with a range of potential outcomes.

Alongside other changes, these developments reflect a rapidly evolving watershed context in which climate pressures, regulatory requirements, restoration activities, and collaborative initiatives intersect. They reinforce the need for a comprehensive, watershed-scale climate resilience plan that builds on past work while addressing the increasingly complex and compounding challenges facing communities, ecosystems, and water systems. A snapshot of this recent history and significant milestones in the watershed can be seen in Figure 2.

Figure 2 Recent History in the Ventura River Watershed



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## 2015 Ventura River Watershed Management Plan

In 2015, the Watershed Council released the Ventura River Watershed Management Plan (WMP), which was funded by a California Department of Conservation Watershed Coordination grant. The WMP is a comprehensive plan addressing the state of the watershed with extensive documentation. The Council membership, Watershed Coordinator, and consultants spent more than three years in collaboration with the ongoing IRWM Planning effort, developing the WMP. Over the past 10 years, the Council has been implementing the Plan's recommendations and program campaigns. Access the WMP here: <https://venturawatershed.org/the-watershed-plan>.

**A few key topics that were *not* addressed in the WMP include: the Sustainable Groundwater Management Act (SGMA) and related implementation; climate change related hazards and adaptation strategies; and more robust engagement with - and participation of - Tribes and overburdened communities. These topics are being addressed in detail with the VRWRP. See below for brief summaries of each of these topics.**

### *Sustainable Groundwater Management*

SGMA, adopted by the California Legislature in 2014, led to the formation of Groundwater Sustainability Agencies (GSAs) and the preparation of GSPs for state-designated medium- and high-priority basins. These plans guide long-term sustainable groundwater management and avoid undesirable results such as chronic lowering of groundwater levels. SGMA also allows the creation of local funding mechanisms to support ongoing basin management.

There are two GSAs in the Ventura River Watershed: the Upper Ventura River Groundwater Agency and the Ojai Basin Groundwater Management Agency. Both have GSPs that have been approved by DWR and are now being implemented. Two other groundwater basins in the watershed—the Lower Ventura River and Upper Ojai basins—are designated low-priority due to limited use and low well yield and are not required to develop GSPs.

### *Climate Change Hazards and Adaptation*

Following the development of the WMP, substantial research has been done at the local, state, and national level regarding climate change. While climate change models do not always agree on specifics, they largely support the conclusion that climate change will result in more intense wildfires, prolonged droughts, intense precipitation and extreme flooding, and higher temperatures. In 2018, climate researchers with the Desert Research Institute conducted an in-depth analysis of climate models and published a report on climate projections for Ventura County. This report, titled *Projected Changes in Ventura County Climate*, was incorporated into the 2019 IRWM Plan, with adaptation approaches included in Section 13. Access the report here: [https://wrcc.dri.edu/Docs/VenturaClimate2019\\_lores.pdf](https://wrcc.dri.edu/Docs/VenturaClimate2019_lores.pdf).

### *Past Engagement with Overburdened Communities and Tribes*

Following the completion of the 2015 Ventura River WMP, the Watersheds Coalition of Ventura County received grant funding to engage more meaningfully with overburdened communities and Tribes. Referred to as WaterTalks, the program resulted in development of needs assessments, capacity building, technical assistance, and implementation of much needed projects in overburdened communities across the County, including in the Ventura River Watershed. This six-year effort helped to set the stage for the work currently being conducted through this effort.

## Chapter 2

# Watershed Network

This chapter provides a clear picture of current watershed conditions, including water supply, groundwater, ecosystems, cultural resources, and community needs. It highlights the challenges and opportunities shaping resilience today, weaving in scientific data and community perspectives.

01  
Introduction

02  
Watershed  
Network

03  
State of the  
Watershed

04  
Climate  
Projections

05  
Climate Change  
Vulnerability

06  
Strategies  
and Actions

07  
Resiliency  
Indicators

08  
Next Steps



## Introduction

The Ventura River Watershed Resilience Plan (VRWRP) was developed through a broad, multi-layered network of organizations, agencies, Tribes, community-based groups, and local community members whose decisions and experiences shape watershed health. This chapter documents how that watershed network was identified, expanded, and engaged throughout the VRWRP process, and how its structure and function were evaluated to support long-term, climate-resilient collaboration.



As the watershed transitions from planning to implementation, the roles of the Watershed Council, Advisory Group (AG), and broader watershed network are expected to evolve. The insights and recommendations from the California State University (CSU) assessment, combined with engagement findings presented in this chapter, provide a roadmap for enhancing watershed-scale coordination and supporting an implementation-ready network capable of advancing the VRWRP in the years to come. Next steps and future considerations for watershed network facilitation are discussed more in the conclusion of this chapter, in addition to Chapter 6 and Chapter 7.

## Foundation of the Watershed Network

The Watershed Council forms the core of the watershed network for the VRWRP. Established in 2006 under the IRWM Program, the Watershed Council provides a long-standing forum that brings together water and wastewater agencies, local governments, land managers, environmental organizations, Tribal partners, community-based groups, agricultural representatives, and interested residents.

With regular public meetings, a public-facing website, newsletters, and a distribution list of more than 500 participants, the Council offers an established structure for transparent and inclusive collaboration. Throughout the VRWRP process, it served as the primary venue for sharing updates, presenting technical work, and gathering input, while also expanding engagement to additional community partners and Tribes.

The Watershed Council's existing Charter and Leadership Committee provided clear roles and expectations that supported effective coordination across a diverse network of partners. These structures helped bridge past watershed planning efforts with the climate-focused work of the VRWRP. Refer to **Appendix C: Watershed Council Charter**.

## Governance Structure for the VRWRP

Developing the VRWRP required a governance structure that supported coordination, transparency, and shared decision-making across the watershed network. This section describes how the Watershed Council and the AG worked together to review materials, guide technical work, and ensure that diverse perspectives were included throughout the planning process.

## Advisory Group Formation and Purpose

The AG was formed at the start of the project, drawing from the Watershed Council’s Leadership Committee and expanding to include Tribal representatives, community-based organizations, agricultural partners, and other subject-matter experts. The AG played a central role in shaping the VRWRP by:

- providing subject-matter expertise;
- reviewing draft technical materials and chapters;
- grounding the plan in watershed-specific knowledge and lived experience;
- supporting transparency and accuracy; and
- documenting consensus and differing perspectives, consistent with the Council’s Charter.

The AG met regularly with flexible participation to accommodate capacity. These virtual meetings were facilitated by the project team and supported with structured materials and follow-ups.

## Advisory Group Protocols and Decision-Making

To guide its work, the AG developed a guidance document. Refer to **Appendix D: Advisory Group Policies and Procedures**. This document outlines:

- roles and expectations;
- how communication flows between the AG, Watershed Council, and project team;
- how AG feedback is incorporated; and
- how the group documents consensus and differences.

The AG used a consensus-based approach. When full agreement was not possible, differing views were noted so they could be reflected accurately in the VRWRP.

## Review and Endorsement Process

After completing AG review, a compiled draft VRWRP was shared with the full Watershed Council and the public for broader feedback. The draft was presented for discussion at a public Watershed Council meeting in March 2026, with formal endorsement anticipated in June 2026 in accordance with the Watershed Council Charter.

## Engagement Approach

Development of the VRWRP was supported by a coordinated, multi-tiered engagement approach designed to gather technical input, elevate community perspectives, and strengthen collaboration across the watershed network. Engagement activities occurred from August 2024 through March 2026 and included regular Watershed Council meetings, AG meetings, key-partner interviews, focused discussions with Tribal and overburdened communities, and public forums. Engagement activities evolved over time, moving from initial network formation and visioning to review of watershed conditions, climate vulnerabilities, and ultimately, development of adaptation strategies and implementation roadmaps. An overview of the engagement activities and associated timeline is displayed in Figure 3, and materials from engagement events can be found in **Appendix E: Engagement Materials**. Details on how feedback informed the drafting of this VRWRP can be found in **Appendix F: Summary of Feedback Received**.

**Figure 3 WRP Network Engagement Timeline (2024-2026)**



## Watershed Resilience Plan Website

The VCRCD created a VRWRP webpage to serve as a central, publicly accessible hub for project information. The webpage included meeting notices, presentations, summaries, and updates throughout the planning process. The final draft VRWRP was also posted online to support transparency and allow for broader review and input. Access the website here:

<https://vcrd.org/venturawatershedresilience/>.

## Key Partner Interviews

At the outset of the project, the VRWRP team conducted interviews with key watershed partners, including water and wastewater agencies, land conservancies, Tribal leaders, environmental organizations, and resource managers. These conversations introduced the VRWRP pilot program, clarified its relationship to existing efforts, and solicited perspectives on climate-related concerns, vulnerabilities, and opportunities for added value.

Insights from key partner interviews informed early technical analyses, such as asset identification, climate-hazard prioritization, and assessment scope, and helped shape subsequent engagement activities. Interviews were held with:

- California State Parks
- Casitas Municipal Water District
- City of Ventura – Ventura Water
- County of Ventura – Watershed Protection District
- Ventura County Farm Bureau
- Meiners Oaks Water District
- Ojai Basin Groundwater Management Agency

- Ojai Valley Fire Safe Council
- Ojai Valley Land Conservancy (OVLC)
- Surfrider
- Upper Ventura River Groundwater Sustainability Agency
- Ventura Land Trust
- Ventura River Water District

## Watershed Council Meeting Presentations

Throughout the project, the VRWRP team provided regular updates during public Watershed Council meetings. Presentations, which were delivered both in person and virtually, covering project progress, technical findings, and draft materials. These meetings provided an open forum for Watershed Council members and the public to ask questions, offer feedback, and help shape the direction of the VRWRP.

## Advisory Group Engagement

The AG met roughly every other month throughout the planning process and played a central role at key decision points. AG members helped develop metrics and thresholds used in the climate vulnerability assessment, reviewed the analysis of risks and consequences, and contributed to the development of strategies and actions. Meetings were held virtually to support broad participation, and optional office hours offered additional opportunities to engage during critical review periods. Draft VRWRP chapters were shared with the AG as they were developed, and the full consolidated draft was reviewed prior to release for broader watershed network and public comment.

## Forums and Workshops

Three major workshops were held to support deeper engagement at pivotal moments in the project. Two were in-person public forums, and one was a joint session with the AG and Watershed Council. These workshops included informational presentations, facilitated activities, and group discussions that helped generate input on assets, climate hazards, vulnerabilities, and potential resilience strategies.



## Tribal Engagement

As a public entity and the lead agency for this project, the VCRCDC followed formal state guidance for Tribal consultation while also investing in relationship-based engagement. After receiving a Tribal Consultation List and Sacred Lands File results from the Native American Heritage Commission, the VCRCDC transmitted formal project notification to the Tribal contacts identified, along with a brief questionnaire inviting participation and requesting input on preferred engagement methods and areas of interest.

While no formal responses were received at that stage, engagement deepened through direct relationship-building with the Barbareño/Ventureño Band of Mission Indians (BVBMI). The Chairman and Tribal representatives contributed to multiple components of the plan, including cultural resources, stewardship perspectives, and adaptation strategies. They also helped host the final community forum titled “kišunuškuy – Planning for Resilience”, which centered Tribal leadership and values.

The broader Chumash community also contributed. Long-time culture bearer Julie Tumamait-Stenslie provided ongoing cultural insights, and the Native Coast Action Network (NCAN) participated in AG meetings, reviewed adaptation strategies, and advised on integration of Indigenous perspectives. Tribal input meaningfully shaped strategies related to fire stewardship, riparian restoration, cultural landscapes, and implementation pathways.

### *The Barbareño/Ventureño Band of Mission Indians*

BVBMI played a central role in shaping the VRWRP. Like many Tribal governments, BVBMI manages broad responsibilities with limited staff capacity, which shaped the timing of their engagement in the process. Once connected, Tribal representatives contributed meaningfully to the VRWRP’s focus on cultural resources, place-based stewardship, and Tribal representation.

The BVBMI Chairman and Tribal representatives participated in an asset-manager interview for the vulnerability assessment, joined an AG meeting, and engaged directly with the project team throughout plan development, and co-hosted the final public forum on adaptation strategies. BVBMI also helped host the final public forum, “kišunuškuy: Planning for Resilience,” creating space to share Tribal values, stewardship principles, and perspectives on implementation. Their leadership elevated Tribal visibility and ensured that Indigenous knowledge informed key elements of the Plan.

### *Broader Chumash Community Involvement*

Beyond formal consultation with BVBMI, the VRWRP benefited from contributions across the wider Chumash community. Chumash Elder and culture bearer Julie Tumamait-Stenslie, whose family maintains deep ties to the watershed, provided long-standing cultural guidance and continued to share insights throughout the planning process as part of ongoing Watershed Council activities.



The project team also partnered with the NCAN, a Chumash-led nonprofit focused on climate resilience, cultural stewardship, and community capacity building. NCAN served as an advisory partner, participating in AG discussions, reviewing adaptation strategies, and helping integrate Indigenous perspectives and cultural resource priorities into the VRWRP.

Together, input from BVBMI, Chumash Elders, and NCAN strengthened the VRWRP’s emphasis on Indigenous knowledge, fire and land stewardship, riparian protection, and culturally significant landscapes. Their guidance directly shaped several adaptation strategies and informed development of

the cultural resources implementation roadmap. For more details and next steps to strengthen relationships, please see **Appendix G: Full Tribal Engagement Report**.

### **au' , o, ' , (water) : Chumash Presence in Ventura River Watershed**

“Climate change’s impacts on water disproportionately disrupts Indigenous lifeways” acknowledge current Tribal Environmental Professionals.

Indigenous knowledge systems (IKS) offer Native knowledge, science and practice to climate adaptation strategies throughout Chumash homelands and homewaters, including the Ventura River Watershed. To include Chumash knowledge systems in watershed-wide planning, it is important to acknowledge the limitations and opportunities for Chumash people, as well as the role of Chumash IKS within broader conversations about Tribal and Indigenous climate adaptation strategies. Tribal climate adaptation professionals remind us that, “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. IKS 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 entwined with multiple aspects of society, such as ceremonies, songs, prayers, dances, clothing, food gathering and preparation, and so on.”

The 2023 Tribal Water Needs Assessment Report for Ventura County found that Chumash respondents mirrored ITPEC STACC 2’s findings that their relationship to water absolutely includes IKS, ceremonial, spiritual, food and lifestyle ways. Chumash respondents acknowledged that water creates life for all relatives. The 2023 Tribal Water Needs Assessment for Ventura County also identified ongoing gaps in access, engagement, and recognition of Tribal water needs.

Climate environmental professionals at the Institute for Tribal Environmental Professionals direct resource managers to build plans, policies, and programs grounded in IKS and to incorporate relationships and reciprocity, rather than foregrounding Western science. What work, collaborations, partnerships and funding sources can contribute to such a shift for our watershed? The VRWRP begins to explore foregrounding Native leadership and Chumash science here in Chumash homelands, however, iterative and long-term plans, actions, collaborations and partnerships need to be made in order to include Chumash IKS into stewardship of the Ventura River Watershed. Chumash people and knowledge systems need to contribute to all planning efforts and implementation in the Ventura River Watershed, which remains critical to Chumash life.

## **Focused Engagement with Overburdened and Frontline Communities**

Providing equitable access to participation in the VRWRP development process was a key state and local priority. Early in the process, the VRWRP team identified disadvantaged communities, recognizing that these communities often face greater climate impacts and barriers to participation. Two areas in the watershed—the West Ventura Avenue neighborhood and Casitas Springs—meet the state’s disadvantaged community criteria based on median household income.

Several equity-focused community-based organizations are active in watershed, including the Westside Community Council (Council), the Central Coast Alliance United for a Sustainable Economy (CAUSE), and the Merito Foundation. They continuously participate in the Watershed Council and had worked on

equity-focused initiatives such as the WaterTalks Program. Building on CAUSE’s prior outreach and needs-assessment work, and to ensure community input was reflected in project outcomes through accessible and inclusive engagement, the VRWRP partnered with CAUSE to lead targeted outreach in West Ventura Avenue and Casitas Springs.

CAUSE conducted in-person surveys and facilitated focus groups to understand community experiences with climate hazards and to elevate local priorities. In summer 2025, CAUSE collected 113 surveys, more than half in Spanish, by conducting outreach at high-traffic locations and through door-to-door visits. Respondents were predominantly West Ventura residents, most identifying as Latino and earning under \$50,000 per year. Surveys captured neighborhood strengths, challenges, and lived experiences with extreme heat, drought, flooding, and wildfire.

In November 2025, CAUSE held two focus groups—one in Spanish with eight adult residents and one in English with thirteen Ventura High School youth. Participants received background information on watershed conditions and climate projections and contributed to structured discussions on key climate hazards. Through a voting exercise, residents identified the resilience strategies they viewed as most urgent and impactful.

Across both surveys and focus groups, several consistent themes emerged. Residents emphasized the need for:

- Expanded shade and cooling infrastructure
- Improved emergency communication, including multilingual alerts
- Accessible, culturally relevant outreach through trusted community spaces like schools

Participants also connected climate resilience to daily lived experiences, including housing conditions, transportation access, public safety, and the availability of green spaces.

These insights directly informed refinement of the VRWRP’s adaptation strategies, particularly those related to extreme heat mitigation, equitable access to resilience infrastructure, and improved communication during climate-driven emergencies. Detailed findings, demographic information, and recommendations are included in **Appendix H: CAUSE Engagement Final Report**.

## Assessment of Existing Regional Networks

To meet DWR’s requirements for evaluating existing regional networks and identifying gaps in engagement, VCRCDD worked with the CSU team to conduct a comprehensive assessment of the watershed’s organizational landscape. This assessment examines how organizations currently collaborate, the sectors they represent, and where opportunities exist to strengthen coordination, inclusivity, and support for overburdened communities and Tribes. The CSU Regional Network Assessment is included below, with additional detail in **Appendix I: CSU Network Assessment Report**.

### Introduction

A key first step in the DWR’s Watershed Resilience Framework is to identify and evaluate the existing regional watershed network of organizations active within the Ventura River Watershed. These organizations work on issues such as water resources, conservation, the environment, wildfire, community engagement, and recreation, and potentially have an intersection with watershed resilience planning. For example, the network includes groups that already collaborate on watershed-related projects and programs, share data or expertise, or coordinate funding, materials, or labor.

There are several purposes for identifying and assessing the watershed resilience network: (1) to determine how existing partnerships can support watershed resilience planning; and (2) to identify opportunities to strengthen collaboration in implementing resilience strategies, particularly by enhancing engagement with overburdened communities and tribes.

To achieve these goals, the assessment focused on three main objectives:

- Creating an inventory of organizations actively working in the watershed;
- Identifying and describing existing collaborative relationships among these organizations; and
- Evaluating the overall health of the network, including how well it engages with vulnerable and historically excluded communities.

The watershed network assessment was conducted by the Center for Geospatial Science and Technology at CSU Northridge, the Institute for Watershed Resiliency at CSU San Bernardino, and the Loyola Marymount University Center for Urban Resilience—collectively referred to as the “CSU team”— in partnership with the Watershed Resilience Project team.

An interactive Story Map on the Ventura River Watershed Network is available at <https://arcg.is/1KvzPO2>.

## Methods Summary

To complete the assessment of the existing regional network in the Ventura River Watershed, an online survey was sent to 72 community partners in May 2025. This survey collected information on several main topics from organizations that currently work in the watershed:

- Where they work and what issues they work on;
- How they currently collaborate with other organizations in the watershed; and
- Their priorities related to water and climate resilience issues.

More details regarding the survey methodology, including the specific survey questions used, can be found in **Appendix I: CSU Network Assessment Report**. To more accurately determine the geographic areas where these organizations operate, the CSU team followed up with several organizations based on their survey responses. To supplement the survey data, the team incorporated information gathered from meetings with key partners held between August and December 2024. While these meetings primarily focused on identifying climate risks and vulnerabilities and priority adaptation strategies, existing collaborations with other organizations also were discussed. The resulting dataset was analyzed using statistical, spatial, and social network analyses.

## Results and Discussion

Of the 72 organizations invited to participate in the survey, 52 responded, resulting in a 72 percent response rate. An interactive dashboard summarizing survey results (shown in Figure 4) is available at <https://t.ly/vrwrp-dashboard>.



the watershed to assess their unique risks and impacts from climate hazards. The findings from their survey and focus groups can be found in **Appendix H: CAUSE Engagement Final Report**.

### *Spatial Characteristics*

The geographic scope of respondents' work within the Ventura River Watershed spans a range of scales, from multi-watershed initiatives to highly localized, project-specific efforts. Eighteen organizations (approximately 35 percent) reported working throughout the entire Ventura River Watershed, although the survey did not capture the specific locations of their projects. Another 33 percent reported working across multiple watersheds, including the Ventura River Watershed, indicating that their resources and staff time are distributed across several regions. This suggests that many organizations take a watershed-wide, holistic approach rather than focusing solely on localized issues.

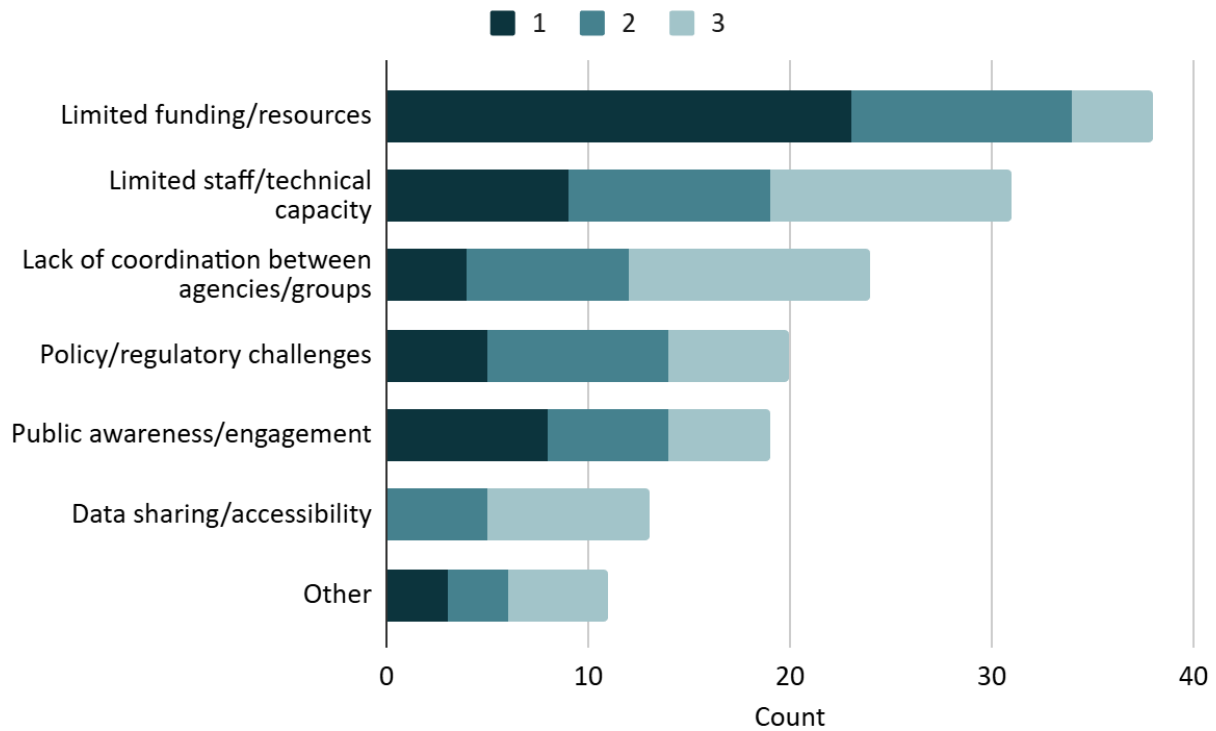
In contrast, a smaller but notable percentage of organizations have more defined service areas. Twelve organizations (23 percent) reported operating within a specific jurisdiction or boundary. For example, one organization focuses on "The Avenue/Westside Community," a highly localized area. Another organization, whose service area spans a landscape both within and external to the watershed boundary, noted that a portion of its water supply comes from the Ventura River, underscoring its particular interest in watershed resources. Additionally, four organizations (8 percent) work at project-specific locations, indicating a narrow but highly focused scope of work. One respondent indicated that they currently have no projects within the watershed. An interactive web map showing where each surveyed organization works is available at <https://t.ly/vrwrp-webapp>.

### *General Collaboration Characteristics*

Collaboration is widespread among the surveyed organizations, with 71 percent indicating participation in regional networks or coalitions within the Ventura River Watershed. The survey identified a high level of collaborative diversity, naming a total of 29 distinct networks and coalitions. The Ventura River Watershed Council emerged as the single most important collaborative body, with 44 percent of all responding organizations reporting participation in it. Collaborations within the watershed are perceived as generally successful: 85 percent of respondents rated their regional networks as either "very effective" (35 percent) or "somewhat effective" (50 percent). However, the 15 percent that remained neutral suggests clear potential to strengthen the impact and perceived value of these partnerships. When asked how often collaborative efforts result in tangible outcomes that address community needs, 39 percent of respondents answered, "very frequently," 56 percent said "occasionally," and 6 percent said "rarely."

Figure 5 illustrates how respondents ranked the primary barriers to successful collaboration. Notably, 44 percent identified limited funding and resources as the primary barrier, and 73 percent ranked it among their top three challenges.

**Figure 5 Main Barriers to Successful Collaboration (Ranked 1-3)**



When asked what additional partnerships might strengthen their work, organizations primarily highlighted the critical need for greater financial and systemic support across the watershed. The most common need was for increased funding and resources from higher-tier partners, particularly state and federal governments. This financial constraint is often tied to a deeper issue: the difficulty of coordinating numerous public and private entities to move large, area-wide projects forward. As one respondent noted, this fragmentation leads to frustrating "starts and stops" that hinder sustained, regional progress.

However, the feedback also identified clear opportunities to expand and diversify the network in targeted ways. Respondents specifically called for better coordination with landowners and land conservancies to support on-the-ground restoration and wildfire resilience efforts on private lands. They also called for deeper engagement with grassroots community groups and youth initiatives, such as the Ventura-River Action Network, to enhance public participation, as well as closer collaboration with technical organizations and academic institutions to leverage specialized data and expertise. Several respondents specifically identified the U.S. Forest Service as a key collaboration partner that would be particularly beneficial. Overall, while the existing network is active, its impact could be greatly strengthened through dedicated external funding and more streamlined multi-agency coordination.

## Climate and Water Resilience

### Meaning of Resiliency

Organizations were asked to answer the open-ended question, "What does watershed resiliency mean to your organization?". Responses were analyzed to identify key themes. The resulting word cloud (Figure 6) visually summarizes these themes, with the most frequently mentioned words appearing most prominently. The dominant concepts—"healthy," "sustainable," "communities," and "habitat"—show



**Figure 7 Most Urgent Climate Hazards Identified by Sector**

*Respondents were asked to select up to three hazards*

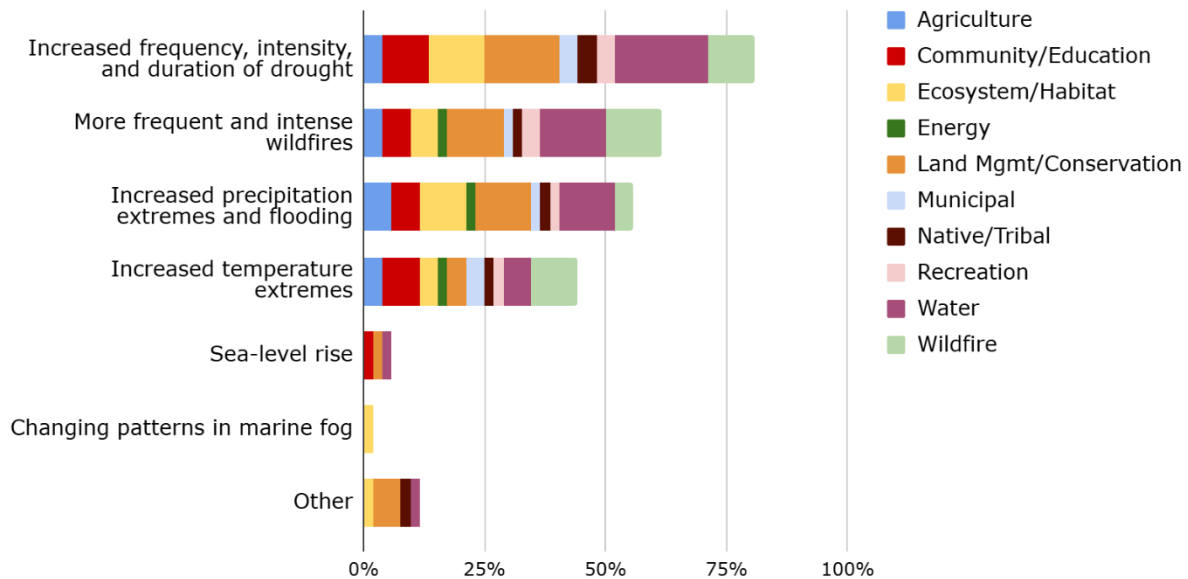
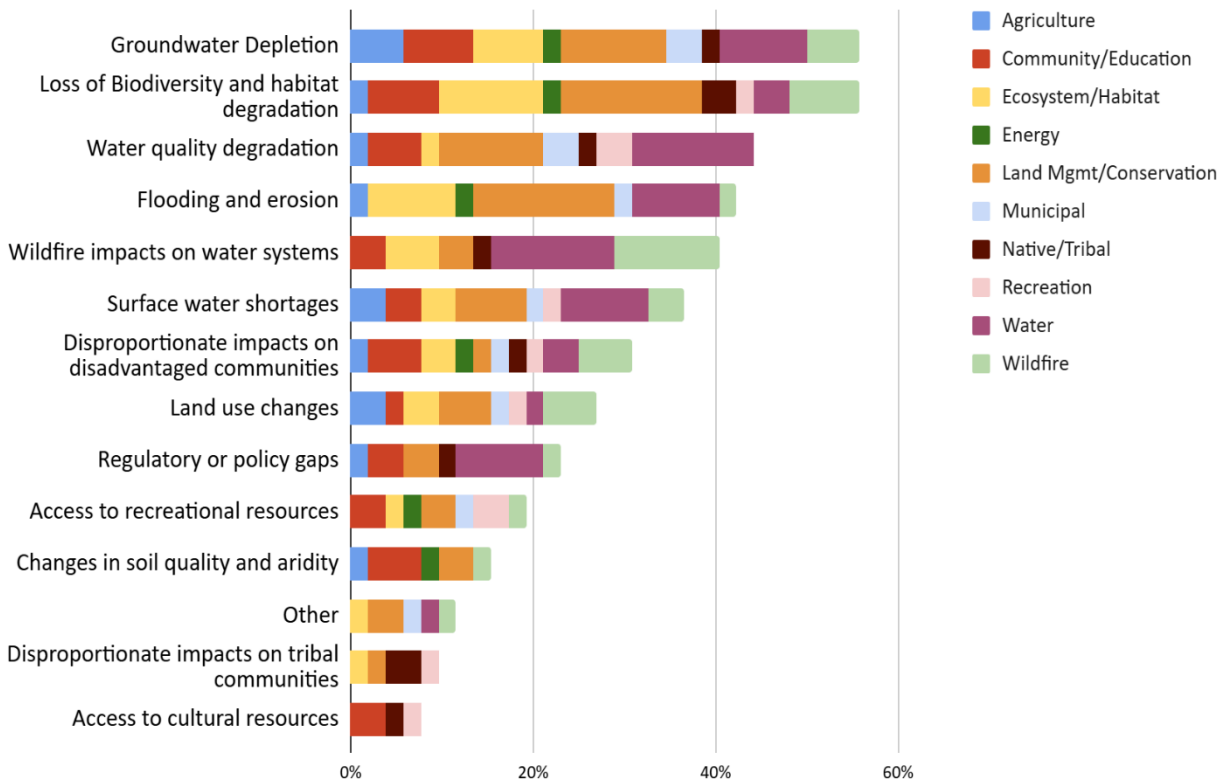


Figure 8 presents the primary perceived challenges to water and climate resilience, based on respondents’ identification of up to five urgent issues. Groundwater depletion and loss of biodiversity and habitat degradation emerged as the most frequently cited perceived challenges, both of which were selected by 29 respondents (56 percent). Notably, concern over groundwater depletion was not equally reflected within the Water sector—only five of the 12 organizations (42 percent) identified it as a top issue, with one respondent noting that regional planning had found climate change to have limited impacts on local groundwater. Additional “Other” challenges mentioned included reduced sediment delivery to the coast, increased wildfire risk to communities, and the Matilija Dam.

**Figure 8 Most Urgent Water and Climate Resilience Challenges by Sector**

Respondents were asked to select up to five resilience challenges

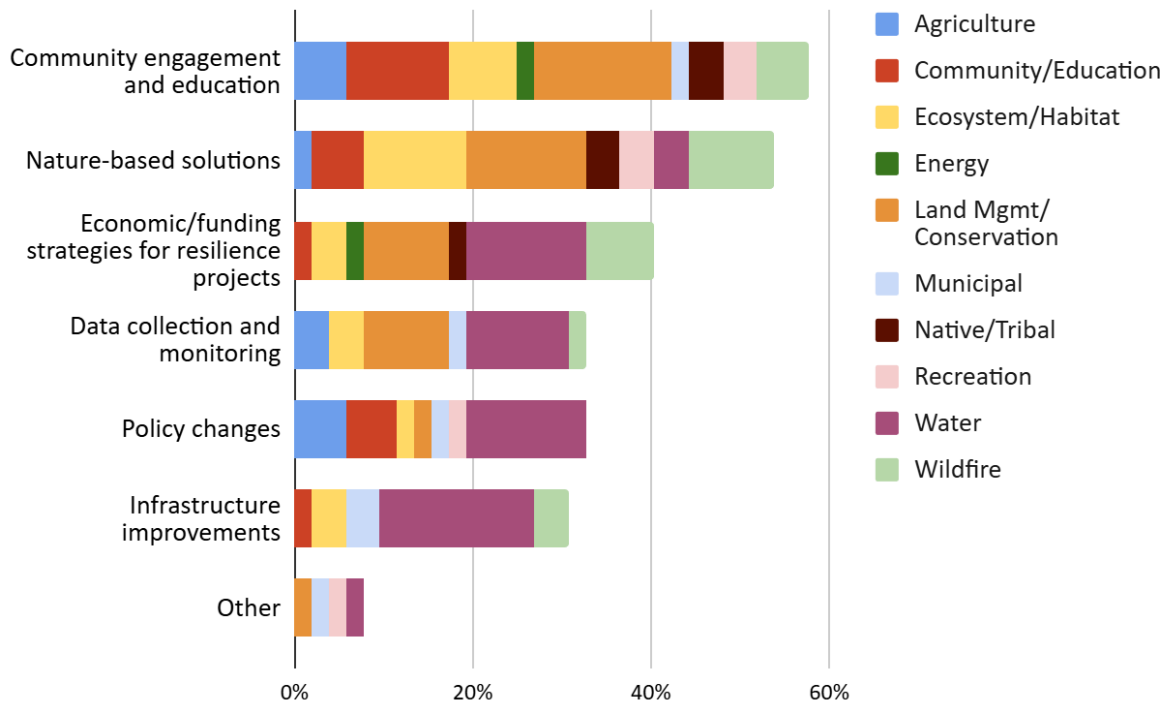


*Resilience Strategies and Implementation Challenges*

The strategies prioritized by organizations indicate a strong emphasis on engagement and nature-based solutions. Community engagement and education (58 percent) and nature-based solutions (54 percent) were the two most frequently identified approaches for advancing climate adaptation and resilience in the watershed (Figure 9). Collectively, respondent priorities reflect a focus on strengthening both social and ecological resilience by harnessing public awareness and the restorative capacity of natural systems.

**Figure 9 Priority Resilience Strategies by Sector**

*Respondents were asked to select up to three strategies*

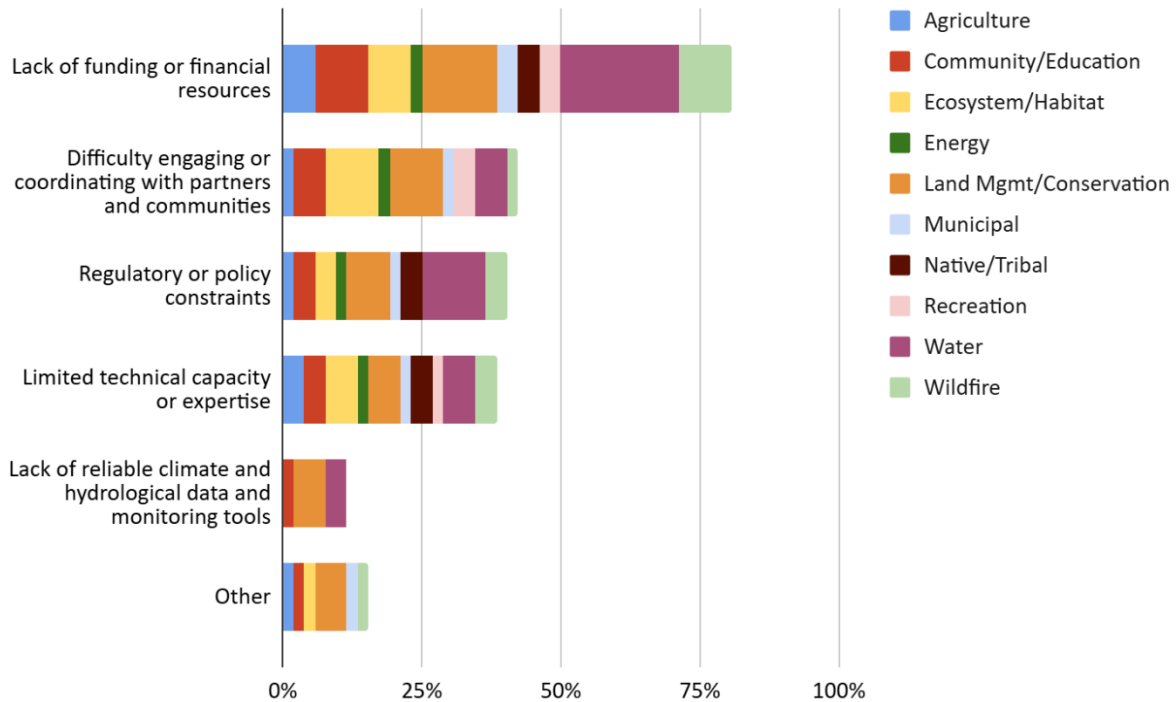


However, the implementation of adaptation and resilience projects remains significantly limited by resource and governance challenges. As shown in Figure 10, a staggering 81 percent of respondents identified a lack of funding as the most pressing challenge. Beyond financial constraints, implementation is further hindered by coordination difficulties, with 42 percent of respondents citing difficulty engaging or coordinating with partners and communities and 40 percent identifying regulatory or policy barriers. Additional "Other" responses referenced issues such as resistance to change, staffing challenges, and authority constraints.

Of particular interest were responses from the Water sector given their role in supporting water resource resiliency that benefits human-environmental landscapes and diverse activities across the watershed. Water sector responses highlighted a strong focus on resilience strategies such as infrastructure improvements, funding and economic approaches, expanded data collection and monitoring, and policy changes. Like other sectors, Water sector respondents identified key challenges, including limited funding and financial resources, regulatory and policy constraints, gaps in technical expertise and capacity, and difficulties with community and partner engagement. Together, these challenges underscore the need for increased investment, better coordination across regulatory frameworks, and stronger, more collaborative partnerships throughout the watershed.

**Figure 10 Main Challenges to Implementing Climate Adaptation and Resilience Projects by Sector**

Respondents were asked to select up to three challenges



*Key Partner Engagement Meetings*

Early in the project, the VRWRP team met with 13 key partner organizations to gather detailed insight on climate-related concerns, current priorities, and perspectives on watershed conditions. Recurring issues included drought, water supply reliability, flooding and erosion risks, and financial barriers to implementing climate-resilient projects. Drought emerged as a primary concern, affecting water availability for supply, ecosystems, and agriculture. Flooding and erosion risks, particularly those affecting critical water infrastructure, were also identified as major challenges, with several partners emphasizing the need to plan for future watershed conditions following the removal of Matilija Dam. Wildfire risk, compounded by invasive species such as *Arundo (Arundo donax)*, was highlighted as a significant threat to infrastructure, habitats, and community safety. Post-fire sediment transport and erosion were recognized as factors that further intensify these vulnerabilities. Extreme heat was additionally cited as a growing concern, particularly for overburdened communities and the water operations workforce.

In addition to environmental risks, key partners—including the Ventura County Watershed Protection District, City of Ventura – Ventura Water and Public Works departments, and local water mutuals—expressed significant concern about the funding limitations and structural financing barriers associated with implementing climate resilience projects. Although each organization faces unique funding challenges, all emphasize the need for more accessible and more flexible funding mechanisms. Addressing these financial barriers is essential to advancing effective climate adaptation strategies.

**Appendix I:** CSU Network Assessment Report provides more details about the key partner engagement meetings.

### *Centering Tribal Perspectives in Watershed Health and Resiliency*

Survey results underscore a clear and urgent need to meaningfully include and elevate Tribal perspectives and traditional ecological knowledge in watershed health and climate resiliency planning. Tribal governments, representatives, and members bring place-based knowledge and long-term stewardship practices that are essential for addressing compounding climate, water, and ecological challenges.

In the Ventura River Watershed, the BVBMI was identified as a regional Tribal representative organization with a primary focus on community and education and serving their members while maintaining a geographic focus across the entire watershed. BVBMI participates in regional networks and coalitions, including involvement in the Matilija Dam Ecosystem Restoration Project, and collaborates with a wide range of partners such as the California State Coastal Conservancy, CSU Channel Islands, Ventura County agencies, and multiple local nonprofits and land trusts.

Despite this broad collaboration, BVBMI characterized the overall effectiveness of partnerships as neutral, noting that tangible outcomes occur only occasionally. The most significant barriers to successful collaboration were identified as limited staff and technical capacity, followed by limited funding and resources, and lack of coordination among agencies and groups. These constraints reflect broader systemic challenges faced by Tribal entities engaging in regional water and climate initiatives.

BVBMI articulated a definition of watershed resiliency (Figure 6) rooted in responsibility, ecological restoration, and land-use restraint: planning around existing water supplies without reliance on imported state water, removing barriers to ecological systems such as dams, and preventing development within floodplains. This perspective emphasizes long-term sustainability and ecosystem integrity.

BVBMI also identified increased drought frequency and severity, extreme heat, and the impacts of legacy development as the most urgent climate hazards (Figure 7). Related water and climate resilience challenges include disproportionate impacts on disadvantaged communities and Tribal members, loss of biodiversity and habitat degradation, declining water quality, and limiting government policies and institutional structures (Figure 8). Priority adaptation and resiliency strategies highlighted by BVBMI include community engagement and education, as well as nature-based solutions such as riparian restoration and wetland enhancement (Figure 9). However, implementation of these strategies continues to be hindered by lack of funding and limited technical expertise (Figure 10).

Collectively, these responses reinforce the need for watershed initiatives to move beyond consultation toward sustained investment in Tribal capacity, leadership, and partnership. Supporting Tribal governments, representatives, and community members as full partners is essential to achieving equitable, resilient, and ecologically sound watershed outcomes.

### **Social Network Analysis**

Social network analyses were completed based on the responses to the two network questions on the survey. Respondents were first asked to name the organizations they collaborate with, choosing from a list of 74 pre-populated organizations from across sectors and scales as well as the option to write in organizations not listed. A follow-up question asked what types of collaboration respondents had with each listed organization: general collaboration, information or expertise, and funding or resource sharing. The results illustrate a network of 114 organizations with collaborative, informational and funding relationships related to water resilience across the Ventura River Watershed. Figure 11 shows a visual of the entire network as displayed through the online platform Kumu. This interactive tool can be explored at <https://t.ly/vrwrp-kumu>.

Figure 11 Interactive Network Map Produced Through the Online Platform Kumu

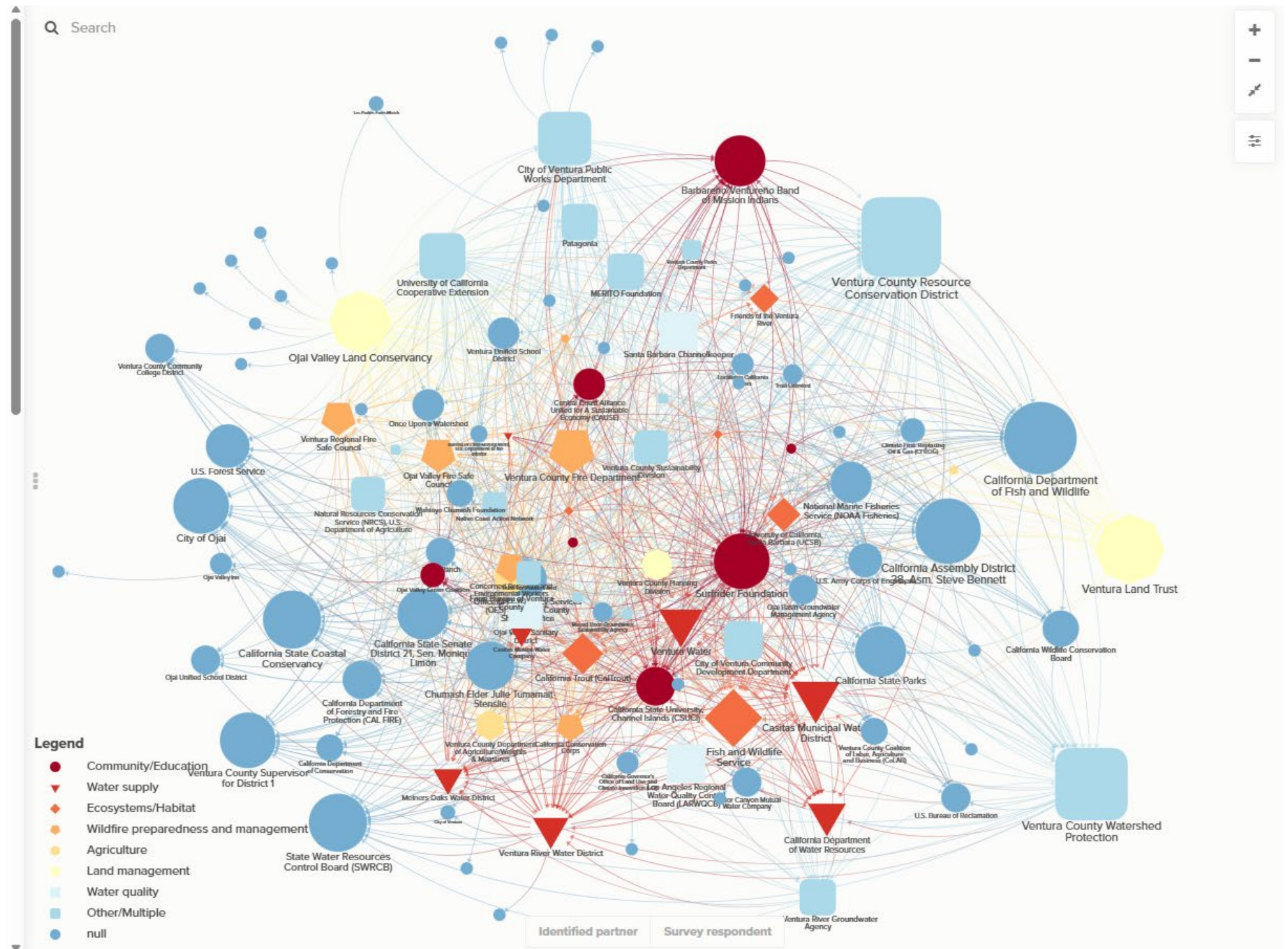
Overview Discussions

This map visualizes network relationships among stewardship organizations as reported by respondents to the Ventura River Watershed Resilience Program survey, which was conducted by the CSUN Center for Geospatial Science and Technology, CSUSB Institute for Watershed Resiliency, and the LMU Center for Urban Resilience in partnership with the Ventura County Resource Conservation District.

**To use this map:** Use the top search bar to find a particular organization (node). The colors and shapes of each node correspond to the focus area of the organization as listed in the legend, with the category "Other/Multiple" describing focus areas chosen by two or fewer responding organizations and the category "null" used for organizations who did not complete the survey. The sizes of the nodes are based on their indegree measure (see below). Clicking on the Survey Respondent button on the bottom of the screen will filter to only show organizations with complete profiles, and clicking on any of these nodes will display their organizational information. Clicking on a line between nodes will provide more information about the type of connection between them.

**Key terms:**

- **survey respondent:** An organization that completed the survey and thus has a complete profile.
- **identified partner:** An organization that did not complete the survey but was identified by a survey respondent as a



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### Degree Centrality

Degree centrality measures how many total connections, or ties, an organization has, with *outdegree* measuring the number of outgoing ties (i.e., the organization named others as partners) and *indegree* measuring the number of incoming ties (i.e., the organization was named by others as a partner).

**Appendix I:** CSU Network Assessment Report provides more detail on network terminology definitions. In general, organizations with high indegree are the leaders, looked to by others for advice, expertise or information.

Focusing on the information network, there were a total of 1,052 incoming and outgoing information ties, as visualized in Figure 12. Network analysis revealed that a total of 32 organizations were weakly or not at all connected to the information network with zero or one information ties, including the six disconnected organizations visible in Figure 12. Another six organizations, or 5 percent of the network, hold 21 percent of the information ties. The top indegree organizations have between 14 to 18 incoming ties, and include the California Department of Fish and Wildlife, Ventura County Watershed Protection District (VCWPD), OVLC, Surfrider Foundation, California State Parks, and VCRCO.



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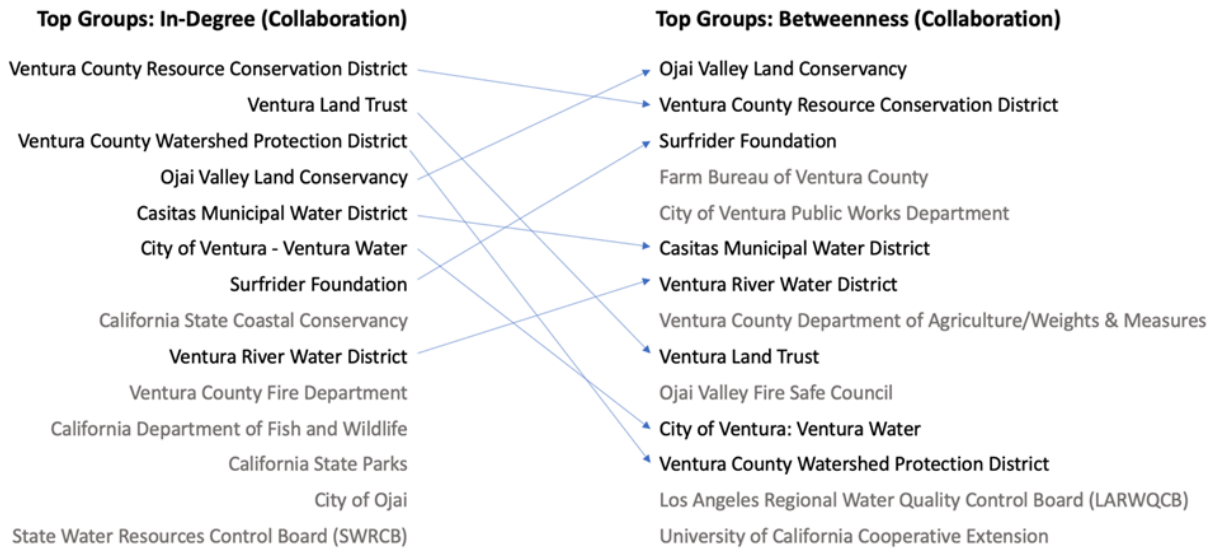
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### Betweenness Centrality

Betweenness centrality measures the number of times an organization lies between two other organizations that otherwise would not be connected. Further information is provided in **Appendix I: CSU Network Assessment Report**, but in general, this bridging or brokering position is considered a measure of influence. A bridging organization connects a diverse—and often expansive—set of actors who would otherwise remain disconnected. A brokering organization goes beyond this by actively mediating relationships between two unlinked organizations or clusters within a network, facilitating specific interactions, exchanges, or collaborations between them. Across all three relationship types (collaboration, information, funding), betweenness was highest in the information network. In the information sharing network, the OVLC had the highest betweenness score of 1340, which was more than three times greater than the second highest betweenness score of 401 held by Surfrider Foundation. Thus, these two organizations are considered highly influential in the network, often serving to connect organizations that would not be connected without this bridge between them.

Overall, it is notable that organizations with highest betweenness are often, but not always, the same as those with the highest indegree. This is shown for the collaboration network in Figure 13, where only eight of the 14 highest-ranked organizations appear in both top indegree (leadership) and top betweenness (influence) for collaboration ties. This indicates that organizations occupy different roles within the network, and their distinct strengths should be strategically considered when developing network approaches to achieve specific objectives.

**Figure 13 Top Ranked Organizations for Indegree (Leadership) and Betweenness (Influence) Centrality in the Collaboration Network**



### Network Strengths and Opportunities

Overall, social network analysis revealed a robust network of organizations working on water resilience in the Ventura River Watershed. Two groups ranked among the top indegree and betweenness for all three relationship types: the OVLC and the VCRC. This indicates that these two groups have the ability to lead and influence other watershed resilience organizations. This opportunity is highlighted further in the case studies below. Another notable finding is that betweenness was highest in the information

network, suggesting that more organizations are playing a bridging role in information sharing. Betweenness was the most concentrated in the collaboration network, suggesting that just a few organizations are playing a bridging or brokering role in collaborative work related to watershed resilience. These organizations have an important role in bringing together collaborative efforts; however, high betweenness can also indicate that large numbers of organizations are peripheral or have limited interest, opportunities, or capacity to collaborate. Increasing collaboration among weakly connected organizations can improve overall network resilience.

As mentioned above for the information network, and shown for other networks in **Appendix I: CSU Network Assessment Report**, a large number of organizations were weakly or not at all connected when looking at individual relationship types. The least connected network was the funding network, which had the fewest number of ties and the lowest indegree and betweenness scores (Figure D-3, Tables D-7 & D-8). We note that many of the respondents are public agencies that may receive budgetary allocations and may not require external funding, or smaller non-governmental entities that may not have the opportunities or capacity to apply for external funding, which may partially explain this finding.

There were 11 organizations holding only one tie across all network types, including one responding organization: the Council. This suggests an opportunity for targeted outreach to these groups, and the groups themselves can utilize the tools created through this project to seek out collaboration opportunities (see Case Studies below) and become better connected and integrated into the network.

## Case Studies

The resources included in this report—such as the community partner profiles in **Appendix I: CSU Network Assessment Report**, along with the dashboard, Kumu map, and interactive mapping tools—provide practical means for identifying collaboration strengths and opportunities within the Ventura River Watershed. The following case studies demonstrate how these tools can be applied in practice; however, they are intended as examples rather than prescriptive guidance.

### *Strength: Ojai Valley Land Conservancy*

The OVLC exemplifies a core strength in the watershed network by leveraging collaborations for large-scale resilience work. Its mission to protect and restore the natural landscapes of the Ojai Valley, coupled with its vision to lead the Valley's response to climate change, is backed by high network centrality. The social network analysis confirms OVLC is a critical partner in the collaboration network, ranking first in "betweenness" and fourth in "indegree". The Kumu map visually demonstrates these extensive connections, while OVLC's partner profile (**Appendix I: CSU Network Assessment Report**) highlights its substantial capacity, including managing over 2,600 acres of open space and mobilizing over 7,100 volunteer hours in 2024.

This robust capacity translates directly to project success, most notably in securing a \$7 million CAL FIRE Forest Health grant to lead the Ventura River Watershed Riparian Resilience Program, a watershed-scale effort to remove invasive *Arundo* and restore riparian forest health. Potential collaborators can use the interactive map to confirm service area overlap with OVLC. Its high network centrality and proven grant and philanthropic success demonstrate it can serve as a powerful anchor to connect partners, navigate regulatory processes, and mobilize the substantial resources required for capital-intensive climate adaptation.

### *Opportunity: Partners for Westside Community Council*

The Westside Community Council is a nonpartisan group dedicated to improving community unity and quality of life on the Westside of the city of Ventura since 1994. Although the Council is eager to partner, it cites a "lack of coordination between agencies/groups" as a major barrier to successful collaboration. The Council explicitly seeks partners who can "help inform the community" and facilitate feedback, signaling a strong willingness to engage but a clear need for external expertise to bridge the gap between residents and technical resources.

To bridge this gap, the Council should utilize the report's tools. They can use the interactive map to find organizations with overlapping service areas, then reference the Kumu map (which lists missions and focus areas) to screen potential partners. Following this process, the Council might identify CAUSE as a valuable ally for social justice and advocacy work, such as hosting water quality workshops. They could also target and engage with key City of Ventura departments, such as Parks and Recreation, a previous project partner. A partnership here could enable the Council to implement additional tangible projects—like urban greening and stormwater management—that directly link resident input to visible, on-the-ground improvements for watershed health.

## Recommendations

Based on the watershed network analysis and community partner feedback received, the following recommendations are offered to support improved collaboration and a stronger Ventura River Watershed network. Implementing these recommendations will help build stronger relationships among community partners, reduce duplication of effort, and improve the network's capacity to address watershed challenges collaboratively.

### **Strengthen Multi-Agency Coordination and Collaboration**

- Formally recognize and provide additional funding support to the Ventura River Watershed Council to play a sustained convening and coordination role across the watershed network.
- Distribute leadership responsibilities to reduce over-reliance on a few organizations.
- Establish clearer coordination mechanisms and governance structures to improve communication and collaboration across jurisdictions, agencies, organizations, and sectors.
- Facilitate structured cross-sector dialogue to better align shared understanding of climate hazards and priority adaptation strategies among community organizations, water service providers, and public agencies, with the goal of advancing integrated, multi-benefit solutions.
- Continue investing in regional planning and implementation efforts, such as the VRWRP, to enable multiple organizations to participate in and benefit from shared planning processes grounded in common problem statements, resilience goals, and strategies.

### **Maintain and Evolve Network Tools as Living Resources**

- Identify a responsible entity, such as the VCRCD, and secure dedicated funding to support the ongoing maintenance and development of the network assessment tools (i.e., Community Partner Profiles web app, Community Partner Survey dashboard, Kumu social network map).
- Establish a regular update cycle for survey data and community partner profiles to reflect the current state of collaborative partnerships and capture changes in relationships and priorities over time.

- Expand data collection and network assessment tools, including development of a shared communication platform, to capture information on specific projects, interests, and needs of community partners and facilitate partner matching and identification of collaboration opportunities.

#### **Improve Network Connectivity and Inclusive Participation**

- Expand and diversify participation in the watershed network by proactively engaging underrepresented and weakly connected organizations, including Tribal governments and representatives, small community-based groups, farms, and groundwater sustainability agencies.
- Support organizational capacity-building through financial assistance and training opportunities to strengthen participation in the watershed network.
- Identify and share resources to help organizations strengthen engagement with historically overburdened communities.

#### **Secure and Coordinate Sustainable, Large-Scale Funding**

- Pursue coordinated, multi-agency funding strategies that support long-term, watershed-scale implementation and reduce fragmented, short-term project cycles.
- Invest in both critical watershed network nodes and weakly connected organizations to improve overall network resilience.

#### **Expand Strategic Partnerships for On-the-Ground Impact**

- Deepen and expand partnerships with Tribal governments and representatives, private landowners, land conservancies, grassroots organizations, youth initiatives, and academic and research institutions to strengthen implementation capacity and community engagement. This may include but is not limited to prioritizing and supporting the meaningful inclusion of Tribes and their perspectives, honoring the dynamic environmental relationships and cultural experiences that inform their stewardship within the region.
- Engage community partners to identify desired collaborators that are currently less active in the watershed, such as the U.S. Forest Service, and take steps to strengthen or establish those partnerships.
- Continue and strengthen collaboration with state agencies that have invested in the watershed, including the Department of Water Resources, Wildlife Conservation Board, Coastal Conservancy, Department of Conservation, CAL FIRE, and the State Water Resources Control Board.

## **Summary and Conclusion**

The Ventura River watershed network assessment reveals a well-established network with significant, yet untapped capacity for climate resilience planning. The network's core focus is building a "healthy" and "sustainable" system, particularly water systems, that benefit both "communities" and "habitat." Organizations are unified in identifying the top threats: drought (81 percent), wildfires (62 percent), and flooding (56 percent). Interestingly, most organizations (50 percent) have a dedicated climate plan, and preferred resilience strategies focus heavily on community engagement and nature-based solutions. Although collaboration is generally strong, 85 percent of respondents say their partnerships are at least "somewhat effective"—the main challenge preventing real progress is a lack of funding and resources. In fact, 81 percent of respondents identify insufficient funding and resources as the top barrier to successful collaboration.

The social network analysis identified several influential organizations—most notably the OVLC and the VCRCD—as key anchors of leadership and expertise, particularly in information sharing. The accompanying network tools—including the online dashboard, interactive Kumu map, and organizational profiles—serve as practical resources for partners to identify overlapping service areas, assess technical expertise, and strategically engage collaborators for specific project needs. Together, these tools can help reduce one of the most common barriers to effective collaboration: coordination challenges.

Overall, the network is well-structured and guided by a clear vision for resilience; however, its potential remains significantly constrained by limited financial resources and fragmented coordination. Moving forward, efforts should focus on securing large-scale, streamlined funding and strategically leveraging key organizations to advance multi-benefit projects, while also strengthening engagement with grassroots groups and community partners.

Additionally, addressing the complex needs of the Ventura River Watershed requires embracing diverse perspectives, knowledge systems, and management strategies. The Watershed Council offers a framework for inclusive collaboration that, when integrated with the expertise of the broader network, strengthens collective capacity and positions the watershed to adapt to evolving resiliency challenges. This integrated approach supports dynamic, forward-looking strategies that ensure today’s efforts remain effective and sustainable for generations to come.



## Chapter 3

# State of the Watershed

This chapter provides a clear picture of current watershed conditions, including water supply, groundwater, ecosystems, cultural resources, and community needs. It highlights the challenges and opportunities shaping resilience today, weaving in scientific data and community perspectives.

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## Introduction

This chapter builds upon the foundational [2015 Ventura River Watershed Management Plan](#) (WMP) and describes the current condition of the Ventura River Watershed, establishing the baseline for understanding how future climate hazards will affect water resources, ecosystems, infrastructure, and communities. It provides an integrated look at the watershed’s physical setting and summarizes how historical climate extremes have shaped present-day vulnerabilities.

This State of the Watershed assessment builds on numerous existing regional studies and datasets, including the 2018 Projected Changes in Ventura County Climate report, the 2019 Integrated Regional Water Management (IRWM) Plan, the Ventura River Watershed Management Plan (2015), and more than 40 additional technical reports compiled during the assessment. These studies provided foundational hydrologic, ecological, infrastructure, and climate-risk information that shaped the selection of indicators, informed system characterizations, and ensured that this assessment builds on prior regional planning efforts. The compilation of these datasets enabled a consistent, watershed-wide picture of current conditions and provided critical reference points for identifying data gaps, historical trends, and emerging climate-driven stressors. See **Appendix B: Related Reports, Resources, and Programs**, for a list of existing regional efforts that influenced the VRWRP.

The chapter also introduces the watershed’s water-resource systems which serve as the organizing structure for the VRWRP: water supply, flood management, groundwater, ecosystems, water quality, and cultural resources.

These water resource systems are examined alongside historical and observed climate hazards, including drought, extreme heat, wildfire, flooding, sea-level rise, and declining marine fog, to illustrate how climate hazards translate into impacts on people, the environment, and critical services. A watershed wide historical water budget further contextualizes how limited storage capacity, precipitation-dependent supplies, and interconnected groundwater–surface water systems influence watershed resilience under changing climate conditions. Together, these components provide the context for the watershed’s key vulnerabilities and problem statements, which form the bridge to the adaptation strategies and implementation roadmaps presented in later chapters.

While this chapter draws from the best available data on hydrology, climate hazards, ecological conditions, and watershed infrastructure, several limitations in historical monitoring records (including limited and inconsistent historical records, sparse data on certain hazards, and insufficient records on cultural resource impacts) introduce uncertainty in how past events are interpreted and compared. A more detailed discussion of data gaps and limitations is provided in **Appendix J: Data Gaps and Limitations on Historical Hazards**.

### Changing Land Use in the Watershed

Displacement of Indigenous Chumash communities, combined with decades of infrastructure development, land use change, and climatic stressors such as drought and extreme heat, has fundamentally altered the watershed’s hydrologic and ecological systems by disrupting natural flow regimes, sediment transport, and disturbance processes through dams, surface water diversions, groundwater pumping, channelization, and long-term fire suppression. At the same time, land uses including irrigated agriculture, urban runoff, septic systems, roadway drainage, livestock operations, and post-wildfire erosion contribute to water quality impairments.

## Overview of the Ventura River Watershed

**Table 1 Quick Facts on the Ventura River Watershed**

<b>Main Tributaries &amp; Subwatersheds</b>	Matilija Creek, North Fork Matilija Creek, San Antonio Creek, Cañada Larga Creek, Coyote Creek
<b>Jurisdictions</b>	Of the watershed area in Ventura County: County of Ventura (49.1 percent), U.S. Forest Service (47.7 percent), City of Ojai (1.9 percent), City of Ventura (1.2 percent). A small corner of the watershed is in Santa Barbara County (3.9 percent of the entire watershed).
<b>Population</b>	43,785
<b>Headwaters</b>	Transverse Ranges
<b>Mouth</b>	Pacific Ocean (Santa Barbara Channel)
<b>Area</b>	226 sq. mi., 144,833 acres
<b>Elevation</b>	Highest: 6,010 ft. Lowest: sea level

Source: *Ventura River Watershed Management Plan, 2015*

### Subwatersheds

The watershed is comprised of key tributary systems including the Matilija Creek, North Fork Matilija Creek, San Antonio Creek, Cañada Larga Creek, and Coyote Creek—all integral to the watershed’s overall hydrologic function and ecological health. The watershed includes six primary subwatersheds, each defined by topographic ridgelines that channel water into the main river system. These sub watersheds, listed with their corresponding hydrologic unit codes (HUC), correspond to the Ventura River’s major tributaries:

- **North Fork Matilija Creek** (HUC-12: 180701010101): Known for supporting critical habitat for endangered species and natural sediment transport processes.
- **Matilija Creek** (HUC-12: 180701010102): Contains the Matilija Dam, which is currently targeted for removal to restore ecological and hydrologic connectivity.
- **San Antonio Creek** (HUC-12: 180701010103): A critical steelhead tributary with cold-water habitat and accessible spawning grounds. San Antonio Creek’s confluence with the Ventura River is below the Robles Diversion, which also supports significant groundwater recharge and agricultural uses.
- **Upper Ventura River** (HUC-12: 180701010104): Encompasses much of the watershed's residential areas, conveying critical runoff from tributary sub watersheds for habitat and groundwater recharge.
- **Coyote Creek** (HUC-12: 180701010105): Contains Lake Casitas, the watershed’s primary reservoir. While naturally drained by Coyote and Santa Ana Creeks, Lake Casitas relies on the Robles Diversion to import Ventura River water, making it the cornerstone of regional water supply and storage.
- **Lower Ventura River** (HUC-12: 180701010106): Includes the urbanized areas near the watershed’s outlet to the Pacific Ocean, where issues like water quality and flooding are particularly prominent.

Collectively, these heirarchial hydrologic units, shown in Figure 14, form the structural and ecological foundation of the Ventura River Watershed (HUC-10: 1807010102).

Figure 14 Subwatersheds of the Ventura River Watershed



Basemap provided by Esri and its licensors © 2026.  
 Additional data provided by CPAD, 2025; NHD, 2024; US EPA, 2022.

24-16486 WRP Climate Modeling Subwatersheds

## Climate, Hydrology, and Ecology

The watershed has a Mediterranean climate, characterized by distinct wet and dry seasons. Rainfall varies significantly across the Watershed, from about 15 inches annually near the coast to over 35 inches in the mountainous headwaters. Streamflow is highly variable and “flashy,” meaning that flows can rise rapidly in response to storm events and decline just as quickly afterward, resulting in short-duration peak flows followed by extended low-flow conditions. Major floods occur approximately every five years (Ventura River Watershed Council, 2013), with notable high-flow events during the wet winters of 2017 and 2023 that produced significant flooding and sediment transport throughout the watershed. In contrast, extended dry periods such as the 2012–2016 drought and the 2020–2022 drought led to reduced baseflows, disconnected stream reaches, and sections of the Ventura River and its tributaries running dry, particularly in the upper watershed and smaller tributary systems.

Groundwater and surface water are closely connected in many parts of the watershed, with groundwater providing baseflows critical for aquatic habitats during dry periods, particularly in the lower reaches of San Antonio Creek and Ventura River. In the upper basins, stream reaches are predominantly losing, meaning surface water percolates into the subsurface and contributes to groundwater recharge. In contrast, lower watershed reaches tend to be gaining, where shallow groundwater is forced to the surface by bedrock controls, sustaining perennial flow conditions. In the headwater areas, distinct groundwater basins are largely absent; instead, streamflow is supported by subsurface flow pathways and mountain front recharge processes that gradually feed downstream surface and groundwater systems.

Ecology in the Ventura River Watershed is shaped by these climate and hydrologic dynamics, resulting in a diverse mosaic of upland, riparian, and aquatic habitats that respond quickly to shifts in flow, sediment movement, and disturbance. Steep topography and flashy hydrology drive natural sediment transport and periodically reset riparian vegetation, while the estuary and perennial and intermittent reaches support habitat for sensitive species such as southern California steelhead (*Oncorhynchus mykiss*), tidewater goby (*Eucyclogobius newberryi*), and a variety of riparian bird species. These ecosystems have been substantially altered over time by infrastructure, land use change, invasive species (particularly the rapid spread of giant reed [*Arundo donax*; *Arundo*]) and legacy flow modifications, which together have fragmented habitat, reduced natural channel function, and increased wildfire and flood vulnerability. In recent years, large-scale efforts to restore ecological processes have accelerated, including watershed-wide *Arundo* removal and native revegetation efforts, and major fish passage projects that aim to rebuild resilient, connected ecological corridors under a changing climate.

## Major Developments Influencing Current Watershed Conditions

The watershed has recently experienced several major developments that reshape its ecological function, water resource conditions, and management priorities. These changes reflect both climate-driven pressures and significant policy, regulatory, and restoration initiatives underway across the region. The following efforts form an important part of the current State of the Watershed and help provide context for the climate resilience strategies developed in the VRWRP.

Large-scale ecological restoration and sediment-management efforts like the Matilija Dam Ecosystem Restoration Project are advancing major infrastructure upgrades, habitat improvements, and sediment-transport restoration intended to reconnect upstream and downstream systems and improve long-term resilience. Watershed-wide invasive species removal and riparian-restoration efforts have expanded substantially, led by agencies, land trusts, and collaborative partners. Removal of *Arundo* (one of the watershed’s most significant ecological stressors) has accelerated through CAL FIRE Forest Health

grants, riparian restoration initiatives, and the Ventura River Watershed Riparian Resilience Program. Coordination and collaboration with programs associated with the Matilija Dam removal effort has also helped efforts.

Fish-passage and aquatic-connectivity improvements have also advanced in recent years. Projects such as the City of Ventura’s 2022 Foster Park Fish Passage Project - Phase 1, the 2025 Wheeler Gorge Fish Passage Project on North Fork Matilija Creek, and the fish-passage work via the Santa Ana Boulevard Bridge Replacement Project, which is the first essential implementation component of the MDERP. These projects are improving access to spawning and rearing habitat for sensitive aquatic species and rebuilding ecological connectivity across the watershed.

Technical advancements in understanding groundwater–surface water interactions have emerged through the State Water Resources Control Board’s development of an integrated model of watershed hydrology. This work provides a more complete scientific foundation for adaptive water-management decisions and for understanding climate-driven changes in flow, recharge, and ecological conditions.

A watershed-wide water-rights adjudication (Ventura River Watershed Adjudication) is underway to clarify groundwater and surface-water rights and establish a coordinated management framework across the Ventura River watershed basins. While independent from the VRWRP, the adjudication is expected to influence long-term coordination among water users and may affect future governance structures. Its outcomes may influence future water management and operating rules, with implications for instream flows, and habitat conditions. The VRWRP should therefore remain flexible to a range of potential outcomes and future management conditions.

Collectively, these efforts reflect a rapidly evolving watershed context in which climate change, regulatory requirements, restoration actions, and collaborative initiatives intersect. They also highlight the scale of ongoing work already underway to restore watershed processes, improve ecological resilience, and support long-term water-resource sustainability.

## Communities and Land Use

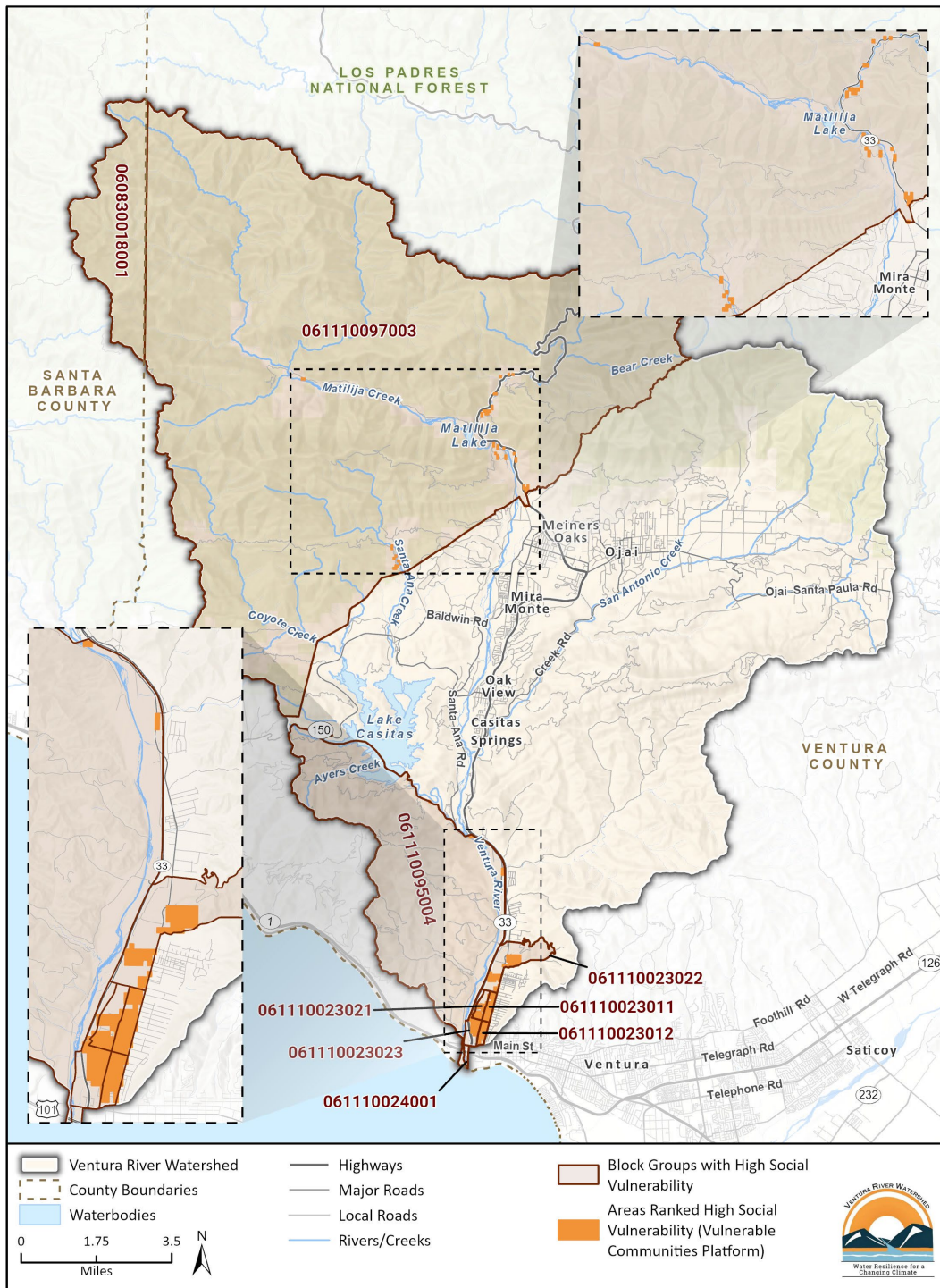
The watershed includes a mix of urban, suburban, rural, and Tribal communities, including the cities of Ojai and Ventura; the unincorporated communities of Meiners Oaks, Mira Monte, Oak View, and Casitas Springs; and Tribal homelands historically stewarded by the Barbareño/Ventureño Band of Mission Indians, as well as the Santa Ynez Band of Chumash Indians and the Coastal Band of the Chumash Nation (Chumash). According to 2020 U.S. Census data, approximately 44,000 residents live within the watershed, with a demographic composition of roughly 58 percent White, 37 percent Hispanic or Latino, 2 percent Asian, and 3 percent other races.

Updated mapping using the California Governor’s Office of Land Use and Climate Innovation Vulnerable Communities Platform (VCP) identifies several block groups within the watershed as having high social vulnerability to climate change (Figure 15). Approximately 17 percent of the watershed’s population resides in these highly vulnerable block groups, which include neighborhoods along Matilija Creek and portions of the West Ventura Avenue area. These areas are characterized by factors that reduce a community’s ability to prepare for, respond to, and recover from climate-related events, increasing risks of health impacts, property damage, displacement, and long-term economic hardship.

The VCP highlights where climate hazards (including extreme heat, flooding, drought, wildfire, and sea level rise-related impacts) are expected to be most severe and where social conditions may heighten community exposure. These insights support the identification of overburdened communities within the watershed and clarify where targeted resilience investments are needed most.

These vulnerabilities are especially acute in neighborhoods served by small mutual water companies, which often have limited technical and financial capacity to upgrade aging infrastructure. Unlike larger utilities, these systems typically lack redundant wells, backup power, or advanced treatment, making them more susceptible to contamination and service disruptions during climate-driven droughts or flood events.

**Figure 15 Areas in the watershed facing high social vulnerability to climate change**



Basemap provided by Esri and its licensors © 2026.  
 Additional data provided by CPAD, 2025; NHD, 2024; US EPA, 2022; Vulnerable Communities Platform, 2026.

24-16486 WRP Climate Modeling  
 High Social Vulnerability Areas

Urban development comprises only about 3 percent of the watershed’s land area, while agriculture, including citrus and avocado orchards and cattle grazing, accounts for over 18 percent. Large portions of the watershed, totaling to over 57 percent, remain protected open space or national forest, while approximately 22 percent consists primarily of rural unincorporated land and undeveloped open space. Local land use policies have limited urban sprawl and preserved agricultural and open space lands (Walter 2015).

### **Community Insight: Agriculture and Climate Hazards in Ventura County**

During the special forum in July 2025, the importance of agriculture emerged as a key priority in the region that is facing a host of vulnerabilities. Agriculture is a cornerstone of Ventura County’s economy, generating \$2.31 billion in gross value in 2024, with strawberries, avocados, and lemons among its leading crops. The county ranks within California’s top tier for agricultural production and recently reported \$9 million in crop losses from the Mountain Fire, illustrating the economic vulnerability of this sector to climate-driven hazards ([County of Ventura](#)).

Community members emphasized that climate change is reshaping working lands. Extreme heat is causing fruit burn and bleaching, reducing yields and increasing heat stress for farmworkers. Wildfire smoke is damaging harvested produce and disrupts labor availability, while pollinator decline and rising disease pressure under warmer conditions is threatening crop viability. Loss of chilling hours and high-wind events further compromise perennial crops.

Farmland in low-lying areas are vulnerable to future flooding, which could undermine irrigation quality and long-term productivity. Pollinator-dependent crops such as berries and orchard fruits are also at risk as native pollinators, including monarchs, decline under habitat loss and climate stress. Extreme precipitation events compound these challenges by causing soil erosion, nutrient depletion, and pesticide runoff, degrading soil health and increasing recovery costs. Farmworkers reported that storms halt harvest operations, creating economic strain for families reliant on seasonal work.

## **Hydrologic and Ecological Degradation**

Displacement of Indigenous Chumash people and communities, and decades of infrastructure development, land use change, and climactic conditions such as drought and extreme heat have fundamentally altered the watershed’s hydrologic and ecological systems. Dams, surface water diversions, groundwater pumping, channelization, and long-term fire suppression practices that have altered natural disturbance and sediment processes have disrupted and constrained natural flow regimes and reduced sediment delivery. Land uses and practices such as irrigated agriculture, urban runoff from developed areas, on-site septic systems, roadway drainage, livestock and manure facilities, and post-wildfire erosion contribute to water quality impairments by increasing sediment, nutrient, legacy pesticide, and pathogen loading to streams and groundwater. Existing water infrastructure and management actions, such as the large storage capacity of Lake Casitas and the local Groundwater Sustainability Plans, have increased the region’s ability to manage drought and climate variability for community water supply. This investment represents an important source of adaptive capacity and has enabled agencies to respond to climate challenges.

However, while infrastructure has strengthened water supply resilience, some modifications have weakened habitat connectivity, diminished riparian and aquatic ecosystem function. Some riverine and ecological systems within the Watershed remain sensitive to extended drought, elevated temperatures, and altered flow regimes, particularly during dry years. These conditions highlight the importance of

considering ecosystem-specific vulnerabilities alongside existing infrastructure and management actions when assessing watershed resilience.

These modifications have reduced the watershed's ability to absorb and recover from climate-driven stressors, including invasive species spread such as *Arundo* which can further degrade riparian zones by consuming large volumes of water, increasing wildfire risk, and exacerbating erosion during storms. For additional detail, see **Appendix K: Hydrologic and Ecological Degradation**.

## **Relationship to Sustainable Groundwater Management Act and Groundwater Management**

Groundwater basins within the watershed are managed under the Sustainable Groundwater Management Act (SGMA) and basin prioritization appropriately reflects groundwater's role in regional water supply. The VRWRP is not intended to and does not evaluate SGMA compliance, revisit groundwater sustainability determinations, or assess the adequacy of adopted Groundwater Sustainability Plans (GSPs) developed by the associated Groundwater Sustainability Agencies (GSAs). Under SGMA, the Sustainable Management Criteria and associated Minimum Thresholds establish regulatory triggers that prompt management actions or projects to avoid significant and unreasonable undesirable results from groundwater pumping. These thresholds serve as an essential backstop to protect basin sustainability. The VRWRP offers a complementary framework that looks beyond minimum compliance to identify strategies that can achieve a higher standard of watershed health and long-term climate resilience, considering the entire watershed beyond the groundwater basin boundaries.

The VRWRP considers watershed-scale conditions and climate-related stressors, such as drought, climate variability, and interconnected surface water–groundwater dynamics, that may result in periods of low groundwater levels or reduced surface flows even in sustainably managed basins. The watershed-scale perspective discussed in the VRWRP is intended to complement existing groundwater management programs by providing broader context for climate resilience planning, while recognizing that formal groundwater management remains the responsibility of the applicable GSAs.

## **Watershed Recreation**

Although recreation is not formally defined as a water resource system within the VRWRP framework, recreational uses are deeply connected to watershed health and community well-being. Community members take advantage of boating at Lake Casitas, and swimming at and accessing the Ventura River, and enjoyment of riparian trails and open space. These activities depend on reliable water supplies, adequate streamflows, good water quality, and resilient ecosystems, all of which are directly influenced by watershed management decisions. Recreation was not included as a standalone resource category in order to maintain focus on core water supply, water quality, flood management, and ecosystem functions. By advancing strategies that sustain streamflow, improve water quality, and enhance habitat conditions, the VRWRP indirectly safeguards the recreational values that contribute to local identity, public health, and economic vitality in the watershed.

### **Project Spotlight: The Matilija Dam Ecosystem Restoration Project**

The Matilija Dam Ecosystem Restoration Project (MDERP) represents a multi-agency partnership effort to restore natural watershed function in the Ventura River Watershed by addressing one of its most significant legacy barriers. Originally constructed in 1947, Matilija Dam has outlived its intended purpose, may be subject to significant damage in an earthquake of magnitude 7.5, and presents a safety hazard for downstream communities. Its reservoir is now filled with sediment and no longer provides the originally intended recreational or water storage uses. Matilija Dam blocks natural sediment from being transported downstream, impacting coastal beaches and estuaries, and prevents Federally and State endangered southern steelhead from accessing critical upstream spawning and rearing habitat within Matilija Creek.

The MDERP is the most significant and widely supported watershed restoration efforts underway in the Ventura River Watershed. Led through coordination among federal, state, Tribal, and local partners, the project reflects decades of coordination to address the structural, ecological, and public safety challenges associated with Matilija Dam. This effort advances a suite of interrelated actions including downstream infrastructure modernization (e.g., bridges, water supply protection, levees, and flood protection), invasive species removal, habitat improvements, and ultimately the full removal of the dam to re-establish more natural hydrologic and sediment regimes that will be more resilient to climate change. The early phases of the effort that are already underway are already improving conditions for natural processes to return, strengthening flood safety, and supporting community and ecosystem function and resiliency before complete dam removal occurs.

The MDERP exemplifies climate resilience in practice by sequencing land-use adjustments and engineering improvements that both protect people and restore important habitat under threat of bigger peak flows, post-fire debris flows, sea level rise influences, and increasing drought and erosion. Upgrades like the widened Santa Ana Boulevard Bridge have already enhanced sediment transport capacity and fish passage while reducing flood risk. Levee reconstructions are bringing critical downstream infrastructure up to current safety standards and the design plans at the Robles Diversion are addressing aquatic habitat concerns. Expansive habitat restoration efforts and invasive species management are increasing ecological health across the watershed. The MDERP proposes a long-term reshaping of the Ventura River watershed's physical and biological systems, reconnecting headwaters within Matilija Creek to the ocean, restoring the seasonal pulse of sediment essential for beaches and estuarine environments, and re-embedding natural processes that support biodiversity in a changing climate.

This critical restoration and resiliency effort will reconnect headwaters within Matilija Creek to the ocean, restore the seasonal sediment pulses that sustain beaches and estuaries threatened by sea level rise, and re-establish natural processes that support biodiversity in a changing climate. Supporting this project will help reduce the impacts of future climate hazards and re-establish the Ventura River as a functional and thriving system for generations to come.

## **Water Resource Systems**

Water resource systems are defined as the connected hydrological, infrastructure, ecologic, and human processes that involve water utilized for a specific purpose. For this plan, water resource systems are the organizing units around which climate resilience is analyzed. Each defined water resource system consists of individual features and components that either naturally evolved or were designed to the

existing conditions of the watershed, and are at risk of future degradation, impairment, or disfunction due to climate change.

The major water resource systems of the watershed include water supply, flood management, groundwater management, ecosystems, water quality, and cultural resources (see Table 2). The following sections describe these systems in more detail.

**Table 2 Defined Water Resource Systems**

<b>Water Resource System</b>	<b>Definition</b>
Water Supply	The sources of local water and the network of infrastructure that collects, treats, stores, and distributes water to meet water demand.
Flood Management	The network of natural and engineered structures that convey high flows or prevents inundation of land with the intent of reducing the impacts of flooding on communities, infrastructure, and the environment.
Groundwater Management	The strategic, sustainable supervision of underground aquifers (i.e., groundwater basins or subbasins) to balance supply and demand, ensuring long-term availability and resilience for future generations.
Ecosystems	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.
Water Quality	The set of parameters and properties measurable in natural and human-made water bodies, aquifers, and associated built infrastructure.
Cultural Resources	Indigenous practices, such as subsistence fishing, and historical sites, ethnobiologically significant natural resources, and culturally important landscape elements.

Though the water resource systems of the watershed are defined individually, the systems are complex and interdependent. The subsequent descriptions focus on individual water resource systems, but their interdependencies are identified and discussed whenever possible. This section defines the current condition of these systems, offering a snapshot of the integrated water resource systems as they exist today.

## 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. The watershed is often described as being largely dependent on local water supplies, including surface water from the Ventura River and its tributaries, storage in Lake Casitas, and groundwater from the Ojai and Ventura River basins. Unlike many Southern California regions, it does not rely on the State Water Project or Colorado River imports for its core municipal supply. The City of Ventura is developing an emergency interconnection with Calleguas Municipal Water District, which will deliver imported State Water Project supplies during severe shortages in the future. Additionally, CMWD is constructing a bidirectional potable water intertie with the Carpinteria Valley Water District, which will enhance regional emergency preparedness and enable the regional transfer of water supplies, including State Water Project allotments, across county lines to enhance long-term drought resilience.

Though the watershed does not currently rely on imported water, future plans and infrastructure to support imported water supply are being pursued. Future potential water supply sources within the watershed and adjacent areas include increased recycled water for potable reuse, imported water, and potentially desalination. Regulatory processes such as Biological Opinions (issued by National Oceanic and Atmospheric Administration), Sustainable Management Criteria (required by SGMA), various water

quality regulations, and active litigation significantly influence water supply management within the watershed, in addition to considerations for the water demand of agricultural, industrial and municipal sectors.

### *Water Supply System Overview*

Casitas Municipal Water District (Casitas MWD) is the primary water supplier in the watershed. Additional water suppliers include the City of Ventura (Ventura Water is the water and wastewater department), Ventura River Water District (VRWD), Meiners Oaks Water District, and 11 small mutual water companies. Mutual water companies are corporations formed to sell, distribute, supply, or deliver water to their shareholder-members, with the authority to levy assessments and withhold water from members who fail to pay. Unlike public water agencies, which are governmental entities governed by publicly elected or appointed boards and subject to broader public transparency, rate-setting, and service obligations, mutual water companies are private entities that serve only their shareholders and operate under corporate law rather than as public districts.

The largest water suppliers in the watershed purchase wholesale water from Casitas MWD, and supply water to customers directly through groundwater wells. Groundwater wells and small water systems play a central role in the Ventura River Watershed, supplying approximately 46 percent of average annual water use. Because of the highly porous alluvial soils, groundwater and surface water are closely interconnected, meaning pumping can directly influence streamflow and river health. The majority of groundwater extraction occurs in the Upper Ventura River and Ojai Valley Basins, where municipal providers such as City of Ventura – Ventura Water, VRWD, Meiners Oaks Water District, and the Ojai Water System (operated by Casitas MWD) serve thousands of connections.

In addition to these larger agencies, numerous small mutual water companies and private domestic and agricultural wells operate throughout the watershed, often serving small clusters of homes or farms. While the Lower Ventura River and Upper Ojai Valley Basins are smaller and classified as very low priority under SGMA, they still support important localized water uses through privately owned wells and small systems. Together, these diverse groundwater users form a decentralized network that is essential to community water supply but also closely tied to watershed hydrology and resilience. Table 3 shows the estimated number of connections associated with each groundwater supplier.

**Table 3 Key Public Groundwater Providers and Connections**

Water Supplier	Estimated Connections
City of Ventura – Ventura Water	31,000 *
Ventura River Water District	2,190
Meiners Oaks Water District	1,280
Casitas Municipal Water District	6,165

\* Not all connections are located within or supplied by the Ventura River Watershed.

Figure 16 illustrates major urban water suppliers and locations of key water supply infrastructure in the watershed. Refer to **Appendix L: Water Resource Systems**, and further discussed in the following subsections.

### **Community Insight: Climate Pressures on Water Quality and Supply**

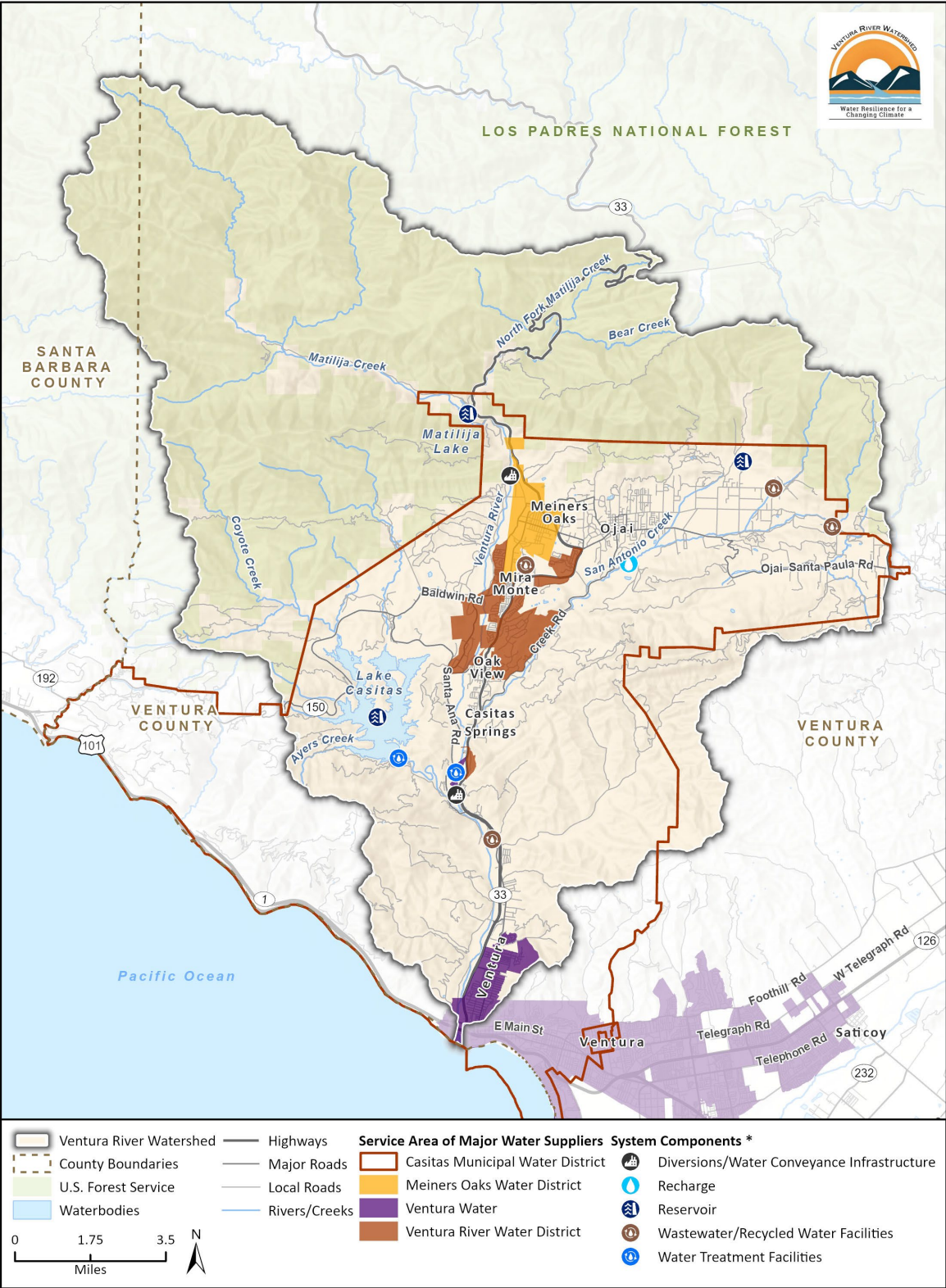
During the July 2025 special forum, community members underscored growing concerns about both water quality degradation and supply reliability under shifting climate conditions. Some participants pointed to the dramatic decline of Lake Casitas during the 2018–2022 drought, when water levels fell to historic lows of below 30 percent capacity, the lowest since the 1970s (National Aeronautics and Space Administration [NASA] 2024). Residents described how this decline triggered worries about drinking water scarcity, agricultural irrigation restrictions, and increased competition for limited water resources.

Forum input in July 2025 also highlighted the threat of post-fire sediment and debris mobilization during subsequent storm events, which can clog reservoir infrastructure and degrade water storage. Wildfire alters vegetation and soil conditions, increasing erosion susceptibility and leading to episodic pulses of sediment, ash, and debris during rainfall, rather than continuous sediment delivery. These post-fire sediment pulses, along with chronic erosion and ongoing sediment transport, affect diversion structures, system conveyance, and treatment plants, posing operational challenges during high-flow events.

Participants also named vulnerabilities in well systems, noting that multi-year drought reduces surface flows and groundwater recharge, while storm-driven sediment transport and post-fire debris flows can introduce fine sediments into wells and intakes, increasing the risk of sediment infiltration and reduced yield for both private and municipal wells. These community insights reflect a dual and multi-timescale challenge: water scarcity driven by prolonged drought and low reservoir levels, combined with episodic post-fire sediment pulses and longer-term erosion processes that strain water infrastructure and amplify concerns about long-term water security and system resilience.



Figure 16 Water Supply System Map



**Casitas MWD** operates Lake Casitas, a reservoir serving as one of the watershed’s primary water storage facilities and sources. Casitas MWD’s system includes wholesale connections to most other retail water districts in the watershed and provides direct service to approximately 6,130 agricultural, commercial, and residential users. In addition to Lake Casitas, Casitas MWD operates wells in the Mira Monte area and in the San Antonio and Mutual well fields, with water treated at the Marion Walker and San Antonio treatment facilities. Casitas provides a supplemental water supply through existing infrastructure, allowing groundwater-reliant customers to access this backup source when primary local supplies are depleted during extended drought periods (Casitas Municipal Water District [CMWD] 2020).

**City of Ventura – Ventura Water** (the water and wastewater department) is another major water supplier, though most of its service area lies within the City of Ventura outside the watershed. Ventura Water uses a combination of water purchased from Casitas MWD, groundwater from wells at Foster Park, and a subsurface intake on the Ventura River. These supplies are treated at the Avenue Water Treatment Plant (City of Ventura, 2021).

**Ventura River Water District** and **Meiners Oaks Water District** are smaller groundwater-reliant agencies operating wells in the Upper Ventura River Groundwater Basin, with Lake Casitas serving as a supplemental source during dry periods. VRWD serves roughly 5,700 people, while Meiners Oaks County Water District serves approximately 4,000 people (Upper Ventura River Groundwater Agency [UVRGA] 2022).

## 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. Major components include reservoirs, levees, floodplains, wetlands, and local drainage infrastructure.

### *Flood Management System Overview*

Flooding in the Ventura River Watershed results from a combination of various types of rainfall and erosion driven flooding and coastal processes, influenced by steep terrain, highly variable rainfall, wildfire burn-scar hydrology, and rapid runoff. Moderate to major floods occur frequently, and many neighborhoods, roads, and facilities lie within Federal Emergency Management Agency-designated flood hazard zones. While existing infrastructure (including the Ventura River Levee, Stewart Canyon and San Antonio Creek debris basins, and local storm-drain networks) helps manage moderate events, the system provides limited protection during high-intensity storms or post-fire conditions (Jong-Levinger et al 2022).

Flood management responsibilities are shared among the VCWPD, local jurisdictions, and state and federal partners. VCWPD maintains regional flood-control facilities, leads watershed-scale planning and hazard mitigation, and operates critical monitoring systems such as real-time stream gauges. The cities of Ventura and Ojai and the County of Ventura manage local drainage systems and enforce floodplain regulations, while the Ventura River Watershed Council supports interagency coordination and integrated planning efforts.

Despite these investments, extreme storms can still overwhelm aging or capacity-limited infrastructure, particularly when debris or sediment obstruct channels. Recent and historic flood events, including the 1969 storms, the rapid flow spikes of 1992, the 1995 U.S. 101 highway closure, the 2005 storm-related sewer rupture, the January 2023 floods, and the 2025–2026 winter atmospheric-river events, illustrate the watershed’s susceptibility to sudden rises in flow, debris impacts, and downstream inundation.

These events often disproportionately affect low-lying and overburdened communities located near river corridors. For additional detail on the flood management water resource system, please refer to **Appendix L: Water Resource Systems**.

## Groundwater Management

The groundwater management system is the strategic, sustainable supervision of underground aquifers (i.e., groundwater basins or subbasins) to balance supply and demand, ensuring long-term availability and resilience for future generations. Groundwater within the watershed includes water stored in the various aquifers and the natural and engineered infrastructure, natural processes, and management practices that contribute to recharge, storage, and withdrawal within its boundaries, as discussed below.

### *Groundwater Management Overview*

The watershed largely encompasses four different groundwater basins: the Upper Ojai, Ojai Valley, Upper Ventura River, and Lower Ventura River. The Lower Ventura River Groundwater Basin is primarily within the Watershed, although it does extend slightly into the Rincon Creek-Frontal Pacific Ocean Watershed, just to the south-east. Similarly, the Upper Ojai Groundwater Basin is primarily within the Ventura River Watershed, with a portion of it extending into the Lower Santa Clara River Watershed. The entirety of both the Ojai Valley Groundwater Basin and Upper Ventura River Groundwater Basin are located within the Ventura River Watershed (Figure 17). DWR classifies the state’s 515 groundwater basins into priority levels to guide sustainable management under SGMA. Table 4 summarizes the groundwater basins in the watershed, along with their priority designation.

**Table 4 Summary of Groundwater Basins within the Ventura River Watershed**

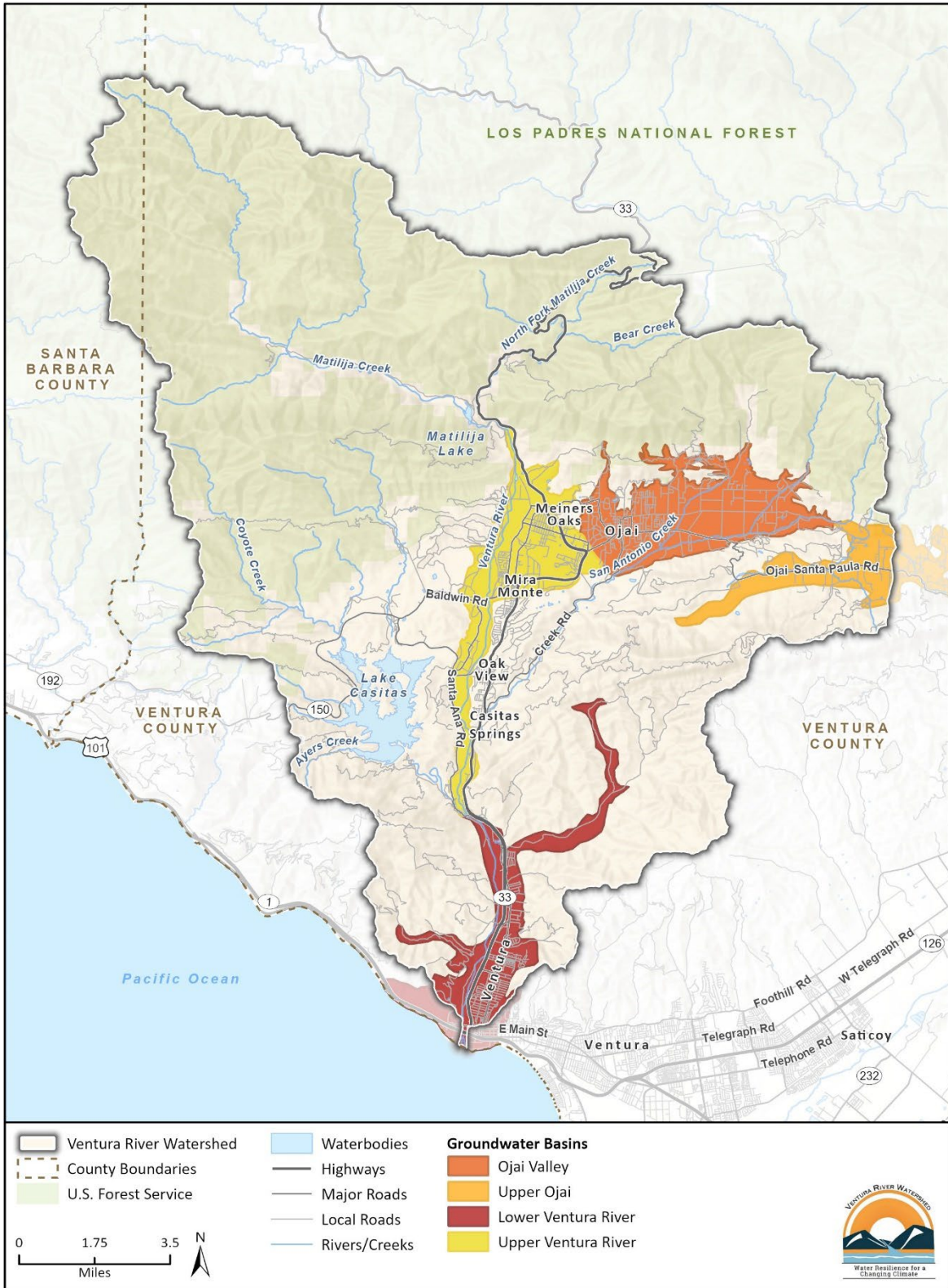
DWR Basin Number	Name	Priority Designation
4-001	Upper Ojai Groundwater Basin	Very Low
4-002	Ojai Valley Groundwater Basin	High
4-003.01	Upper Ventura River Groundwater Basin	Medium
4-003.02	Lower Ventura River Groundwater Basin	Very Low

Basins ranked high or medium must be actively managed by local GSAs, which develop and implement GSPs aimed at achieving long-term sustainability by 2042. The two GSAs within the watershed are the UVRGA, which manages the Upper Ventura River Groundwater Basin, and the Ojai Basin Groundwater Management Agency, which manages the Ojai Valley Groundwater Basin. Both GSAs developed and adopted GSPs (approved by California DWR in 2023) for their respective basins. These GSPs serve as the regulatory framework for local agencies to achieve long-term sustainability in high- and medium-priority basins over a 20-year implementation period. These plans are designed to prevent six undesirable results identified under SGMA: chronic lowering of groundwater levels, reduction of groundwater storage, land subsidence, seawater intrusion, water quality degradation, and depletion of interconnected surface water. Ultimately, DWR uses these roadmaps to ensure that aquifers are managed as a reliable, drought-resilient resource for agricultural, urban, and environmental needs.

The GSAs within the watershed manage groundwater within their respective basins in a way that supports long-term water reliability, ecosystem health, and compliance with SGMA requirements while improving monitoring and coordination across jurisdictions.

For more detail on the Groundwater Management System and Ventura River Watershed’s four subbasins, please refer to **Appendix L: Water Resource Systems**.

**Figure 17 Groundwater Basins in the Ventura River Watershed**



Basemap provided by Esri and its licensors © 2026.  
 Additional data provided by CPAD, 2025; NHD, 2024; Ventura County, 2023; DWR, 2025.

24-16486 WRP Climate Modeling  
 Groundwater Basins

## Ecosystems

An ecosystem is a complex network where biotic communities such as plants, animals, and microbes interact with abiotic factors like soil, water, and climate. These systems comprise diverse upland, riparian, and aquatic habitats where biological organisms and abiotic elements like sunlight and nutrients are deeply interdependent. Recognizing the inherent connections between these biotic and abiotic components enables watershed decision makers to foster overall system health, balance, and sustainability.

### *Ecosystem Overview*

The Ventura River Watershed supports a diverse mosaic of upland, riparian, aquatic, and estuarine ecosystems, shaped by steep headwater terrain, dynamic sediment movement, and varied river flows ranging from ephemeral to perennial.

These habitats include chaparral, oak woodlands, and coastal sage scrub in the upland areas, extensive riparian corridors along major rivers, freshwater wetlands adjacent to riverine habitats, and a brackish estuary at the mouth of the Ventura River. Together, these biotic and abiotic ecosystem components perform critical functions such as filtering sediment, capturing bedload, and improving floodwater retention. They also support groundwater recharge, maintain water quality through nutrient cycling, provide habitat connectivity, and assist in climate regulation. Figure 18 illustrates the spatial distribution of major vegetation communities and land cover types, highlighting natural habitats as well as developed and agricultural areas within the watershed boundaries.

Riparian and aquatic habitats are especially sensitive yet adaptive to fluctuations in flow, temperature, and sediment movement. High-energy storm events periodically reshape channels, scour vegetation, and create new riparian recruitment surfaces. Perennial and intermittent reaches provide important habitat for sensitive species including southern California steelhead, southwestern willow flycatcher (*Empidonax traillii extimus*), and California red-legged frog (*Rana draytonii*) and the estuary at the mouth of the Ventura River is important habitat for tidewater goby. Each of these species are federally listed as threatened or endangered and the southern California steelhead and southwestern willow flycatcher are also state endangered. Portions of the watershed are designated critical habitat for each of the above mentioned species.

Over time, land-use changes, infrastructure, altered flow regimes, and invasive species have significantly modified these riparian and aquatic habitats. Legacy hydrologic modifications, including channelization, diversions, and long-term fire suppression, have further contributed to habitat fragmentation and altered natural disturbance processes. Among the most pervasive ecological stressors is Arundoan aggressive invasive plant species that has severe ecological impacts on physical processes, plant and animal communities, and has high rates of dispersal and establishment. Arundo has spread extensively along riparian corridors within the watershed and increases evapotranspiration, narrows channels, elevates wildfire intensity, contributes to post-fire debris loads, and displaces native vegetation, reducing habitat quality and altering natural disturbance regimes. While watershed-wide removal and riparian-restoration efforts are underway and described earlier in this chapter, Arundo continues to influence ecosystem condition and natural Ventura River condition recovery potential.

As discussed earlier in this chapter, recent progress has been made towards major fish-passage and habitat-connectivity improvement projects within the watershed. Additionally, Casitas Municipal Water District is in the planning phases of implementing seasonal flow-augmentation and habitat-enhancement measures in San Antonio Creek under interim regulatory orders to improve

ecological conditions during dry periods, demonstrating the link between water management operations and habitat health.

Ecosystem conditions are further influenced by climate change. More extreme heat, prolonged drought, reduced marine fog, and more intense wildfire seasons heighten stress on vegetation communities and aquatic organisms. Severe wildfires and subsequent post-fire erosion can destabilize slopes, alter channel form, increase sediment inputs, and degrade riparian and aquatic habitats. These interacting stressors, combined with invasive-species pressures and legacy hydrologic modifications, underscore the importance of ongoing restoration, collaborative management, and adaptive strategies to sustain ecosystem resilience under future climate conditions.

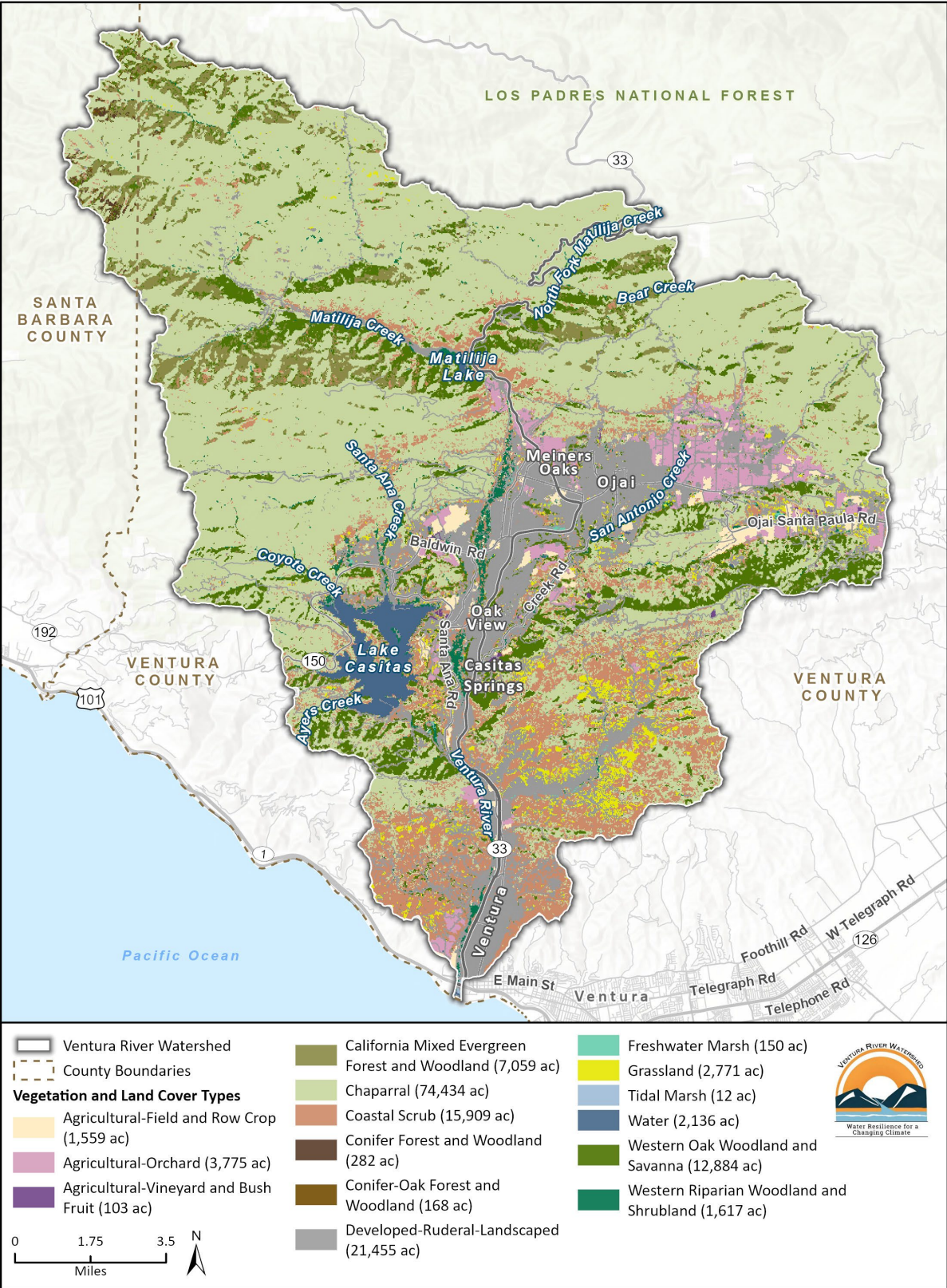
Detailed descriptions of vegetation communities, hydrologic processes, aquatic resources, special-status species, and regulatory frameworks are provided in **Appendix L: Water Resource Systems**.

### Defining Watershed Terminology

“Take” under the Endangered Species Act of 1973 means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. This definition encompasses both direct physical injury and indirect actions, such as significant habitat modification or degradation that kills or injures wildlife by impairing essential behavioral patterns like breeding, feeding, or sheltering. In a watershed context, this can typically refer to water management activities that reduce flows, alter, destroy or appreciably diminish the value of designated critical habitat, or block access in ways that injure or kill listed species, even indirectly.



Figure 18 Vegetation and Land Cover Types of the Ventura River Watershed



## Water Quality

The water quality system is the chemical, physical, and biological characteristics of water that determine its suitability for drinking, agriculture, recreation, and ecosystem health. In the Ventura River Watershed, maintaining good water quality is essential because the Ventura River and its aquifers provide nearly all local water supplies and support culturally and ecologically significant species.

### *Water Quality*

Water quality is shaped by the interaction of land use, hydrology, climate extremes, and built infrastructure. Regulatory mandated monitoring programs track conditions in surface water, groundwater, and stormwater systems to protect beneficial uses and support treatment operations. (In California water law in Article X of the California Constitution, “beneficial use” is the foundational principle that determines whether a water right is valid and how much water may legally be used.) Despite ongoing stewardship efforts, water quality challenges persist and are expected to become more complex with climate change.

To better define water quality, this section summarizes the major water quality issues impacting surface water, groundwater, and stormwater. An overview of applicable water quality regulatory programs is provided in **Appendix L: Water Resource Systems**.

### *Surface Water Quality*

Surface water quality in the Ventura River Watershed reflects the combined influence of point and non-point source discharges interacting with highly variable hydrologic conditions. Surface waters are shaped by nutrient inputs, algal production, indicator bacteria, sediment transport, and temperature variability, all of which respond to land use, flow regime, and climatic conditions. Runoff from agricultural and developed landscapes introduces pollutants to streams and tributaries, while prolonged dry periods reduce natural dilution and increase residence time, concentrating constituents in surface waters.

Point source discharges, particularly wastewater treatment facilities, play a more prominent role during low-flow conditions when treated effluent can represent a substantial portion of streamflow. Under these conditions, nutrients and organic matter can contribute to eutrophication, especially in slower-moving reaches and the Ventura River Estuary, where warm temperatures and limited circulation further intensify water-quality stress. During extreme storm events, wastewater and stormwater systems may be hydraulically stressed, increasing the potential for short-duration contaminant loading and downstream transport.

Non-point source discharges are primarily episodic and driven by storm events, when rainfall mobilizes nutrients, bacteria, and sediment from across the watershed. Agricultural lands, urban surfaces, eroding channels, and disturbed hillslopes all contribute to these pulses, with the magnitude of impact closely tied to storm intensity, antecedent conditions, and land management practices. Wildfire and other large-scale disturbances can further amplify these effects by increasing erosion and runoff until watershed recovery occurs.

Understanding these dynamics is supported by a broad suite of long-term surface water monitoring programs implemented by municipal stormwater agencies, wastewater treatment facilities, drinking water providers, and non-profit organizations. Together, these efforts provide a comprehensive picture of water quality across seasons, flow conditions, and land uses, indicating that overall watershed

conditions are relatively good, with challenges concentrated during storm events, extended dry periods, and in sensitive receiving waters such as the estuary.

As climate change alters precipitation patterns, increases the frequency of extreme events, and lengthens dry periods, the balance between point and non-point source influences is expected to shift. Continued coordination among monitoring programs and integration of their findings will be critical for understanding evolving water-quality drivers, supporting adaptive management, and maintaining the Ventura River Watershed as a resilient and functioning water resource system.

### *Groundwater Quality*

Groundwater is vulnerable to elevated nitrates from septic systems, fertilizers, livestock operations, and aging wastewater infrastructure. While public-supplier wells generally meet drinking water standards, elevated nitrates have been detected in some domestic wells. These conditions are being monitored and evaluated by UVRGA, the Ventura County Public Works Agency, and the State Water Resources Control Board through its Groundwater Ambient Monitoring and Assessment (GAMA) Program. The Lower Ventura River Groundwater Basin has limited groundwater pumping due to naturally high total dissolved solids and other constituents. Strong surface-groundwater connection means drought and reduced streamflow often worsen groundwater quality conditions (DWR 1959, Watershed Coalition of Ventura County 2014).

### *Stormwater Quality*

Stormwater runoff carries pollutants accumulated during dry periods into creeks, the river, and the estuary. The regulatory framework associated with Municipal Separate Storm Sewer Systems (MS4s) manage point-source pollution by conveying stormwater separately from wastewater, but high-intensity storms can damage local drainage systems and increase erosional forces, which can increase pollutant loads. In rare cases, wastewater treatment system overflows or damaged infrastructure may discharge untreated wastewater during extreme precipitation events.

#### **Wastewater Treatment System Overflows During Severe Rain Events**

In January 2023, heavy rainfall overwhelmed the Ojai Valley Sanitary District sewer system, resulting in approximately 1.2 million gallons of untreated sewage entering San Antonio Creek near Oak View. The overflow occurred when intense storm flows exceeded system capacity and a damaged sewer main allowed sewage to discharge directly into the creek.

Untreated sewage introduced high levels of bacteria, nutrients, organic matter, and other contaminants into receiving waters. In creeks like San Antonio Creek, which provide habitat and contribute flow to the Ventura River, such discharges can degrade water quality, increase health risks for downstream communities, reduce dissolved oxygen levels, and harm aquatic life. As a result, beaches in proximity to the Ventura River mouth were closed.

## **Cultural Resources**

The Ventura River Watershed is home to many forms of culture, identity, and lived connection. Community members hold diverse ties to this landscape through recreation, farming, stewardship, long-standing family presence, and other meaningful relationships with the watershed. The VRWRP recognizes and respects those connections. At the same time, the VRWRP intentionally centers Tribal cultural resources because Indigenous communities have stewarded these lands since time immemorial, and their voices and knowledge systems have been historically marginalized or excluded from formal

water and land-use decision-making. Elevating Tribal leadership and cultural perspectives, including deep ecological knowledge and practices that strengthen watershed resilience, is essential to building an equitable and climate-resilient future for all.

In the VRWRP, cultural resources are included as a distinct water resource system to help identify climate impacts, vulnerabilities, and adaptation strategies that might otherwise be overlooked. The Ventura River Watershed has been home to Chumash peoples for at least 12,000 years, with ancestral communities relying on the region's diverse coastal, riparian, and upland environments for food, materials, and cultural practices (Jones and Ferneau 2002, Moratto 1984). Subsistence patterns historically blended hunting, inland and coastal fishing, gathering, and careful stewardship of plant communities, including the use of cultural burning to enhance food plants such as chia and maintain basketry materials (Lightfoot and Parrish 2009, McCawley 2017).

The watershed lies within traditional territories of several Chumash language groups, whose contemporary descendants include the Barbareño/Ventureño Band of Mission Indians, the Coastal Band of the Chumash Nation, the Santa Ynez Band of Chumash Indians, and others with ancestral ties to the region (Golla 2007).

While cultural resources intersect with many aspects of the watershed, elevating them as a distinct system helped the planning team identify potential climate impacts, vulnerabilities, and adaptation strategies that might otherwise be overlooked. These resources include Tribal cultural landscapes and knowledge systems and the ways communities interact with and value the river today.

Tribal Chairman Matthew Vestuto of BVBMI and respected Chumash Elder Julie Tumamait-Stenslie have played important roles in informing the VRWRP process.

### **Community Insight: Cultural Resources and Sacred Sites**

Cultural resources across the Ventura River Watershed are experiencing intersecting pressures from wildfire, post-fire erosion, drought, extreme heat, and coastal stressors. Community input described how wildfire and subsequent debris flows can damage archaeological and sacred sites and limit access for ceremonies and teachings. Participants also noted that culturally significant plants and animals (used for food and medicine) face heightened risk when invasive species proliferate after fire and when hydrologic shifts alter stream corridors. In the lower watershed, where river meets ocean, community members emphasized that sea-level rise and storm surge can damage or permanently inundate coastal access and affect the meaning and use of beaches and estuarine areas central to cultural practice. Together, these hazards erode cultural landscapes and reduce access to key resources, underscoring the need for restoration that integrates invasive removal, riparian recovery, and culturally appropriate access agreements.

### *Cultural Resources Overview*

The Ventura River Watershed is home to several Tribal nations with ancestral, cultural, and ongoing stewardship ties to the region, including the Barbareño/Ventureño Band of Mission Indians, the Coastal Band of the Chumash Nation, and the Santa Ynez Band of Chumash Indians. Ongoing language revitalization efforts reflect community-preferred dialect names such as mitsqanaqañ (San Buenaventura region) and s<sup>h</sup>amala (Santa Ynez Valley). These Tribes maintain deep cultural relationships to the watershed's lands, waters, and species, and each played an important role in shaping this Plan.

Among these Tribes, the Santa Ynez Band of Chumash Indians is the sole federally recognized Tribe; the BVBMI and the Coastal Band of the Chumash Nation are not federally recognized. As a result, they may face barriers to accessing federal funding programs and set-aside grants, entering government-to-government consultation processes required under federal law, qualifying for certain Bureau of Indian Affairs technical assistance programs, and participating in formal co-management or regulatory decision-making frameworks tied to federal trust status. Regardless of recognition status, all Tribes bring essential cultural knowledge, stewardship practices, and community priorities that inform watershed resilience.

These constraints are compounded by the historical dispossession of Tribal lands. Colonial settlement beginning in 1769 disrupted Indigenous lifeways through missionization, land dispossession, forced labor, violence, and disease. Subsequent Mexican-era ranchos and American expansion further displaced Chumash communities and transformed the watershed's landscape (Santa Ynez Band of Chumash Indians 2025, Castillo 2025). More recently, reduced access to cultural and ceremonial sites, and the extensive modification of the lower watershed through urban development and major infrastructure projects, including the construction of Matilija Dam and channelization, which have altered river flows, sediment transport, habitat connectivity, and access to traditional resources central to Chumash stewardship practices.

Climate change is exacerbating these issues and impacting cultural practices across the region. Shifts in weather, extreme heat, drought, and wildfire affect access to traditional foods, medicinal plants, ceremonial areas, and culturally significant species. As a result, the VRWRP considers a broad range of cultural resources (including subsistence practices, ethnobiologically significant species, sacred landscapes, and cultural-use sites) while maintaining confidentiality regarding specific locations and sensitive information.

Despite these disruptions, Chumash people remain an active and present community in the Ventura River Watershed today, continuing cultural traditions, gathering practices, stewardship activities, and ceremonial connections that depend on healthy river flows, access to culturally important species, and protection of sacred sites. Many Tribal members in the region remain engaged in river-based subsistence, ethnobotany, and cultural restoration despite obstacles created by climate change, land-use changes, and restricted access.

These living cultural connections underscore that cultural resources in the watershed are not solely archaeological or historical; they include current Tribal communities, cultural landscapes, and the species, materials, and places that support ongoing cultural identity and practice. Understanding historical context helps frame these resources, but the VRWRP recognizes Indigenous peoples as present-day knowledge holders, land stewards, and community leaders whose continued relationship with the Ventura River is essential to watershed resilience.

## Current Climate Hazards

The following section outlines how climate drivers, including changes in temperature and precipitation, are currently creating climate hazards, like extreme heat, drought, wildfire, flooding, sea level rise, and marine fog reduction. These hazards directly affect the watershed's water-resource systems, ecosystems, infrastructure, and communities. Historical examples of these events and their impacts are summarized in **Appendix M: Historical Climate Events**, and **Chapter 4: Future Climate Conditions** builds on this baseline by examining how these hazards are projected to intensify under future climate scenarios.

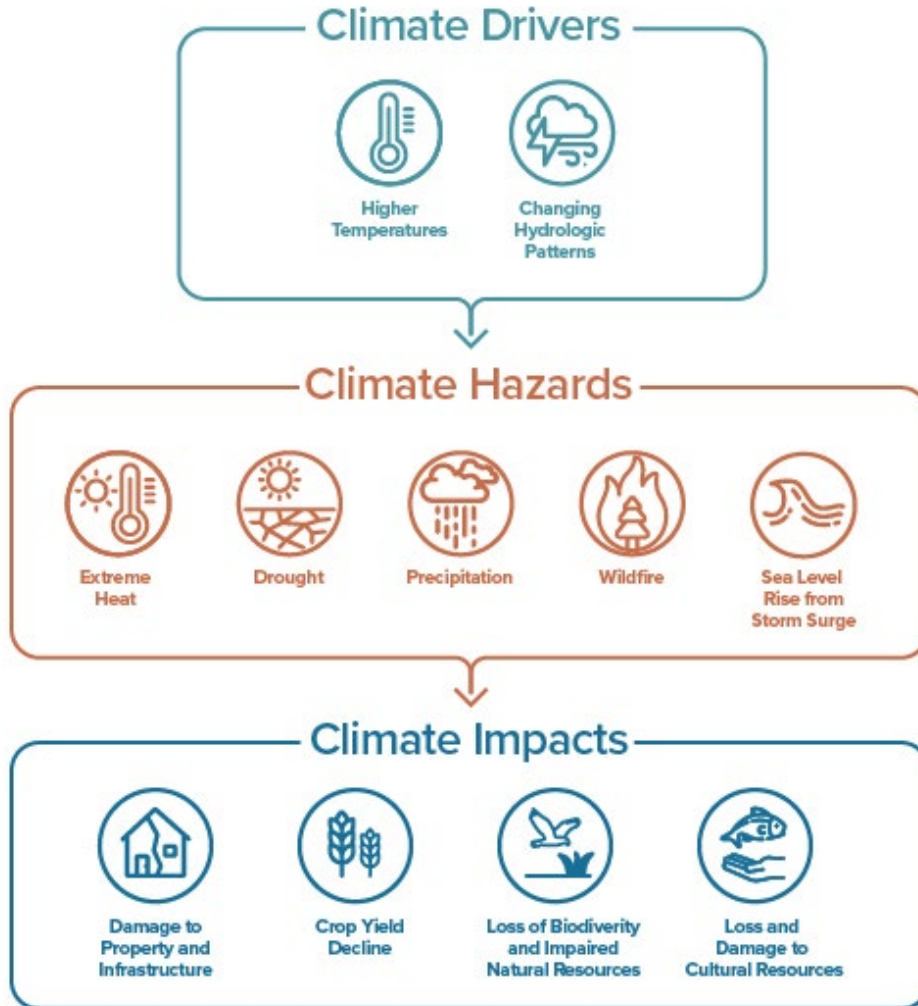
## Definitions

Climate planning literature contains a vast array of terminology, often with conflicting definitions. This plan adopts the following key definitions with respect to climate drivers, climate hazards, and climate impacts:

- **Climate Drivers:** The processes, variables, and phenomena in the climate and weather domain that may span 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. Primary 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 (Zscheischler 2018, U.S. Global Change Research Program 2017).
- **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 (California Governor's Office of Emergency Services 2020, Zscheischler 2018).
- **Climate Impact:** The effect of climate hazards 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 (Legislative Analyst's Office 2022).

The relationships between climate drivers, hazards, and impacts as understood for this plan are visualized in Figure 19.

Figure 19 Climate Impacts on the Ventura River Watershed



The following sections describe the specific climate hazards of concern in the Ventura River Watershed and their impacts. Climate impacts are complex and interdependent, resulting in disparate impacts to people, property, and the environment. While everyone is impacted by climate hazards, overburdened communities face greater adverse outcomes to their health, economic well-being, and neighborhoods due to systemic inequities. These inequities stem from historical and current institutional structures, such as water rights and governance, discriminatory housing and land-use practices, uneven infrastructure design, and patterns of public investment, that have concentrated risk and limited access to the resources needed for effective climate preparedness, response, and recovery.

### **Community Insight:** Built Infrastructure and Safety Under Compounding Hazards

During the July 2025 VRWRP Forum, community members described how storm drains, culverts, and low-lying roads failed under extreme precipitation, creating transportation gridlock and delaying access to emergency services for isolated communities. Residents in the Ventura Avenue neighborhood emphasized that limited evacuation routes, poor signage, and inadequate multilingual alerts heightened risks for renters, unhoused individuals, and non-English speaking households. Flood management systems downstream of the Ventura Avenue neighborhood were flagged as vulnerable to sea-level rise and storm surge, increasing the possibility of levee and wastewater failures in the lower watershed.

The Thomas Fire of 2017 exemplifies these vulnerabilities. Widespread road closures and Public Safety Power Shutoff events during the fire disrupted access to water facilities and emergency services, while post-fire debris flows overwhelmed drainage systems and prevented emergency access to neighborhoods. Cascading impacts from the fire (power disruption, flooding, and infrastructure failure) remain central to community concerns about future multi-hazard events. Participants stressed the need for redundant and culturally appropriate communication systems, resilience hubs, and coordinated evacuation planning to protect vulnerable populations when infrastructure falters.

### *Extreme Heat*



Extreme heat is a prolonged period of high temperature and high humidity that is much higher than expected for a region at a given time of year. Extreme heat can be an acute (short-term) hazard or a chronic (long-term) hazard (National Integrated Heat Health Information System 2025). Specifically, extreme heat days refers to the number of days per year when the daily maximum temperature reaches the 98th percentile value of historical daily maximum temperatures. In the Ventura River Watershed, extreme heat is characterized by a 98th percentile temperature threshold of 89.8 °F, meaning that based on the historic record, extreme heat refers to days hotter than 89.8 °F (Cal Adapt 2025).

Extreme heat events have increased in frequency and severity across the Ventura River Watershed, impacting public health, agricultural productivity, and sensitive riparian habitats. These thermal extremes accelerate evapotranspiration, which significantly depletes soil moisture and leads to the physical hardening of the land surface (Langridge 2018). This process reduces the infiltration capacity of the soil, effectively increasing the runoff coefficient for the watershed. Consequently, during subsequent high-intensity precipitation events, these hardened, desiccated soils act as semi-impermeable surfaces, shedding water rapidly and exacerbating the risk of flash flooding and sedimentation in both developed and natural areas.

Farmworkers are among the most vulnerable populations to extreme heat due to prolonged outdoor exposure, limited access to cooling infrastructure, substandard housing conditions, and systemic inequities resulting in barriers to healthcare and legal protections. High temperatures have led to documented increases in heat-related illnesses among agricultural workers in Ventura County, particularly during multi-day heat events. Although California requires shade, rest, and water breaks for farmworkers in temperatures above 95 °F, enforcement and access to such resources remain uneven (California Department of Industrial Relations 2024).

Since 1997, there have been six notable extreme heat events (multi-day periods of consecutive extreme heat days) throughout the watershed, including as recently as September 2024. Key features of these events include temperatures above 90 °F in coastal areas and temperatures as high as 119 °F in inland areas such as in Ojai and Meiner’s Oaks (Western Regional Climate Center 2019). Extreme heat is more prevalent in the inland and urban areas of the watershed, especially near the communities of Ojai, Meiner’s Oaks, and Wheeler Springs (Western Regional Climate Center 2019, Ventura Star 2024).

### *Drought*

Drought is defined as an extended period of dryness caused by low precipitation and high temperature that negatively impacts soil moisture and water resources availability for some activity, group, or environmental sector. Both single and multi-year drought events have been a recurring hazard throughout history in the watershed, with 11 significant droughts occurring since 1898. Drought is a top concern and drives significant water supply reductions, ecological stress, agricultural and community impacts, and infrastructure issues. It represents a key climate vulnerability, particularly in a watershed that currently relies exclusively on local water supplies.

During drought years, water supply reductions occur, resulting in streamflow declines in the Ventura River and its tributaries, especially during summer and fall months. Similarly, groundwater recharge deficits occur especially in the Upper Ventura River and Ojai Groundwater Basins, causing disruptions to agricultural and urban uses (Ventura County Public Works Agency 2020).

The watershed’s dependence on natural recharge, due to both its lack of imported water and geology, leaves its basins particularly vulnerable during drought. During dry years, the lack of surface flows reduces infiltration and curtails opportunities for recharge through spreading grounds. The Ojai Valley GSP includes provisions for enhancing recharge and capture opportunities for stormwater when available (Ojai Basin Groundwater Management Agency 2022).

Local water supplies provide irrigation to more than 6,000 acres of agricultural land in the watershed. These supply sources are vulnerable to drought, particularly where agricultural communities rely on wells without access to alternative surface water allocations or deliveries due to infrastructure gaps or economic barriers. While most farming operations within the watershed have dual supply (surface water and groundwater sources), agricultural lands outside the Lake Casitas distribution system, particularly in parts of the Ojai Basin and rural headwater areas, depend primarily on groundwater for irrigation and are therefore more exposed to drought-related well failures and pumping cost increases. During the 2014 drought in Ojai, when wells ran dry, most agricultural communities were unable to purchase new water allocation due to the heightened costs of water, resulting in crop die-off and large economic losses (Walter 2015).

Droughts reduce local supplies and necessitate costly operational shifts, such as increased reliance on groundwater pumping. Under the Water Efficiency and Allocation Program, the CMWD Board of Directors may implement, at their discretion, demand reduction measures including surcharges when Lake Casitas storage falls within specific ranges, such as Stage 3. While a drop below 40 percent storage indicates a potential Stage 3 condition, the implementation of penalties for exceeding allocations remains a policy decision managed by the board to effectively balance remaining supplies.

### *Wildfire*

A wildfire is any unwanted and uncontrolled fire that burns natural or developed areas. Historically, fire in the Ventura River Watershed resulted from lightning ignitions and Indigenous cultural burning, which together shaped the watershed’s natural fire return interval (Cal Fire Vegetation Treatment Program

2025). These frequent, low-intensity fires supported ecological health by promoting fire-dependent plants and maintaining open, resilient vegetation structures. After the late eighteenth century, Federal- and State-imposed restrictions on Indigenous burning and subsequent significant fire-suppression policies disrupted this regime, allowing fine fuels (small, lightweight vegetation that dries out quickly and ignites easily) to accumulate. Continued suppression over the past century has further increased fuel loads, contributing to today's high-intensity wildfires that burn larger areas at a pace that is much more difficult for wildfire responders to control, and burn at an intensity that results in more significant impacts, generating severe erosion, sedimentation, vegetation, species, and property and human loss (van Wagtenonk et al. 2018).

Approximately 95 percent of the Ventura River Watershed falls within zones capable of extreme fire behavior, with most of the region classified as Very High Fire Hazard Severity Zones. Areas extending from the City of Ventura north along SR-33 to Ojai face elevated wildfire risk due to fuel conditions, steep terrain, hazardous wind patterns, and the region's characteristic fire weather (CAL FIRE 2025).

Wildfires pose serious impacts to water resources and infrastructure. High severity fires increase sedimentation and ash loads in waterways, strain firefighting systems through high demand and infrastructure damage, and create power outages that limit pumping and treatment capacity (Walter 2015). Severe burns destabilize slopes and create hydrophobic soils, reducing infiltration and amplifying runoff. As a result, even moderate post-fire storms can trigger flash flooding, debris flows, and sediment surges that overwhelm flood-control structures (Ventura County Office of Emergency Services 2022). Sediment export in burned areas has been documented at up to two orders of magnitude above unburned conditions (Jumps et al. 2022), carrying ash, sediment, and nutrients downstream and threatening drinking water supplies, habitat, and public safety.

Wildfire impacts extend to the agricultural sector, where farmworkers face hazardous smoke conditions and respiratory exposure. In past events, such as the 2017 Thomas Fire, thousands of agricultural workers reported limited access to protective masks or sheltered conditions (English et al. 2020, CDPH 2018), while rural farmworker housing remains particularly vulnerable to fire damage. The Thomas Fire also burned thousands of acres of avocado and citrus orchards in Ventura and Ojai, destroying crops, damaging irrigation systems and farm infrastructure, and causing over \$170 million in agricultural losses in Ventura County alone, severely impacting avocado and citrus industries.

Although fire has been part of the watershed for millennia, the shift toward larger, hotter, and more frequent wildfires threatens both ecological systems and cultural resources. High-severity fires destroy archaeological and cultural sites, disrupt access to culturally important plants and materials, and permanently convert native shrublands and forests into non-native, fire-prone grasslands (National Parks Service 2016).

### *Extreme Precipitation and Flooding*



Extreme precipitation refers to rainfall that exceeds typical intensity or frequency, while flooding is the temporary inundation of normally dry land (U.S. EPA n.d.). Flooding is a long-standing feature of the Ventura River Watershed: since 1933, major or moderate floods have occurred roughly once every five years (Walter 2015). Because flooding in the watershed is closely tied to intense rainfall, this plan considers extreme precipitation and flooding together.

During extreme precipitation events, soils saturate quickly and excess runoff raises water levels in creeks, sloughs, reservoirs, and stormwater systems. Floodwaters increase depth and velocity, which can damage homes, infrastructure, crops, and natural areas. Major floods on the Ventura River, defined by a peak discharge threshold of 40,000 cubic feet per second (cfs) at the Ventura River near Ventura

gage (USGS 11118500), have occurred at least 11 times since records and historical reconstructions began in 1862 (USGS 2023). These high-magnitude events are characterized by rapid rising limbs on the hydrograph, often increasing from baseflow to peak discharge in fewer than four hours. (U.S. Geological Survey, 2023)

Several significant events illustrate the watershed's exposure. The watershed experienced six peak-flow floods above 40,000 cfs after 1933, including two major events during the 1969 winter storms, which brought 43 inches of rain in nine days and produced peak flows of 58,000 cfs. These storms caused widespread infrastructure damage and more than \$43 million in losses (Ventura County Public Works Agency 2025a).

Subsequent storms produced similarly rapid rises in flow. In 1992, Ventura River flows spiked from less than 100 cfs to 46,700 cfs in under three hours at Foster Park. In 1995, regional storms overtopped the Ventura River near U.S.-101, forcing a 33-hour freeway closure and inundating areas used by unhoused residents, resulting in one fatality (DWR 2003).

More recent events confirm the trend. For example, during the federally declared disaster in January 2005, extreme high-water flows and severe bank erosion along San Antonio Creek and the Ventura River exposed and ruptured sewer mainlines operated by the Ojai Valley Sanitary District, resulting in a major release of raw sewage (Ventura County 2022). In January 2023, peak flows exceeding 34,000 cfs triggered widespread flooding and months-long recovery efforts, with damages surpassing \$30 million (Ventura County Public Works Agency 2025a).

### *Sea-level Rise and Storm Surge*



Sea-level rise is the long-term increase in average ocean water levels, while storm surge is the temporary rise in water above predicted tides caused by storm events (Central Coast Wetlands Group, 2017). Together, these hazards pose growing risks to low-lying coastal areas of the Ventura River Watershed. Rising seas and more frequent high-energy storm events accelerate beach erosion, raise coastal groundwater levels, increase seawater intrusion into aquifers, inundate roads and neighborhoods, and damage wetlands and coastal infrastructure. Storm surge further intensifies these impacts by rapidly eroding unstable shorelines, damaging beachfront homes and businesses, and undermining protective structures such as seawalls and breakwaters.

Coastal areas of the watershed have long experienced these hazards. Since 1907, at least 11 major coastal flooding events have been documented, with impacts often amplified during El Niño years. Notable El Niño events (including those in 1982–83, 1997–98, 2010, and 2024) generated powerful waves, severe erosion, and significant infrastructure damage (Walter, 2015; Leonard, 2024). In 2010, a series of storms combined heavy rainfall, large surf, and elevated tides to cause widespread flooding (Ormond Beach 2018 Emergency Report, 2018). More recently, in late 2023 and early 2024, intense atmospheric river storms paired with high surf resulted in extensive coastal flooding, road closures, evacuations, and damage to neighborhoods near the Ventura River mouth (Office of the Governor, 2024; Jenkin, 2024).

The lower Ventura River Watershed is particularly exposed, especially where the river meets the Pacific Ocean near U.S.–101. Since 2011, the City of Ventura has implemented the Surfers Point Managed Retreat Project, which replaced portions of a damaged parking lot and bike path with sand dunes and a buried cobble berm to stabilize the back-beach area. These modifications addressed localized erosion and public-access issues at the site (City of Ventura, n.d.). These actions were designed for the unique conditions at this location and do not necessarily represent approaches applicable elsewhere in the watershed.

### Declining Marine Fog



Marine fog forms when moist air moves over cooler ocean waters, creating low-lying clouds that moderate coastal temperatures and reduce evaporative demand. Fog occurrence is shaped by large-scale atmospheric processes, including the position of the Pacific high-pressure system and the jet stream. While persistent marine layers traditionally keep summer temperatures cooler, heat waves—driven by strong high-pressure systems and offshore winds—can punctuate or disrupt these fog cycles, intensifying drought stress, crop losses, and wildfire conditions (Kawai et al. 2018).

Historically, marine fog has played a critical ecological and hydrologic role in the Ventura River Watershed. Fog reduces plant water loss, supports coastal and riparian vegetation, lowers irrigation demand, and moderates extreme heat events (Fischer et al. 2009, Baguskas et al. 2018, Gershunov and Guirguis 2012). However, long-term observations indicate a decline in fog frequency along the southern California coast (Williams et al. 2015). Decreasing fog cover heightens evaporative stress, increases irrigation requirements, exacerbates vegetation drought stress, and intensifies heat extremes—particularly in coastal and lower-watershed zones where fog historically provided natural cooling (Torregrosa et al. 2014).

## Historical Watershed-wide Water Budget

### Understanding the Watershed's 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. Because the Ventura River Watershed has historically relied almost entirely on local precipitation and has limited natural storage, it is highly sensitive to drought, shifting rainfall patterns, and climate extremes. Understanding the historical water budget provides critical context for water resource vulnerabilities discussed throughout this plan.

### Summary

Historically, the Ventura River Watershed has relied on local precipitation, with no significant managed recharge programs or external (imported) water sources. 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 and surface water are strongly interconnected throughout the watershed, supporting agricultural, municipal, industrial, and ecological uses. Groundwater pumping can reduce surface-water availability in interconnected reaches, while the relationship between surface-water extraction and groundwater recharge is more context-specific. In the Upper Ventura River Basin, most surface-water diversions occur only during high-flow periods when flows exceed diversion thresholds, and thus have a limited effect on recharge relative to other uses. Regardless of source, changes in either groundwater or surface-water availability can influence ecosystem health in connected reaches.

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 system percolation provides a small amount of incidental recharge to shallow groundwater, but the watershed does not currently conduct managed aquifer recharge. Primary outflows from the watershed include evapotranspiration and surface water discharge to the ocean, particularly during wet years when runoff is elevated.

Total watershed water budget components and the annual water budget volumes for the Ventura River Watershed inflow and outflow components across the period of analysis, 1994-2017, are documented in **Appendix N: Historical Water Budget**. 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.

### *Key Findings:*

Key findings from the historical water budget are discussed below, along with the associated adaptation measures developed to help address these challenges. Measures referenced here have not undergone a prioritization process, and are discussed in greater detail in **Chapter 6: Adaptation Strategies, Actions, and Implementation Roadmaps**.

- The watershed relies on precipitation as its primary water source, a vulnerability that potentially increases with climate change.
  - *Adaptation measure:* Diversify water sources (Strategy 2.3)
- Water storage capacity is limited by geology and topography, with Lake Casitas as the only significant reservoir.
  - *Adaptation measure:* Expand water storage and conservation programs (Strategies 2.2 and 2.3)
- Groundwater and surface water are highly interconnected and jointly used by all many users.
  - *Adaptation measure:* Continue to improve equitable water resource management (Strategies 1.3 and 2.2)
- Natural groundwater recharge is highly variable, dependent on water-year type, and aquifers have limited storage.
  - *Adaptation measure:* Infiltrate elevated runoff, increasing recharge opportunities where feasible and where recharge enhancements are deemed beneficial (Strategies 1.2 and 4.2)
- Managed aquifer recharge is limited to supply from a wastewater treatment system.
  - *Adaptation measure:* Diversify and expand infiltration and recharge opportunities where feasible and where recharge enhancements are deemed beneficial (Strategies 1.2 and 4.2)
- Major outflows include evapotranspiration and surface water discharge to the ocean.
  - *Adaptation measure:* Reduce inefficient water use (e.g. invasive species, overwatering, water-intensive plants) (Strategies 1.4, 2.2, 6.1, 6.2, and 6.3)
  - *Adaptation measure:* Increase permeable area (e.g. expand parks, green-infrastructure, infiltration basins) where feasible and where recharge enhancements are deemed beneficial (Strategies 3.2, 4.2 and 5.1)

For a more detailed accounting of the Historical Water Budget, see **Appendix N: Historical Water Budget**.

## Key Watershed Problems and Challenges

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. Refer to **Appendix O: Problem Statements** for full descriptions of each problem statement.

### Thematic Area: Infrastructure

1. Wildfires Damage Water Infrastructure and Temporarily Interrupt Water Supply
2. Extreme Precipitation and Flooding Damage Stormwater, Water Supply, and Wastewater Systems
3. Drought and Extreme Heat Reduce Surface Water, Lower Groundwater Levels, and Strain Local Water Supplies
4. Drought, Extreme Heat, Wildfire, and Flooding Degrade Water Quality and Increase Treatment Challenges

### Thematic Area: Natural Resources

5. Drought, Extreme Heat, and Wildfire Degrade Ecosystems, Reduce Habitat Quality, and Spread Invasive Species
6. Drought, Heat, and Flooding Accelerate the Spread of Invasive Species in Riparian and Coastal Areas
7. Sea Level Rise, Storm Surge, and Declining Marine Fog Impact Coastal and Estuarine Ecosystems
8. Human Infrastructure Alters River Flows and Reduces Natural Hydrologic and Habitat Functions
9. Soil Degradation and Watershed Management Practices Increase Erosion, Runoff, and Water Supply Vulnerability

### Thematic Area: Cultural Resources

10. Climate Hazards Degrade Cultural Resources, Traditional Lifeways, and Access to Culturally Significant Places

### Thematic Area: Communities and Land Use

11. Climate Hazards Reduce Access to Open Space and Impacts Community Health and Well-Being
12. Water Access Disruptions and Rising Water Costs Disproportionately Impact Overburdened Communities
13. Extreme Heat, Drought, and Flooding Impact Water-Dependent Agriculture and Farmworker Well-Being
14. Development in Flood and Fire Hazard Zones Increases Community Exposure to Climate Risks

## Thematic Area: Operations and Community Services

15. Wildfire, Extreme Precipitation, and Flooding Disrupt Critical Services and Emergency Operations
16. Insufficient Funding and Coordination Limit Proactive, Climate-Responsive Planning Across the Watershed
17. Outdated Permitting and Infrastructure Policies Leave Communities Vulnerable to Climate-Driven Hazards



## Chapter 4

# Future Climate Conditions

This chapter explains how climate change is projected to affect the Ventura River Watershed, from hotter temperatures and more intense droughts to larger storms, shifting fog patterns, and coastal hazards. It translates global climate science into local, watershed-specific implications.

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## Introduction

This chapter describes the climate projections used to understand how conditions in the Ventura River Watershed may change over time and provides the scientific foundation for the climate vulnerability assessments that follows. It explains how the latest global and statewide climate datasets were downscaled to locally relevant projections for extreme heat, drought, precipitation, wildfire, sea level rise and storm surge, and marine fog.

These climate projections provide a basis by which to evaluate how people, infrastructure, ecosystems, and water resource systems may be exposed to and affected by climate-related hazards, supporting informed selection of adaptation strategies.

## Methodology and Assumptions

### Global and California Climate Projections

This Plan relies on climate projections developed for California’s Fifth Climate Change Assessment (CCA5), which began releasing updated climate data and research products in 2023 and continues through 2026. California’s Fifth Climate Change Assessment draws from the most recent scientific assessments of the Intergovernmental Panel on Climate Change (IPCC), whose Sixth Assessment Report was published between 2021 and 2023. These projections are based on the Coupled Model Intercomparison Project Phase 6 (CMIP6) global model ensemble and integrate information on future greenhouse gas emissions pathways and global climate simulations. As part of the CCA5 process, state research teams at Scripps Institution of Oceanography and the University of California, Los Angeles evaluated global climate models (GCMs) for their performance in representing California’s historical climate. Downscaling for California uses the LOCA2 dataset, which applies a statistically based method to translate CMIP6 global model results into high-resolution projections suitable for local to watershed-scale climate analysis.

### Application to the Ventura River Watershed

The localized CCA5 projections provide a consistent scientific basis for assessing climate-related hazards in the Ventura River Watershed. These projections characterize potential future changes in:

- Extreme heat
- Drought
- Precipitation
- Wildfire
- Marine fog
- Sea level rise and storm surge

The metrics used in this assessment were developed in collaboration with the Advisory Group. This collaborative process helped ensure that the metrics reflected local expertise, operational realities, and lived experiences across the watershed. In many cases, metrics were aligned with established standards, such as National Weather Service (NWS) definitions for heat-index categories, to maintain consistency with widely recognized guidance. Where appropriate, the Advisory Group also helped refine locally meaningful metrics that better capture the watershed’s unique climate and hydrologic conditions. This

approach ensured that the metrics used were both scientifically grounded and relevant to local conditions.

Climate projections used in this VRWRP are organized around Shared Socioeconomic Pathways (SSPs), a set of global scenarios developed by the IPCC to represent alternative future trajectories of population growth, energy use, economic development, and greenhouse gas emissions. SSPs do not represent predictions, but rather plausible “what-if” futures that help evaluate climate risks under different levels of global greenhouse gas mitigation and societal change.

Each SSP combines a socioeconomic storyline with a corresponding greenhouse gas emissions pathway, resulting in different levels of global warming by the end of the century. For example:

- **SSP2-4.5** reflects an **intermediate** or “middle-of-the-road” trajectory in which emissions stabilize and gradually decline.
- **SSP3-7.0** represents a **higher-emissions** pathway driven by regional competition for resources and slower technological change.
- **SSP5-8.5** reflects **very high emissions** associated with fossil-fuel-intensive development.

Using multiple SSPs allows this VRWRP to evaluate climate risks across a range of plausible futures, rather than relying on a single assumed emissions outcome.

## Global Warming Levels

To evaluate when major climate thresholds may be reached, this VRWRP uses Global Warming Levels (GWLs) as defined by the IPCC. GWLs represent specified amounts of global mean temperature increase relative to the pre-industrial period (1850–1900), such as 1.5 °C, 2.0 °C, or 3.0 °C of warming. The IPCC estimates the timing of each GWL based on the first 20-year period during which global temperatures exceed that threshold, providing a standardized method for comparing climate outcomes across greenhouse gas emissions pathways and modeling approaches.

Using GWLs supports planning by providing a consistent reference point for comparing climate projections, clarifying how different greenhouse gas emissions pathways influence the pace of global warming, and aligning impact assessments with temperature thresholds used in global climate policy. Based on recent global emissions trends and assessments synthesized in the IPCC’s Sixth Assessment Report and subsequent analyses, current implemented policies and emissions trajectories are broadly consistent with an intermediate-to-high pathway between SSP2-4.5 and SSP3-7.0. While future emissions remain uncertain and subject to policy and technological change, observed global greenhouse gas emissions to date most closely align with scenarios that reach 1.5 °C of warming in the 2020s–2030s and approach 2–3 °C later in the century.

Exposure to climate hazards was evaluated by comparing projected conditions at GWL 3 °C with those at GWL 0.8 °C, which represents approximately present-day baseline climate conditions. The difference between these two warming levels isolates the magnitude of climate-driven change in key hazard indicators (e.g., temperature, precipitation, runoff), allowing the analysis to quantify how much conditions may shift under higher levels of global warming. This approach focuses on the incremental climate signal rather than absolute values, providing a consistent way to assess how exposure to climate hazards may intensify across the watershed as warming increases. These projections combine results from multiple GCMs and show changes at a local, neighborhood-scale level across the watershed.

A summary of the projected timing of key GWLs under multiple greenhouse gas emissions pathways is provided in Table 5 below.

**Table 5 Estimated Timing of Global Warming Levels (1.5 °C, 2.0 °C, 3.0 °C) Under Different Emissions Scenarios (IPCC AR6)**

GWL <sup>1</sup>	SSP2-4.5 <sup>2</sup>	SSP3-7.0	SSP5-8.5
1.5 °C (2.7 °F)	2021-2040	2021-2040	2018-2037
2.0 °C (3.6 °F)	2041-2060	2036-2055	2030-2049
3.0 °C (5.4 °F)	n.c.	2066-2085	2055-2074

<sup>1</sup> GWL = Global Warming Level (refers to the amount of global average temperature increase relative to pre-industrial conditions)

<sup>2</sup> SSP = Shared Socioeconomic Pathway (SSPs are "what if" scenarios developed under the coordination of the IPCC to explore how global society, demographics, and economics might change over the next century)

The entries report the timing of when each GWL is first crossed, expressed as a 20-year period. This central estimate represents the median crossing period across IPCC models. An entry "n.c." indicates that the GWL is not crossed during the period 2021–2100.

Source: IPCC Climate Change, 2021

## Hydrologic and Coastal Projections

CCA5 includes watershed-scale hydrologic modeling based on the Variable Infiltration Capacity model, using an ensemble of GCMs to simulate future changes in runoff, streamflow, and related hydrologic metrics. Variable Infiltration Capacity simulations translate climate projections into estimates of flood magnitude, seasonal runoff timing, and drought severity by running multiple climate scenarios through a consistent land-surface model framework. These results support the analysis of watershed-scale exposure to future hydrologic hazards.

For coastal portions of the watershed, projections of sea level rise and storm surge draw from work conducted by the California Ocean Protection Council, Scripps Institution of Oceanography, and the U.S. Geological Survey's Coastal Storm Modeling System (CoSMoS) modeling system. These datasets provide consistent scenarios for evaluating future sea level rise and coastal flooding.

## Summary of Results

Across all metrics and global warming levels (1.5 °C, 2.0 °C, and 3.0 °C), the projections indicate that climate change will produce a hotter and more variable future, with increased extremes across the climate hazards in the watershed. Key findings include:

- **Daytime temperatures are projected to increase** across seasons, with the largest warming in summer and fall. Figure 20 and Figure 21 show that median daily maximum temperatures rise under all GWLs, with fall warming exceeding 4 °F at 3.0 °C (GWL 3.0).
- **Nighttime temperatures will rise substantially**, reducing the number of cold nights by more than 40 days per year at higher warming levels. Figure 22 shows a sharp decline in days below 40 °F, driven by higher minimum temperatures.
- **Winter heat-index advisories will become more common**, including conditions that rarely occur under the current climate. Figure 23 and Figure 24 show increases in NWS "Caution" and "Extreme Caution" days, including in December–February.
- Drought frequency remains similar, but **droughts become more severe**, shifting from mild/moderate events toward more severe dry periods. Figure 25 and Figure 26 show that while the proportion of dry months remains stable, the distribution shifts toward "severe" Standardized Precipitation Index (SPI) conditions under higher GWLs.

- **Total precipitation increases modestly in winter but declines in spring and fall**, reshaping seasonal water availability. Figure 27 and Figure 28 show winter increases up to ~4 inches in some locations under 3.0 °C and drying in spring and fall.
- **Daily extreme precipitation intensifies**, even as multi-day storm totals weaken, shifting flood risks toward short-duration, high-intensity events. Figure 29 - Figure 31 show increases in 1-day extremes (up to ~2 inches) and decreases in 2-day and 10-day event magnitudes.
- **Compound storm sequences become more frequent**, increasing the likelihood of cascading flood and debris-flow impacts. Figure 32 shows a near doubling of sequences where a 3-inch storm is followed by a 1-in-2-year rainfall event within one week.
- **Wildfire-favorable weather conditions increase**, with more Red Flag–level days during dry, windy periods. Figure 33 shows 10–20 additional Red Flag–threshold days per year under 3.0 °C.
- **Marine fog (marine stratus) declines** by 5–10 days during summer months, intensifying coastal heat and evapotranspiration. Figure 34 shows reductions in June–September cloud-cover days, particularly in the lower watershed.
- **Sea level rise will progressively narrow** beaches and degrade coastal and estuarine habitats with sunny day flooding. Figure 35 and Figure 36 demonstrate the extent and frequency of 100-year coastal storm flooding near the Ventura River mouth, particularly under higher sea level rise scenarios that constrain shoreline migration.

## Relationship to Prior Climate Studies and Sustainability Plans

Climate projections applied in this VRWRP build on the earlier analyses completed for Ventura County, including the Western Regional Climate Center's Projected Changes in Ventura County Climate report (Oakley and Hatchett 2019) and Upper Ventura River and Ojai Valley GSPs, which incorporated climate change data for their assessment of future groundwater conditions.

The Western Regional Climate Center's Projected Changes in Ventura County Climate report relied on the 4<sup>th</sup> California Climate Assessment and quantitatively evaluated precipitation and temperature changes under the RCP 8.5 scenario. The report identified both maximum and minimum temperature changes, with changes greatest in the summer and fall seasons. Inland areas were identified as areas most likely to see an increase of at least 3–5 °F. Coastal areas were identified as areas likely to see an increase of at least 2–3 °F. Inlands areas with low-to-moderate elevation were identified as areas to see the greatest change in number of days exceeding extreme/impactful temperature thresholds. The report also indicated an increase in the number of dry days in the spring and fall; and little change projected in precipitation totals, implying intensification of precipitation. The report also identified the possibility of more frequent days exceeding historic 85th percentile daily precipitation. While there are some differences in the seasonal timing of precipitation changes between the Western Regional Climate Center's Projected Changes in Ventura County Climate report and this VRWRP's findings, the overall predictions for intensification of storms are aligned. Predictions in temperatures between the report and this VRWRP are generally aligned.

Both the Upper Ventura River and Ojai Valley GSPs relied on technical methods consistent with SGMA requirements, focusing primarily on groundwater models, historical hydrology, and adaptive management, rather than quantitative climate-change scenario modeling. These models were driven by historical climate and hydrologic data, consistent with SGMA's requirement to use a 50-year historical hydrologic baseline as the basis for projected water budgets, as required in §354.18(c)(3) of SGMA. Change-factor climate-change datasets, provided by DWR, were applied to historical hydrology and included projected climate and hydrologic data for 2030 central tendency scenario, 2070 central

tendency scenario, and 2070 extreme scenarios (drier with extreme warming and wetter with moderate warming). Both GSPs consider climate change qualitatively and acknowledge that warming temperatures, hydrologic variability, and wildfire may influence groundwater recharge and surface-water interactions over time. The GSPs apply DWR's climate change adjustment factors to develop future water-budget components and use SGMA's adaptive-management framework and ongoing monitoring to address remaining uncertainties.

The VRWRP should be viewed as a complementary study to these previous efforts, using the CMIP6 data consistent with California's 5<sup>th</sup> Assessment climate data to provide updated, downscaled, and watershed-specific projections of extreme heat, drought severity, precipitation extremes, wildfire-related conditions, marine fog, and sea level rise and storm surge. This expanded analysis identifies climate-driven stressors that may reduce water supply reliability, alter groundwater–surface water interactions (such as diminished baseflows and changes in recharge patterns), degrade ecological conditions, and increase infrastructure exposure to flooding, erosion, wildfire, and power disruptions, while remaining consistent with the resilience-based planning framework embedded in SGMA. Specific updates provided by the VRWRP include CMIP6 climate simulations, 3-km Weather Research and Forecasting (WRF) dynamical downscaling, and LOCA2 hybrid statistical downscaling. The newer VRWRP findings produce high-resolution watershed-specific projections of the climate hazards using data that was not available or used during GSP development. The VRWRP therefore provides a more realistic and spatially focused assessment of how climate hazards may evolve, which provides forward-looking climate stressor information that can complement the existing GSPs.

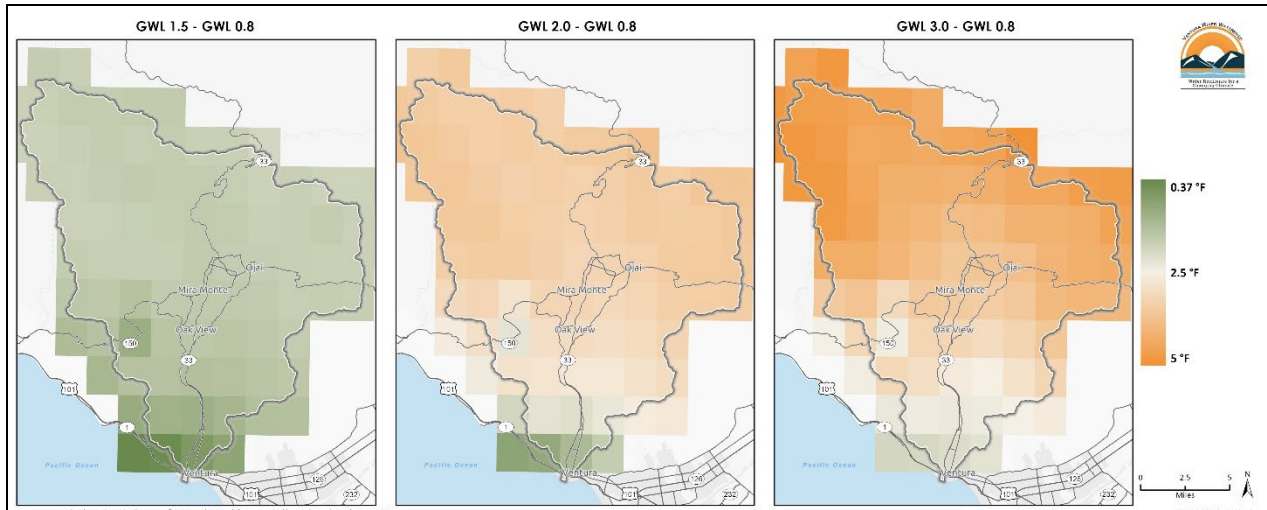
## Extreme Heat Discussion

Extreme heat, defined as anomalously high temperatures for extended periods of time, directly impacts human health, heat sensitive economies, ecosystems, and infrastructure. Characterizing the changes in duration and intensity of both daytime and nighttime temperatures under a warming climate is critical for making climate-informed adaptation decisions for the Watershed. Multiple metrics analyzing daily highs and lows as well as heat indices were developed to assess the risk of extreme heat for the Watershed.

Under 3.0 °C of warming, the number of days exceeding the historical extreme heat threshold (89.9 °F) within the watershed is expected to increase by roughly 25 days. Daily max temperatures are expected to increase by 2 °F on average for the entire year by mid-century and 4 °F near the end of the century. The largest increase will occur during the spring and fall, with over 4 °F of warming expected by the end of the century in fall (September, October, November). Nighttime temperatures will provide little relief with an anticipated increase in nighttime temperatures (i.e., an increase in minimum temperatures) of over 6 °F during fall. Nights with lows below 40 °F will decrease by at least 40 days per year. The figures below use the anticipated change in median daily maximum temperature, showing how a typical day's high temperature increases as global warming levels rise, relative to a 0.8 °C baseline. The 0.8 °C baseline refers to the amount of global mean temperature warming above pre-industrial conditions that is used as the reference period for comparison in this analysis.

The NWS issues heat warnings depending on the severity of the heat index, a derived metric that incorporates humidity and temperature. The watershed should anticipate at least 20 more 'Extreme Caution' or higher days by midcentury. Under 3 °C of warming, the Ventura River Watershed could see 'caution advisories' issued during winter (December, January, and February), something typically not observed. This suggests little seasonal reprieve in heat index.

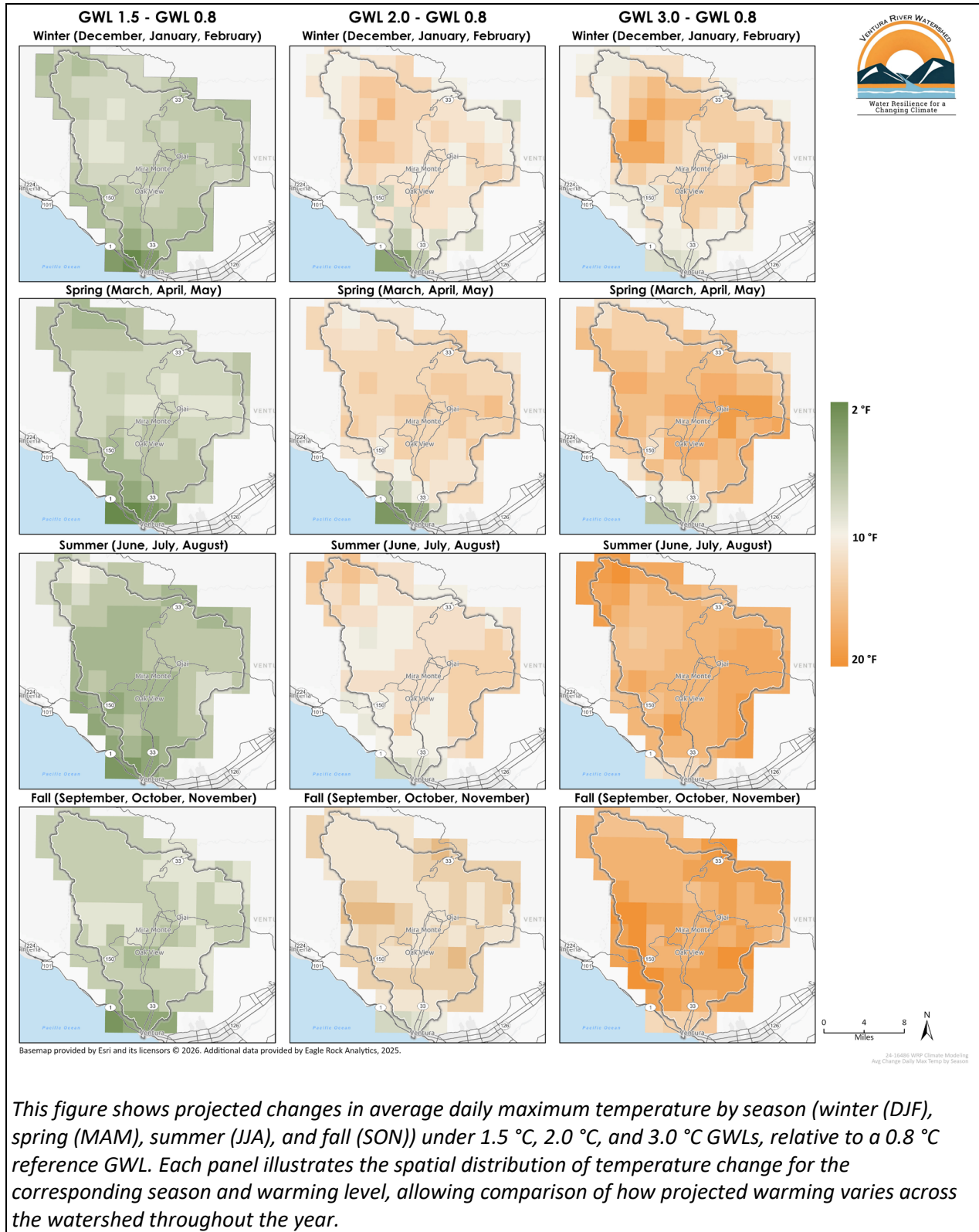
**Figure 20 Average Change in Daily Maximum Temperature**



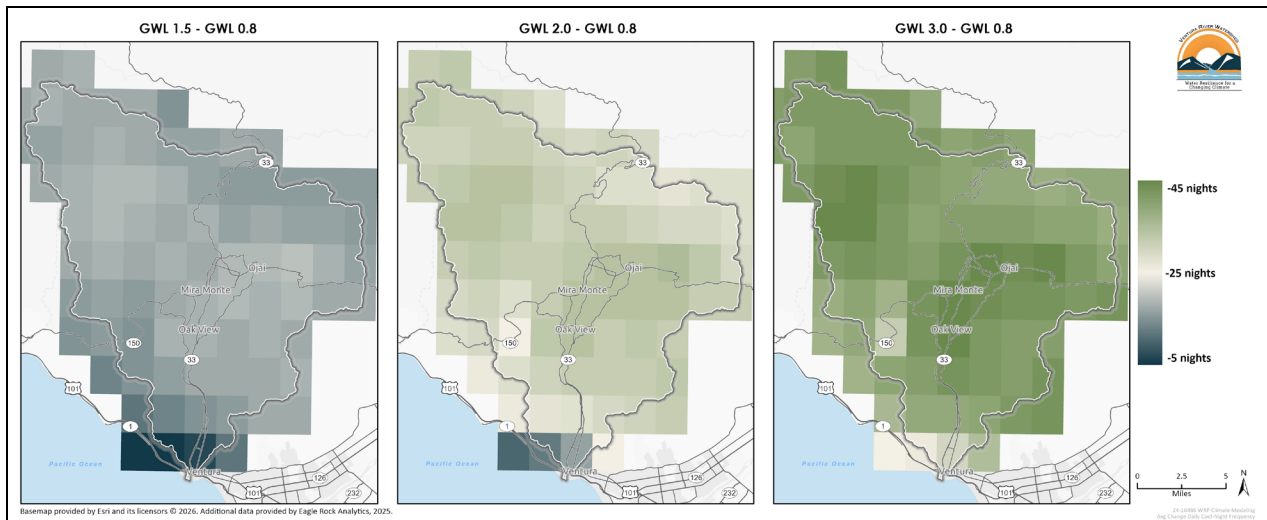
*This figure shows projected changes in average daily maximum temperature under 1.5 °C, 2.0 °C, and 3.0 °C GWLs, relative to a 0.8 °C reference GWL. Each panel illustrates the spatial distribution of temperature change for the watershed at a different warming level, depicting how average daytime high temperatures increase across the landscape as global warming intensifies.*



**Figure 21 Average Change in Daily Maximum Temperature by Season**



**Figure 22 Average Change in Cool-Night Frequency**



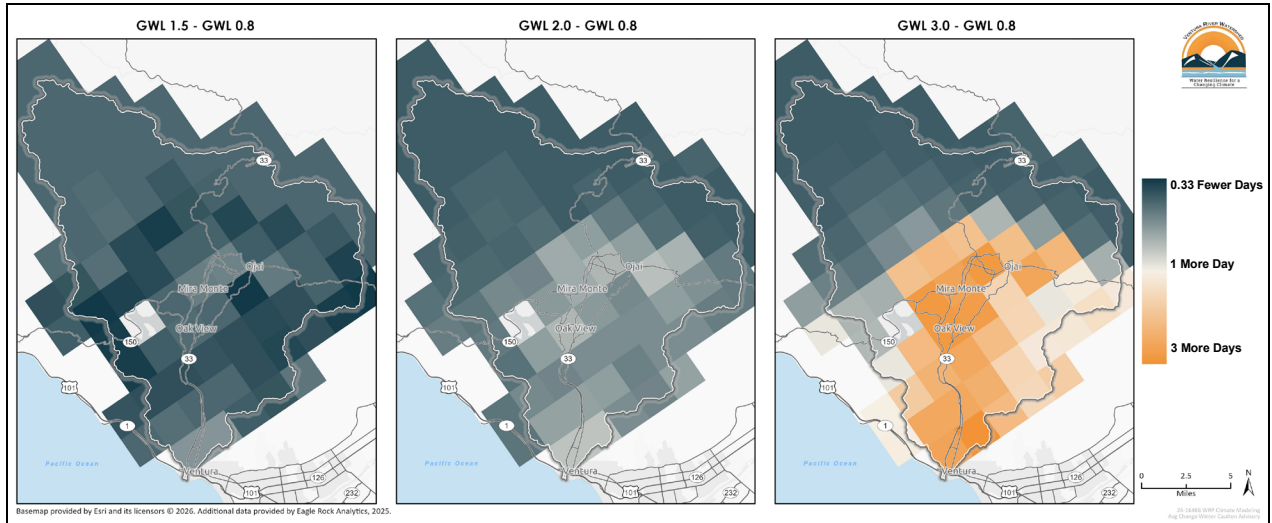
The figure depicts the difference in the average number of nights per year falling below the historical 25th-percentile minimum temperature threshold (40 °F), comparing future GWLs to a 0.8 °C reference GWL. Across all warming levels, the region experiences a substantial decline in cool nights, with losses increasing at higher global warming levels. Reduced nighttime cooling contributes to greater heat stress for people, ecosystems, and infrastructure, and limits the overnight recovery period that typically moderates daytime heat impacts.

**Figure 23 Average Change in the Number of Days per Year with an ‘Extreme Caution’ Advisory Issued from the NWS**



The figure shows projected changes in the average annual number of days triggering an “Extreme Caution” advisory from the NWS, defined by the National Oceanic and Atmospheric Administration (NOAA) Heat Index as temperatures between 90–103 °F, under 1.5 °C, 2.0 °C, and 3.0 °C GWLs, relative to a 0.8 °C reference GWL. Each panel displays the spatial distribution of changes in 1-day consecutive heating events for the corresponding warming level, showing how increasing temperatures lead to more frequent heat-stress conditions in the watershed, particularly in areas near Ojai, Mira Monte, and Oak View.

**Figure 24 Average Change in the Number of Days per Winter with a ‘Caution’ Advisory Issued from the NWS**



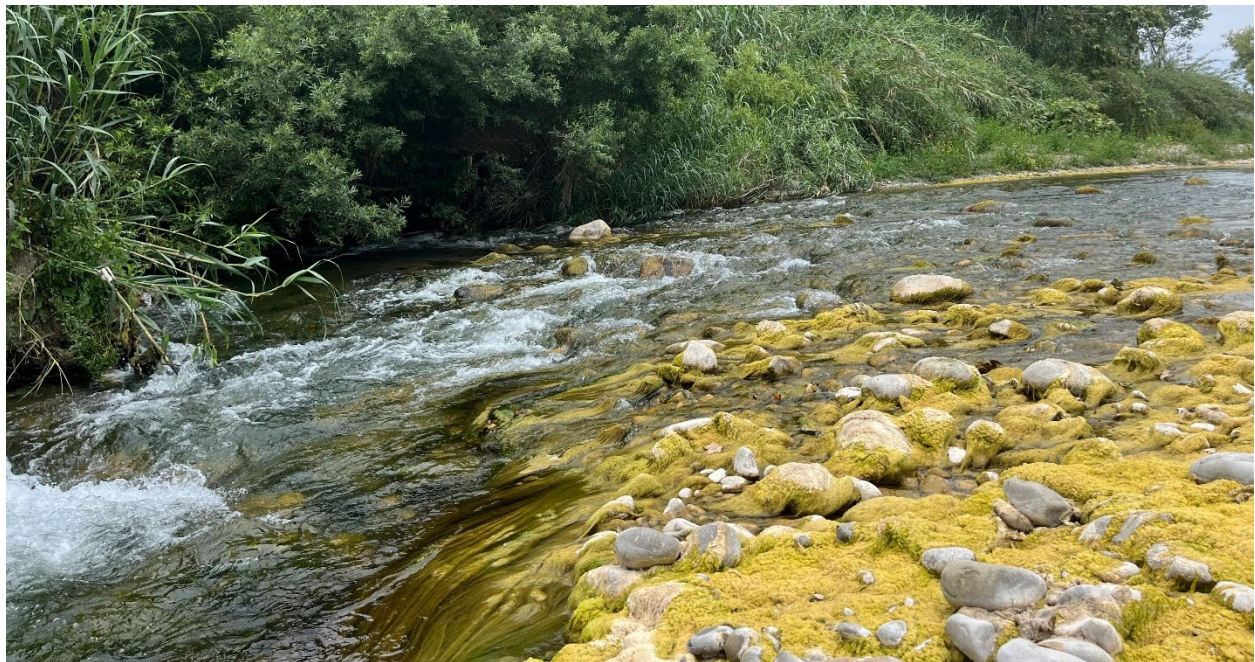
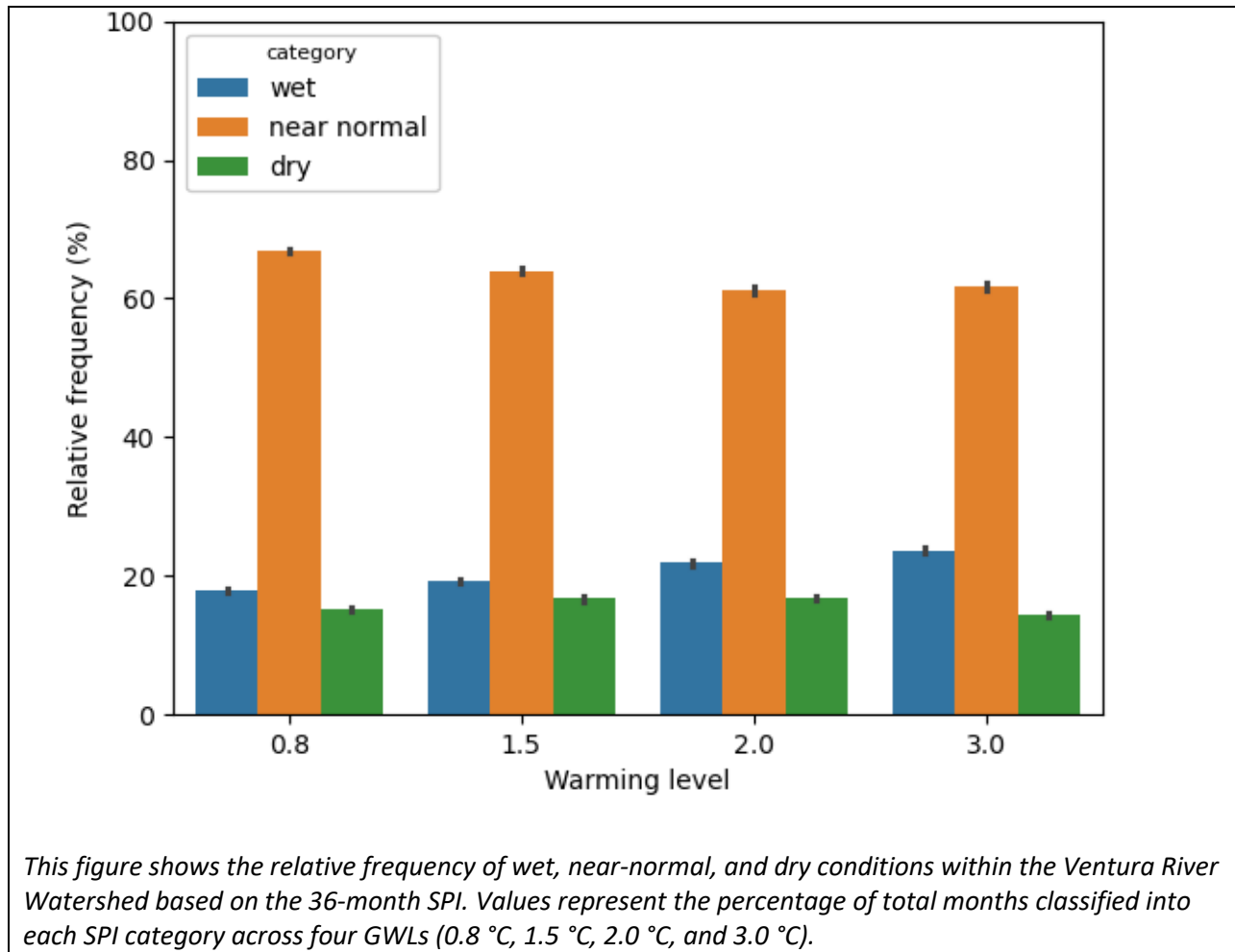
*This figure shows projected changes in the number of winter days (December–February) triggering a “Caution” advisory from the NWS, defined by the NOAA Heat Index as temperatures between 80–90 °F, under 1.5 °C, 2.0 °C, and 3.0 °C GWLs, relative to a 0.8 °C reference GWL. Each panel presents the spatial pattern of changes in 1-day consecutive heating events for the corresponding warming level. These patterns illustrate how continued warming increases the projected frequency of hot winter days in the watershed, particularly in the City of Ventura, City of Ojai, and towns of Oak View and Mira Monte.*

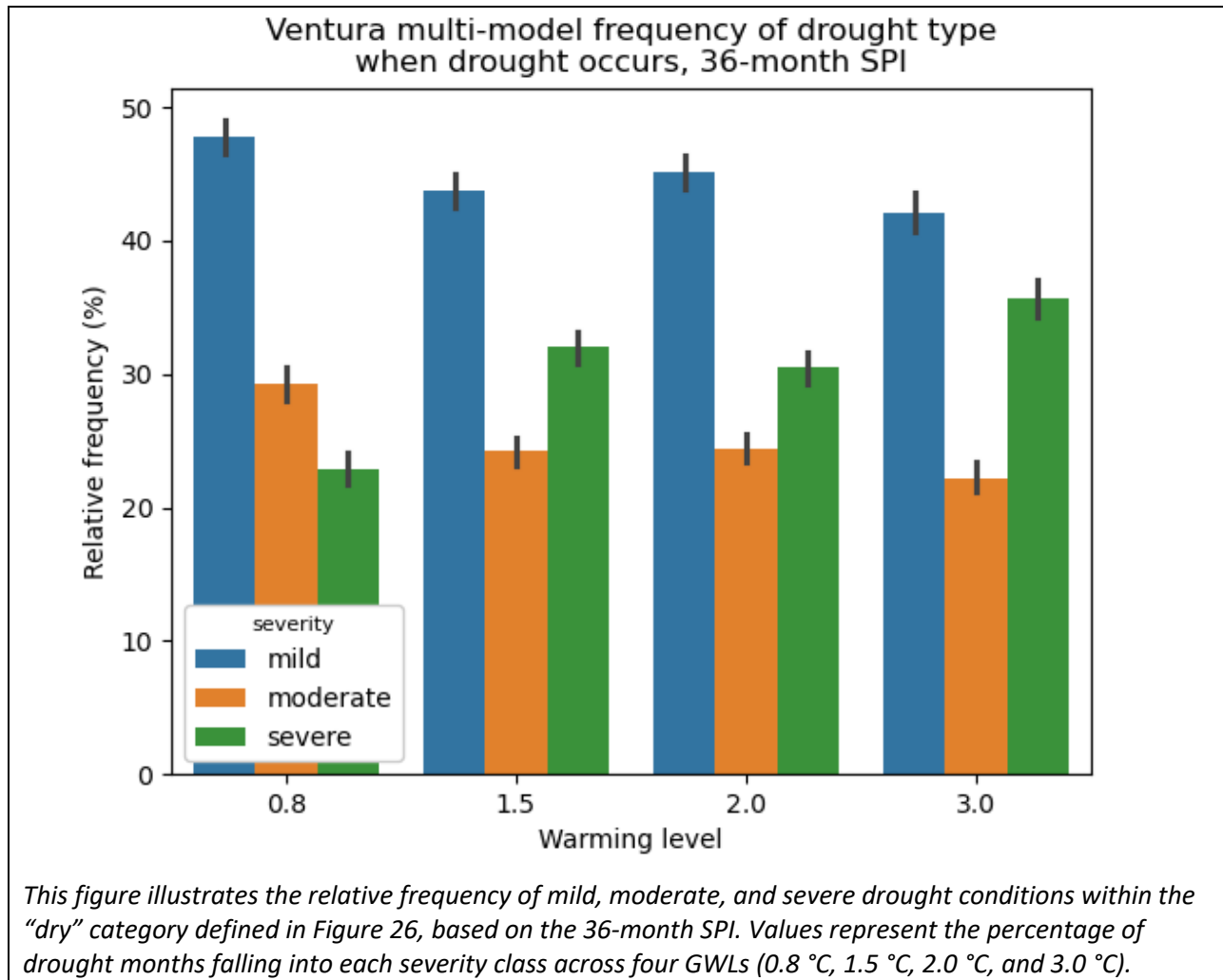
## Drought Discussion

Droughts can span timescales ranging from weeks (flash droughts) to years. There are many different types of droughts (hydrological, meteorological, snowpack, etc.) and many metrics to characterize. The SPI was selected, a common statistical tool used to characterize meteorological droughts by measuring how much precipitation deviates from the long-term historical average over a specific period. SPI values are interpreted as standard deviations from the historical mean.

The SPI is broken into three main categories, providing an overview of the general change or shift in precipitation patterns in the future: Wet (SPI of +1.00 or higher), Normal (SPI of -0.99 to +0.99), and Dry (SPI of -1.00 or lower). The watershed should anticipate little to no change in the frequency of dry periods. Within the dry category, however, SPI can be further broken into mild, moderate, and severely dry subcategories. While the frequency of dry periods is projected to remain constant, the split between the three subcategories will likely change. The watershed should anticipate the frequency of severe droughts to increase while the frequency of mild and moderate droughts decreases, suggesting an overall shift from mild to severe. Thus, though the frequency of droughts is projected to remain the same, they will likely become more severe.

**Figure 25 Relative Frequency of Precipitation Conditions by Global Warming Levels**



**Figure 26 Relative Frequency and Severity of Droughts by GWL**

## Precipitation Discussion

Intense periods of heavy rain extending hours to days can impact water infrastructure, water quality, transportation systems, and result in compounding events, such as mudslides. Understanding how the sequencing of storms, annual median precipitation, and daily extreme precipitation will change under a warming climate is critical for water resource and flood management. Three metrics were selected for characterizing changes in precipitation: median annual precipitation, daily precipitation, and the frequency of back-to-back heavy rain events.

### Median Annual Precipitation

The watershed should anticipate an increase of up to 4 inches for both wet and dry years in median annual precipitation under 3 °C of warming, consistent with the drought metric, SPI, which showed a shift towards more wet periods. The median of all simulations across all years shows an increase in precipitation under 3 °C of warming, up to 4 inches in some locations within the watershed but with ranges from 0–4 inches overall. The expected increase will come during winter (December, January, and

February). Drying is anticipated in the shoulder seasons of spring (March, April, and May) and fall (September, October, and November).

**Figure 27 Average Change in 50th Percentile (Median) of Annual Precipitation**

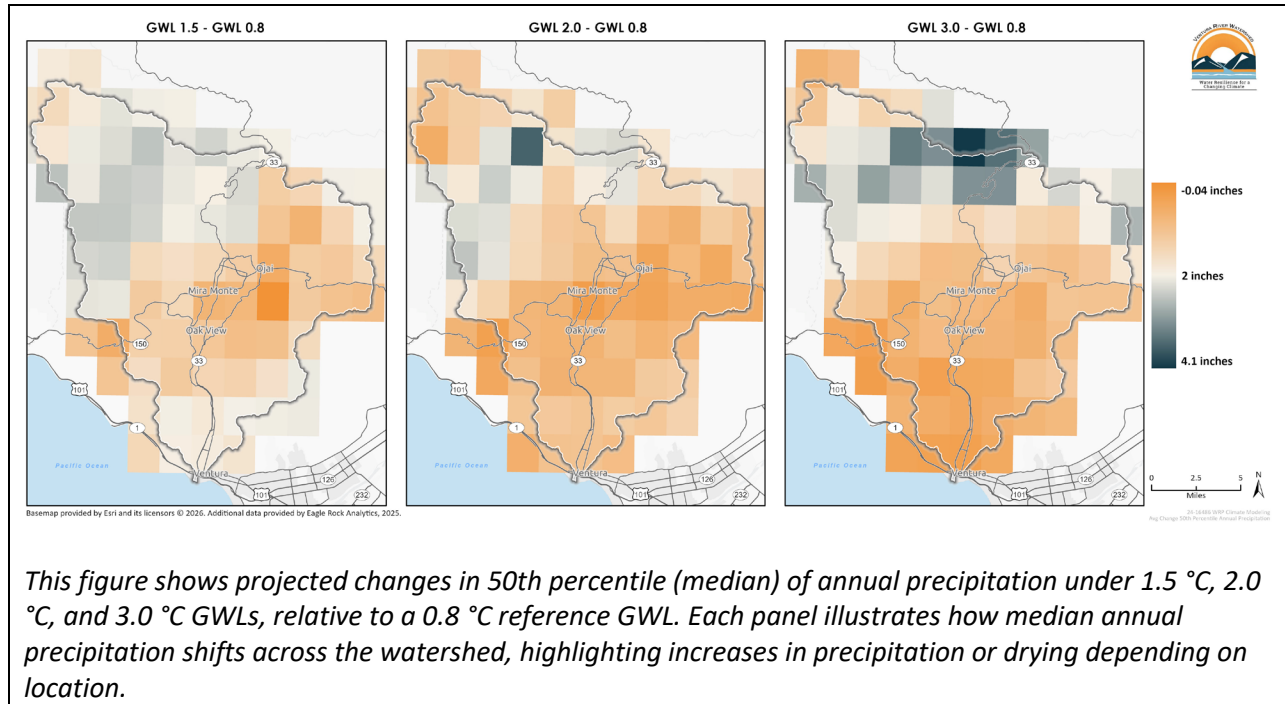
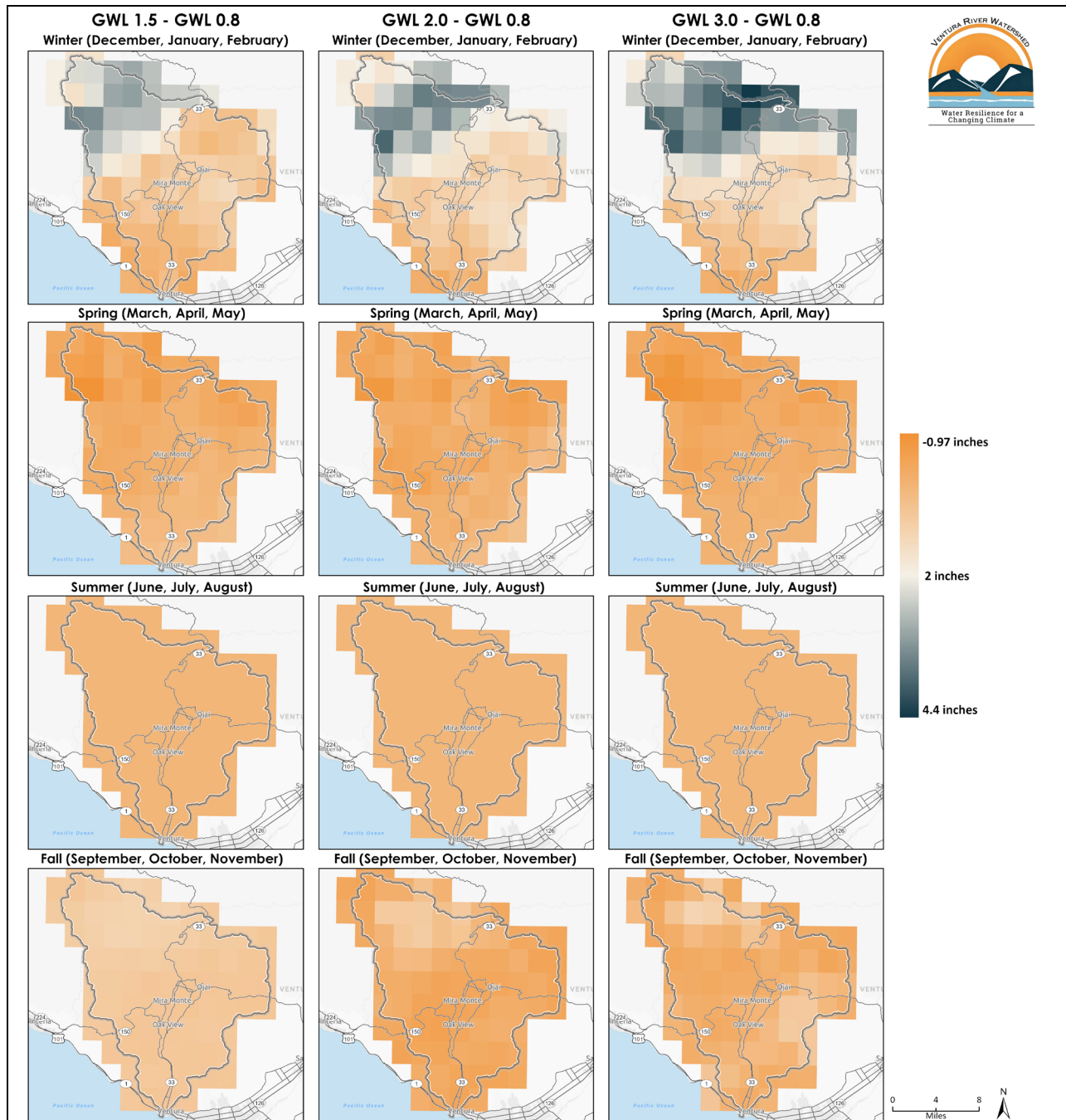


Photo Credit: Rich Reid/Surfrider Foundation

**Figure 28 Average Change in 50th Percentile (Median) Precipitation by Season**

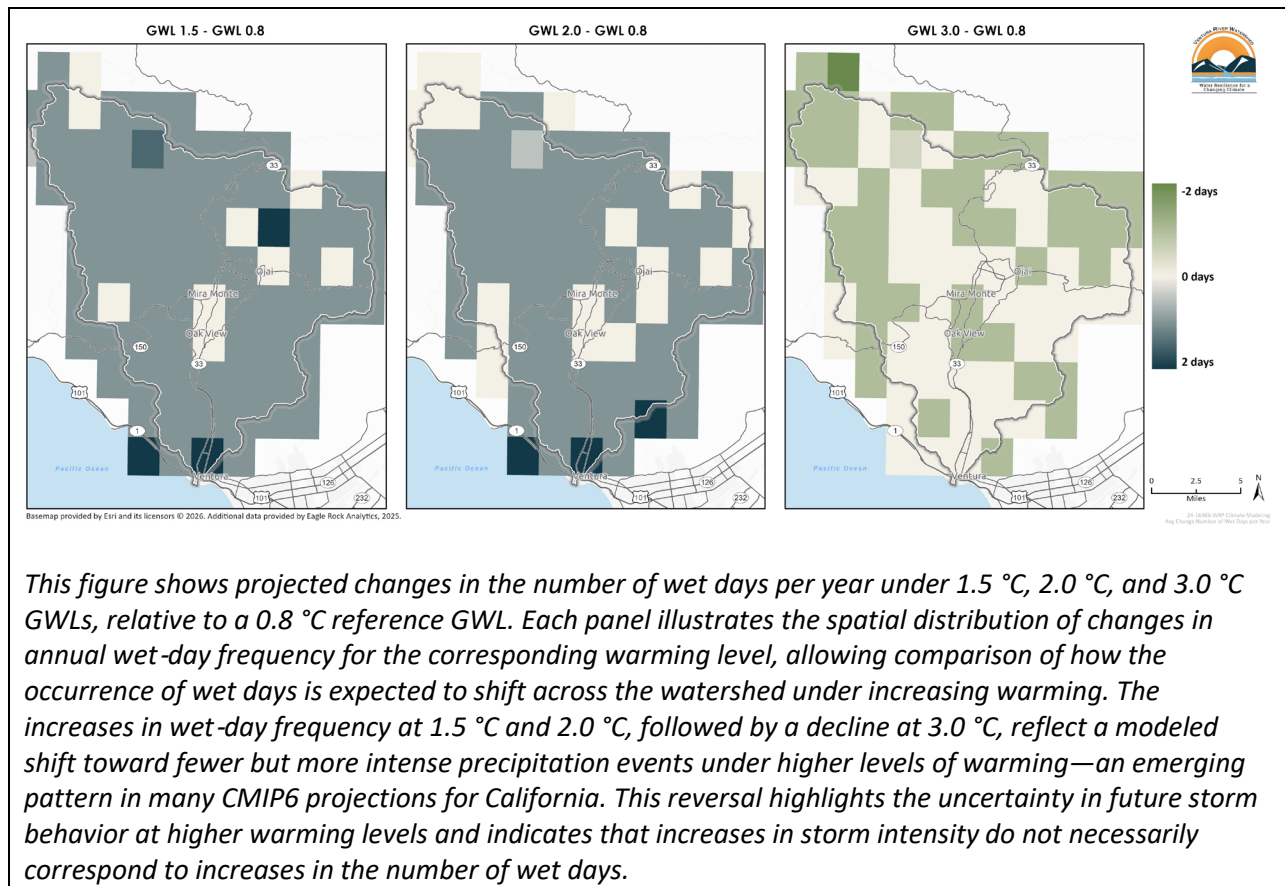


*This figure illustrates projected changes in median seasonal precipitation, winter (DJF), spring (MAM), summer (JJA), and fall (SON), under 1.5 °C, 2.0 °C, and 3.0 °C GWLs, relative to a 0.8 °C reference GWL. Each panel shows the change in the median (50th percentile) seasonal precipitation for the corresponding season and warming level, allowing comparison of how projected precipitation patterns vary across the watershed throughout the year. An increase in precipitation is expected to occur during winter (December, January, and February) and drying is anticipated in the shoulder seasons of spring (March, April, and May) and fall (September, October, and November).*

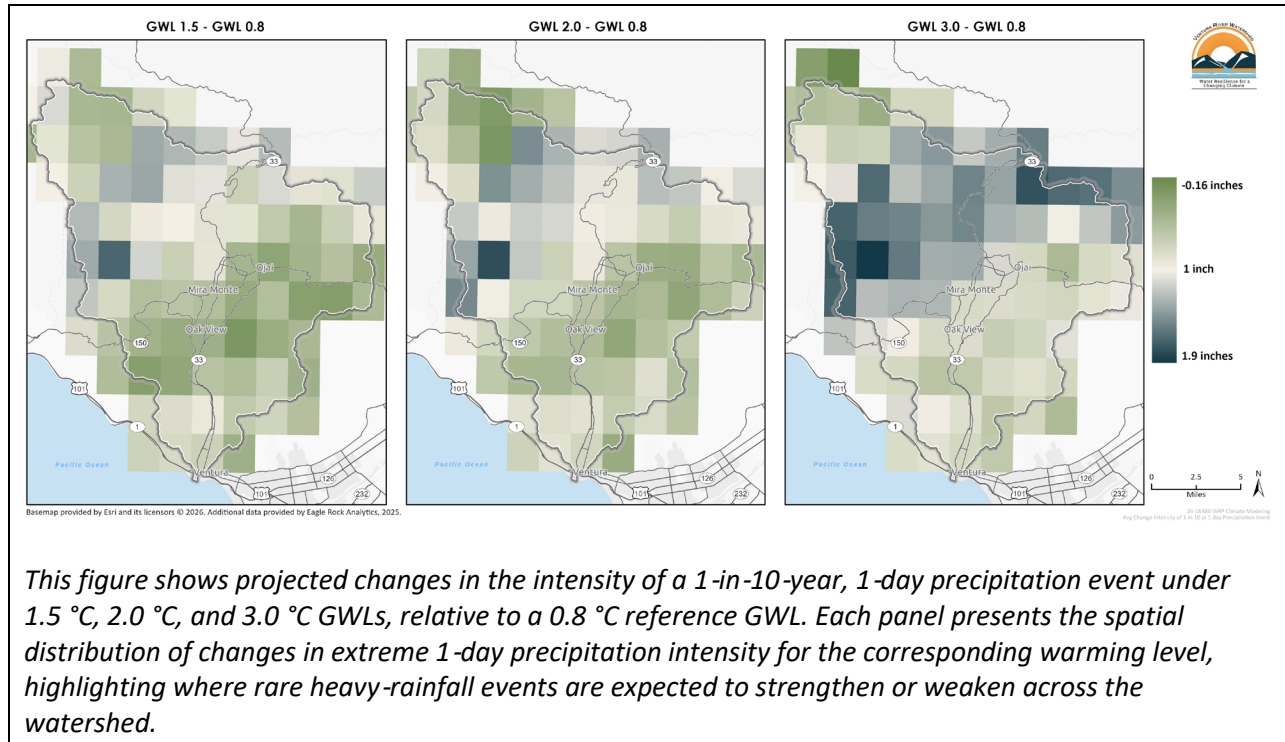
## Daily Precipitation

Projected changes in the number of wet days are modest and mixed across scenarios, generally increasing under 1.5 °C and 2.0 °C GWLs and decreasing under 3.0 °C, while short-duration precipitation intensity increases across scenarios. This indicates that a larger share of annual precipitation is expected to be delivered in heavier events. The intensity of the 1-day total 1-in-10-year (an event that has a 10 percent chance of occurring in any given year) precipitation event will increase by the end of the century. These 1-day events could increase by up to 2 inches while the 2-day and 10-day 1-in-10 year events are all expected to decrease substantially in the future; confirming the overall increase in annual precipitation is coming from an increase in the intensity of short-duration (daily) precipitation events instead of long-duration (multi-day) events.

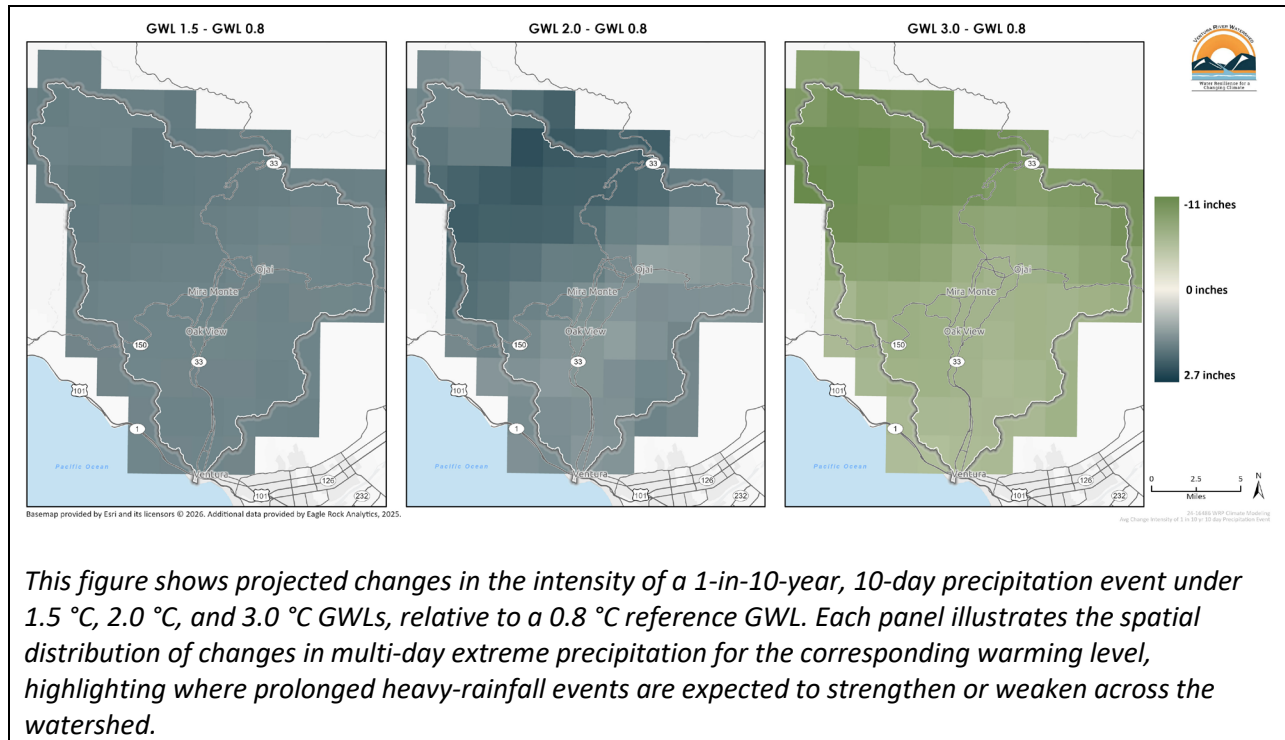
**Figure 29 Average Change in the Number of Wet Days per Year**



**Figure 30 Average Change in the Intensity of a 1-in-10-Year 1-Day Precipitation Event**



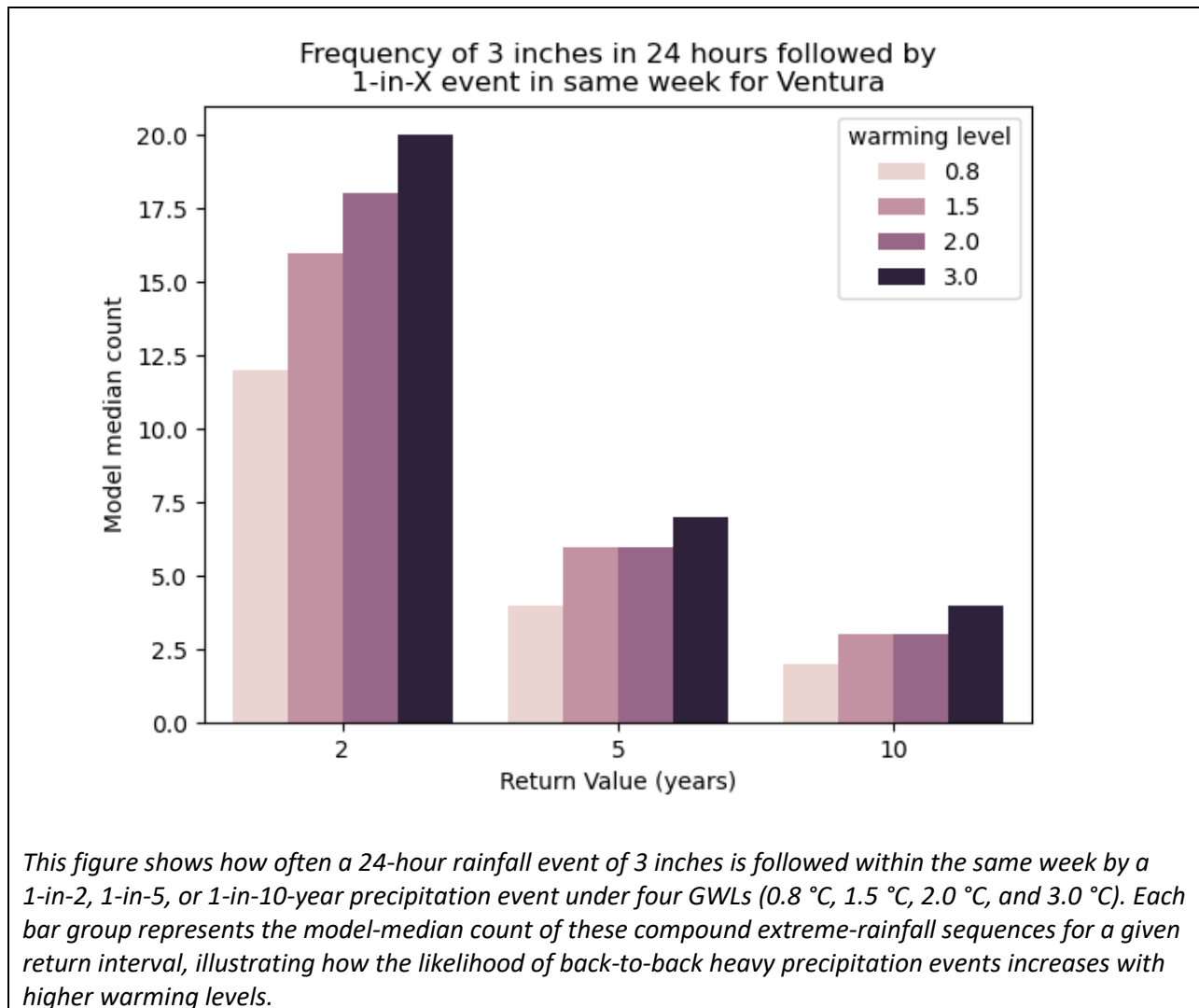
**Figure 31 Average Change in the Intensity of a 1 in 10 year 10-day Precipitation Event**



## Back-to-Back Heavy Rain Events

Back-to-back storms can create cascading impacts in the watershed, especially when soils are saturated and streamflows remain elevated. For this analysis, a representative storm sequence was selected to reflect the types of conditions known to cause problems locally: a 3-inch, 24-hour storm followed by a 1-in-2-, 1-in-5-, or 1-in-10-year event within the same week. A 1-in-2, 1-in-5, and 1-in-10 year storm events are defined by their annual exceedance probability (representing a 50%, 20%, and 10% chance of occurring in any given year, respectively) and are quantified by the specific precipitation depth and intensity reached over a set duration (under 3 °C warming, these return-interval storms produce roughly 9, 12, and 15 inches of rain, respectively). The results show that the frequency of a 3-inch storm followed by a 1-in-2-year event could nearly double by the end of the century (from roughly 10 such sequences per year to about 20), indicating that compound, back-to-back storm events may become increasingly common. These sequences are significant because closely spaced storms reduce the time available for natural and engineered systems to drain, recover, or be cleared of debris. When soils remain saturated and channels stay near capacity, the likelihood of flooding, debris movement, and infrastructure strain increases even if individual storms are not extreme.

**Figure 32** Frequency Back-to-Back Rain Events by Global Warming Levels

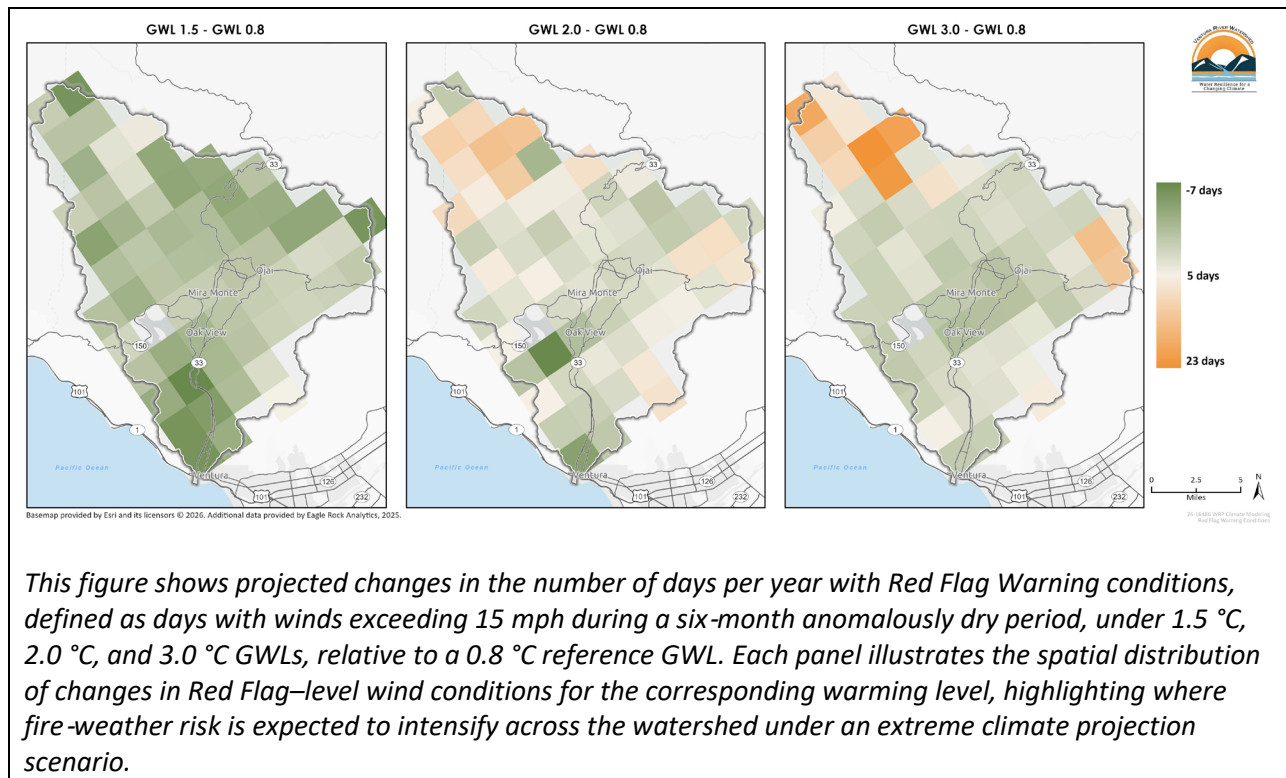


## Wildfire Discussion

Wildfires can cause widespread destruction, threatening local water quality, interrupting supplies, destroying infrastructure, impacting homes and businesses, and disrupting ecosystems. Identifying high wildfire risk regions is critical for proactive management and adaptation planning, however there are many factors that lead to wildfire risk that stem beyond the natural environment. Therefore, the metric developed to characterize wildfire risk was built to understand the weather conditions that are commonly used to signal a potential wildfire threat.

Red Flag Warnings, issued by the NWS, are used to inform the public, firefighters, and land management agencies that conditions are ideal for wildfire combustion and rapid spread. The NWS will issue a red flag warning when an anomalously dry period coincides with wind speeds greater than 15 miles per hour. Under 3 °C of warming, the Watershed should expect 10 to 20 additional days per year where conditions are met to issue Red Flag Warnings.

**Figure 33** Change in the Number of Days per Year with Red Flag Warning Conditions

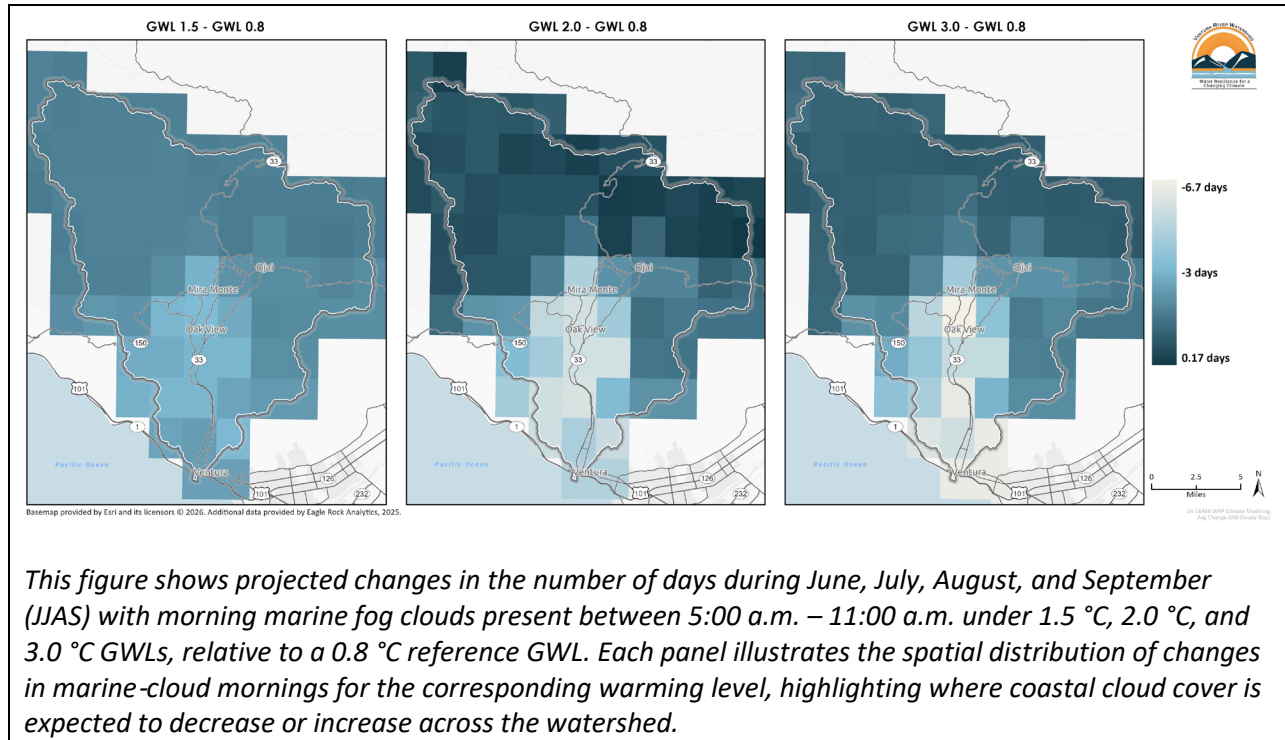


## Marine Fog Discussion

Marine fog, or marine stratus clouds, are an important weather phenomenon in Ventura during June, July, August, and September. Marine fog influences evaporative demand and moderates temperature directly. Declines in the frequency of marine fog days could increase evaporative demand, leading to an increase in drought stress and reducing the moderation of temperature thereby increasing the chance of heatwaves along the coast. Such declines will impact crop productivity, ecosystem health, and reduction in streamflow. Cloud fraction for low clouds along the coast during June, July, August and September in the morning (5:00 a.m.–11:00 a.m.) was selected as a proxy for marine fog.

In both mid-term and long-term planning scenarios (2.0 °C and 3.0 °C), coastal parts of the watershed should expect a decrease in 5 to 6 days with marine fog present. These decreases directly align with increases in hotter temperatures and evapotranspiration, consistent with results from both the temperature and drought findings (overall warmer temperatures and more severe droughts).

**Figure 34 Average Change in June, July, August and September Cloudy Days**



## Sea Level Rise and Storm Surge Discussion

Sea level rise presents a growing climate hazard for the lower Watershed, particularly at the river mouth and along the open coast where shoreline response and coastal flooding processes intersect. Figure 35 illustrates projected shoreline positions under incremental sea level rise scenarios of 25, 75, and 100 centimeters, which are estimated to result in approximately a 65, 115, and 135 feet dry beach loss, respectively. This beach narrowing estimation assumes a “hold the line, no nourishment” management approach in which existing development and coastal infrastructure prevent the shoreline from migrating landward, and no additional sediment is added to offset erosion. As sea levels rise, this constraint leads to progressive beach narrowing, increased wave reflection and eventual loss of dry beach and intertidal habitat, especially under the higher sea level rise scenarios. It is important to note that these modeled shoreline positions do not reflect recent coastal adaptation projects in the watershed, including the Surfer’s Point Managed Shoreline Retreat project, which was designed to allow for inland migration of dunes and beaches and reduce reliance on hardened coastal infrastructure. Additionally, these beach narrowing scenarios are estimated directly north of the mouth of the Ventura River, and can vary significantly depending on tidal conditions and the topography of the sand where the measurements are taken along the coast.

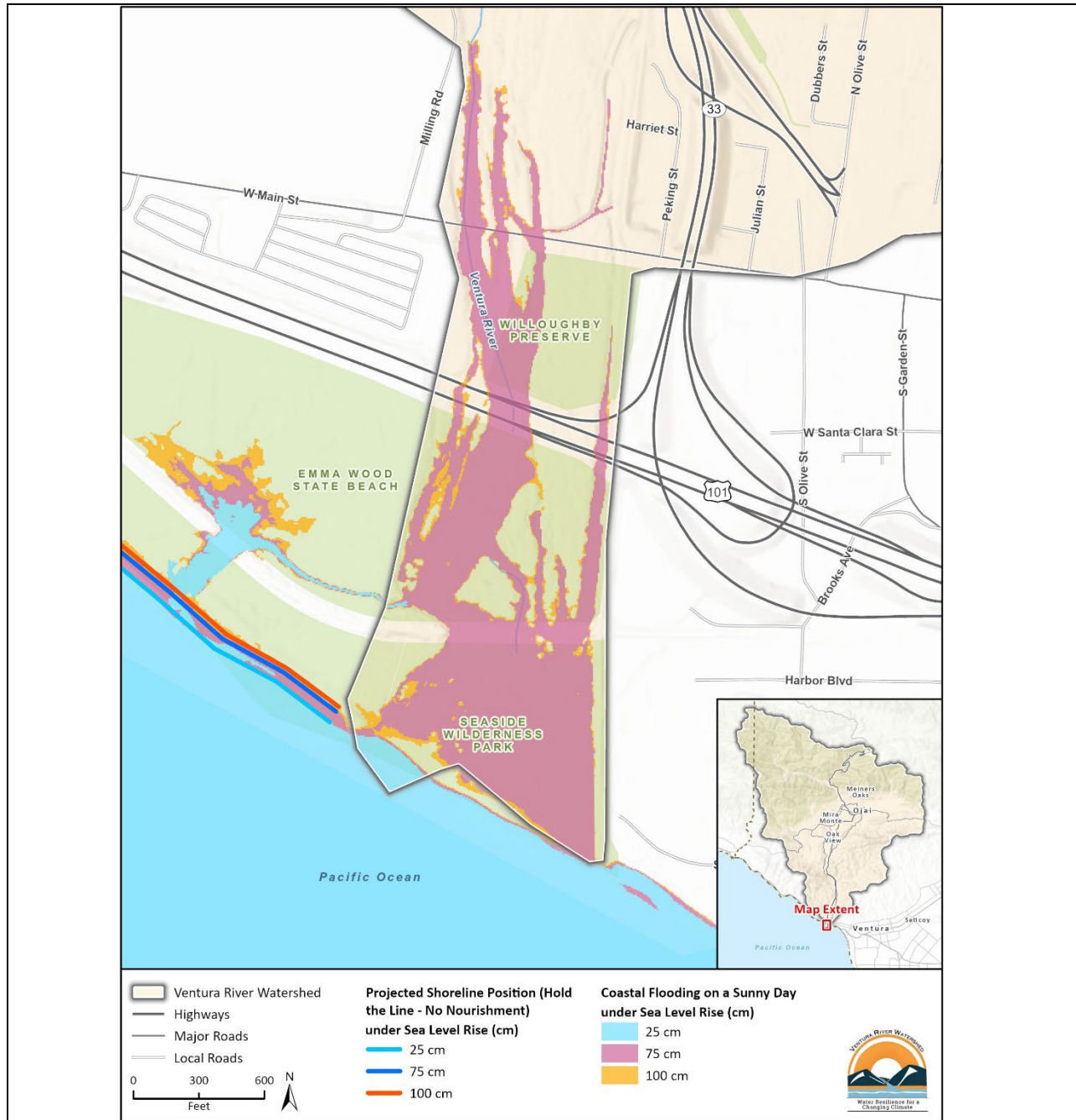
In addition to chronic shoreline erosion, Figure 36 shows coastal flooding extents associated with a 100-year storm event superimposed on rising sea levels. Even at lower sea level rise increments, low-lying areas near the Ventura River mouth and estuarine margins experience inundation, reflecting the

exposure of these areas to elevated coastal water levels. These conditions can impede river discharge to the ocean, exacerbate flooding during high flows, and increase exposure of transportation corridors, utilities, and nearby communities. Together, these projections demonstrate that sea level rise will drive both gradual and episodic hazards, including chronic beach loss, degradation of coastal and estuarine habitats, and increased frequency and severity of coastal flooding during extreme storms.

The figures below demonstrate impacts from sea level rise solely within the watershed boundary. However, the WRP includes analysis, strategies, and actions for watershed systems and infrastructure that are important to the watershed but may lie outside this boundary. The sea level rise and coastal flooding projections shown in these figures are based on CoSMoS data, which integrates global and regional sea level rise scenarios with physics-based modeling of tides, storm surge, wave setup, and coastal processes. CoSMoS simulates shoreline response and 100-year coastal storm-driven inundation to evaluate future hazards under incremental sea level rise conditions.

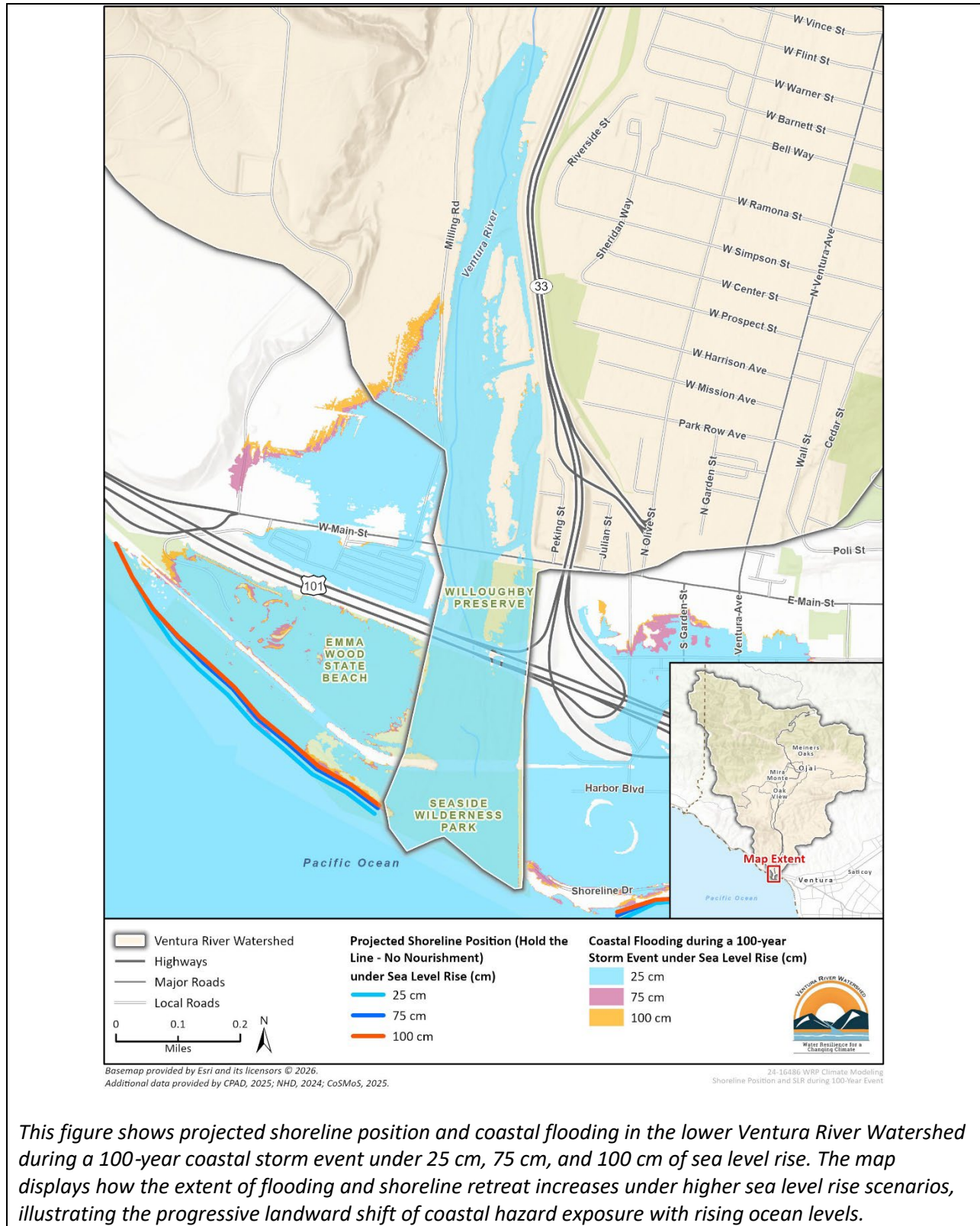


**Figure 35 Projected Shoreline Position and Coastal Flooding on a Sunny Day**



*This figure shows projected shoreline position and coastal flooding in the lower Ventura River Watershed during a sunny-day tidal condition under 25 cm, 75 cm, and 100 cm of sea level rise. The map displays how static coastal water levels expand landward under higher sea level rise scenarios, illustrating the progression of shoreline retreat and the increasing extent of inundation associated with rising ocean levels.*

**Figure 36 Projected Shoreline Position and Coastal Flooding During a 100-year Storm Event Under Sea Level Rise (25cm, 75 cm, and 100cm) in the Lower Ventura River Watershed**



*This figure shows projected shoreline position and coastal flooding in the lower Ventura River Watershed during a 100-year coastal storm event under 25 cm, 75 cm, and 100 cm of sea level rise. The map displays how the extent of flooding and shoreline retreat increases under higher sea level rise scenarios, illustrating the progressive landward shift of coastal hazard exposure with rising ocean levels.*

## Chapter 5

# Climate Change Vulnerability

This chapter assesses how climate hazards interact with the watershed's natural systems, built infrastructure, and communities. It identifies where vulnerabilities are highest, what systems are most at risk, and how climate impacts may compound across the landscape.

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## Introduction

This chapter describes the methods and results of the climate change vulnerability assessments conducted for the watershed's water resource systems. The assessments combine quantitative analysis (flood modeling under future climate scenarios) with qualitative, community-informed evaluations to understand how climate hazards affect water resource systems across the Ventura River Watershed and increase risks and consequences for the community.

The goal of this chapter is to identify which assets and system components are most vulnerable to climate change, and why. These findings directly inform the adaptation strategies and implementation roadmaps presented in **Chapter 6: Adaptation Strategies, Actions, and Implementation Roadmaps**.

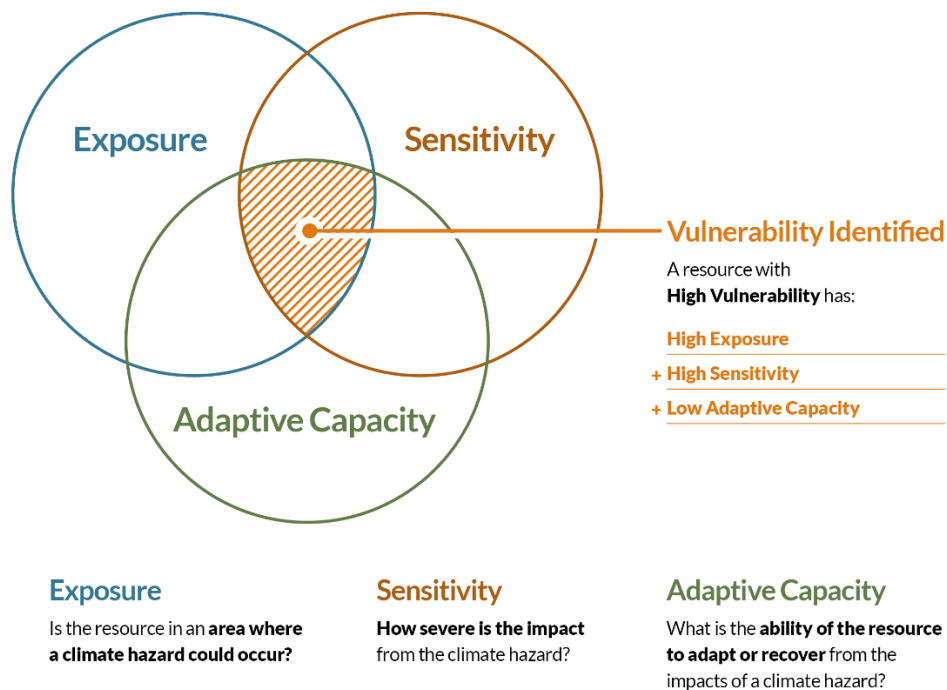
## Definitions

**Vulnerability** refers to the degree to which a system is susceptible to harm from climate hazards, based on three interacting components:

- **Exposure:** the extent to which an asset or system is physically in harm's way (e.g., located in a flood zone, burn area, or drought-sensitive reach).
- **Sensitivity:** how severely the asset or system would be affected if exposed (e.g., whether it can maintain function, how it performed in past events).
- **Adaptive Capacity:** the inherent ability of the asset or system to adjust, absorb impacts, or recover based on its existing design, operations, or management (excluding speculative future upgrades).

This framework, depicted in Figure 37, is consistent with California Department of Water Resources' (DWR) Watershed Resilience Framework (DWR 2024) and is used throughout the qualitative assessment.

**Figure 37 Vulnerability Assessment Components**



## Assessment Approach

The vulnerability assessment uses two complementary approaches: a qualitative evaluation of watershed assets and a targeted quantitative analysis of future flood conditions. The qualitative assessment evaluated 89 water-resource system assets and features. Each asset and feature was rated for exposure, sensitivity, and adaptive capacity across six climate hazards: extreme heat, drought, precipitation/flooding, wildfire, marine fog decline, and sea level rise/storm surge. Scores were combined into final vulnerability ratings based on standardized criteria aligned with DWR guidance.

The flood hazard quantitative assessment presented in this chapter was developed in response to the vulnerabilities identified in the qualitative assessment, guidance from DWR, the priorities raised during asset manager interviews, and a gap identified in existing quantitative studies. Across discussions with partners, the need to better characterize future flood conditions was consistently emphasized, leading to the focused hydrologic and hydraulic analysis that centers on future flood conditions. This analysis models projected changes in flood magnitudes, frequencies, and compound storm sequences under multiple future warming levels. Future quantitative assessments will be needed to assess in greater detail the other critical hazards and key vulnerabilities identified in the qualitative assessment, including drought and the impacts on ecosystems and water supply.

**Together, these methods provide a comprehensive picture of where vulnerabilities exist, what drives them, and which assets warrant priority attention.** This assessment highlights opportunities for resource managers to reduce vulnerabilities and manage climate-related risks through targeted actions.

## Qualitative Assessment

### Methodology

For the qualitative vulnerability assessment, a comprehensive list of assets and features was developed. Each asset or feature was then assigned scores for exposure, sensitivity, and adaptive capacity for each of the six climate hazards considered. Scores followed a standardized qualitative scale: low, low/moderate, moderate, moderate/high, or high.

### *Assets and Features*

Assets and features included water supply, water quality, groundwater and flood management infrastructure, natural systems, cultural resources, and community-serving locations. Advisory Group (AG) members, Tribal partners, and community forum participants helped to identify locally important resources and confirm the list of assets evaluated. Where assets were functionally interconnected or co-located, they were grouped and assessed together.

### *Exposure*

Exposure describes the degree to which watershed assets are expected to experience climate hazards. Climate data and climate change projections informed the selection of hazard indicators and exposure metrics used to evaluate exposure in the qualitative vulnerability assessment. This information is based on statewide climate projections developed for California's Fifth Climate Change Assessment, the State's multi-year scientific research program that provides updated, downscaled climate projections for climate hazards across the state.

Many different climate indicators were reviewed as part of this effort, but only one was selected for each hazard to assess exposure and highlight areas most likely to be affected. Exposure metrics were identified using a combination of published guidance, local data, and professional judgment from senior technical experts, and were then reviewed and confirmed by the Advisory Group and local managers to ensure they reflected conditions known to trigger stress or damage in the watershed. Table 6 summarizes the exposure metrics used for each climate hazard. Where future trends were unclear, current conditions and alternative indicators were used to provide a more complete picture.

Exposure scores were assigned by visually overlaying asset locations with the exposure metrics. A full GIS-based spatial analysis was considered, but due to variation in asset-level data resolution and the purpose of the assessment (to compare relative exposure rather than calculate quantitative impacts) a visual overlay method was used. Each exposure metric is linked to a performance threshold that reflects when climate-driven conditions begin to meaningfully impair system function. These thresholds draw from regulatory guidance (e.g., SGMA Sustainable Management Criteria and GSP-defined minimum thresholds for groundwater), observed ecological and hydrologic conditions (e.g., streamflow reductions that impede fish passage or disconnect habitat), and the professional judgment of local managers and technical experts. Because thresholds vary by water-resource system, hazard indicators were applied flexibly—for example, interpreting more than five 2-day 99th-percentile precipitation events as a meaningful stress point for flood-related impacts. These conceptual thresholds informed the scoring of exposure and sensitivity across the qualitative assessment.

**Table 6 Selected Climate Hazard Indicators and Exposure Metrics for the Vulnerability Assessment**

Climate Hazard	Exposure Metrics
Extreme Heat	Median change in the average annual frequency of 3-day heat events and median average annual frequency of days above 95 °F by future global warming level (GWL), calculated projection-specific and summarized across CMIP6 models relative to GWL 0.8.
Drought	Changes in long-term (3-year) drought conditions across the watershed using the Standardized Precipitation Index, combined with temperature-based SPI indicators (days above 95 °F) to capture increasing water stress and runoff losses driven by warming.
Precipitation	Spatially distributed change in the 2-day 99th-percentile precipitation between future GWLs and GWL 0.8, supplemented with FEMA Flood Insurance Rate Map Special Flood Hazard Areas to account for downstream and floodplain exposure.
Wildfire	Change in future GWLs relative to GWL 0.8 in the annual frequency of wind events exceeding 15 mph during the 6-month dry season, combined with present-day State of California Fire Hazard Severity Zones (LRA and SRA) to characterize existing wildfire exposure.
Marine Fog (Marine Stratus)	Projected change in the mean number of cloudy days under future GWLs relative to GWL 0.8, based on marine stratus cloud definitions, used as a proxy for potential reductions in marine fog associated with warmer and drier future conditions.
Sea Level Rise & Storm Surge	Coastal Storm Modeling System-modeled coastal flooding, groundwater emergence, and shoreline change under 25, 75, and 100 cm sea level rise scenarios, evaluated for both sunny-day and 100-year coastal storm conditions, including shoreline evolution under hold-the-line and no-hold-the-line assumptions.

### *Sensitivity*

Sensitivity reflects how severely an asset would be affected if exposed to a hazard. Ratings were informed by asset function, known performance during past events, and inherent physical or ecological characteristics. Assets that have historically experienced damage or disruption under similar conditions

were assigned higher sensitivity ratings. Assets designed to withstand or rapidly recover from hazard conditions were assigned lower sensitivity ratings.

### Adaptive Capacity

Adaptive capacity captures an asset’s inherent ability (under current conditions) to adjust or continue functioning during climate hazards. Only existing infrastructure, operations, and management practices were considered; potential future upgrades or planned improvements were intentionally excluded due to uncertainty in timing and design. Assets with flexible operations, redundancy, or natural resilience characteristics received higher adaptive-capacity ratings.

### Vulnerability Scoring

Initial vulnerability scores were assigned by combining sensitivity and adaptive capacity. High sensitivity paired with low adaptive capacity yielded high initial vulnerability; low sensitivity paired with high adaptive capacity yielded low initial vulnerability. See the scoring matrix below in Figure 38 for how initial vulnerability scores were assigned.

Exposure was then applied as a secondary screen to obtain a final vulnerability score: assets with moderate to high exposure retained their initial rating, while assets with low or moderate-low exposure received a final rating of “N/A,” indicating negligible vulnerability under future climate scenarios. An additional category, H\*, was assigned to assets with both high exposure and high initial vulnerability (high sensitivity × low adaptive capacity). H\* identifies assets requiring priority attention in subsequent adaptation planning. See Figure 39 for the final vulnerability scoring matrix.

**Figure 38 DWR Vulnerability Scoring Matrix (Sensitivity x Adaptive Capacity)**

		Sensitivity				
		Low	Moderate/ Low	Moderate	Moderate/ High	High
Adaptive Capacity	Low	L	M/L	H	H	H
	Moderate/ Low	L	M	M/H	H	H
	Moderate	L	L	M	M	H
	Moderate/ High	L	L	L	M	M
	High	L	L	L	L	M

Source: California Department of Water Resources, Watershed Resilience Framework and Toolkit

**Figure 39 Final Vulnerability Scoring Matrix (Screening with Exposure)**

		Vulnerability (Sensitivity x Adaptive Capacity)				
		Low	Moderate/ Low	Moderate	Moderate/ High	High
Exposure	Low	N/A	N/A	N/A	N/A	N/A
	Moderate/ Low	N/A	N/A	N/A	N/A	N/A
	Moderate	L	M/L	M	M/H	H
	Moderate/ High	L	M/L	M	M/H	H
	High	L	M/L	M	M/H	H+

**Community Input**

Community input played a central role in shaping the asset list and priorities used in the qualitative vulnerability assessment.

During the July 2025 community forum, participants helped identify the key water-related assets and resources across the watershed (including infrastructure, natural systems, cultural areas, and community spaces) and described how they rely on these assets in their daily lives. This input directly informed the list of assets and features evaluated in the vulnerability assessment. Community members also provided insight into which system components would have the most significant consequences if damaged or disrupted. This helped inform the preliminary vulnerability ratings assigned during the qualitative assessment.

After preliminary vulnerability ratings were developed by the project team, the AG and individual asset-managing entities provided input on the initial scores between September and November 2025 to review and revise the draft results. AG members provided detailed feedback on exposure, sensitivity, and adaptive-capacity scores and helped validate where the assessment aligned with on-the-ground experience. Their input refined the ratings, improved system-specific accuracy, and informed prioritization of assets and climate risks for further analysis and adaptation planning. A subsequent AG meeting focused specifically on the risks associated with the identified key vulnerabilities. During that session, AG members ranked the vulnerabilities based on the consequences of asset or resource failure or damage. This input further guided the prioritization of key vulnerabilities and helped shape the development of related adaptation strategies in later stages in the project.

Asset manager interviews also contributed essential system-level expertise. During these discussions, interviewees assessed the likelihood and consequences of climate hazard impacts on their assets and reviewed draft ratings. This process allowed the project team to qualitatively assess risk and incorporate local operational knowledge. As conversations evolved both through the asset manager interviews and in AG meetings, partners consistently emphasized flood-related risks, which informed the decision to focus the quantitative assessment on future flood conditions and hydrologic and hydraulic changes associated with intensifying precipitation events.

Feedback was received from:

- Participants from the general public in attendance at the July Forum
- AG members
- Asset-managing entities:
  - California State Parks
  - Chairman of Barbareño-Ventureño Band of Mission Indians
  - Chumash Elder Julie Tumamait-Stenslie
  - City of Ventura
  - County of Ventura
  - Ojai Basin Groundwater Management Agency
  - Ojai Valley Land Conservancy
  - Ojai Sanitation District
  - Upper Ventura River Groundwater Management Agency
  - Ventura Land Trust
  - Ventura River Water District

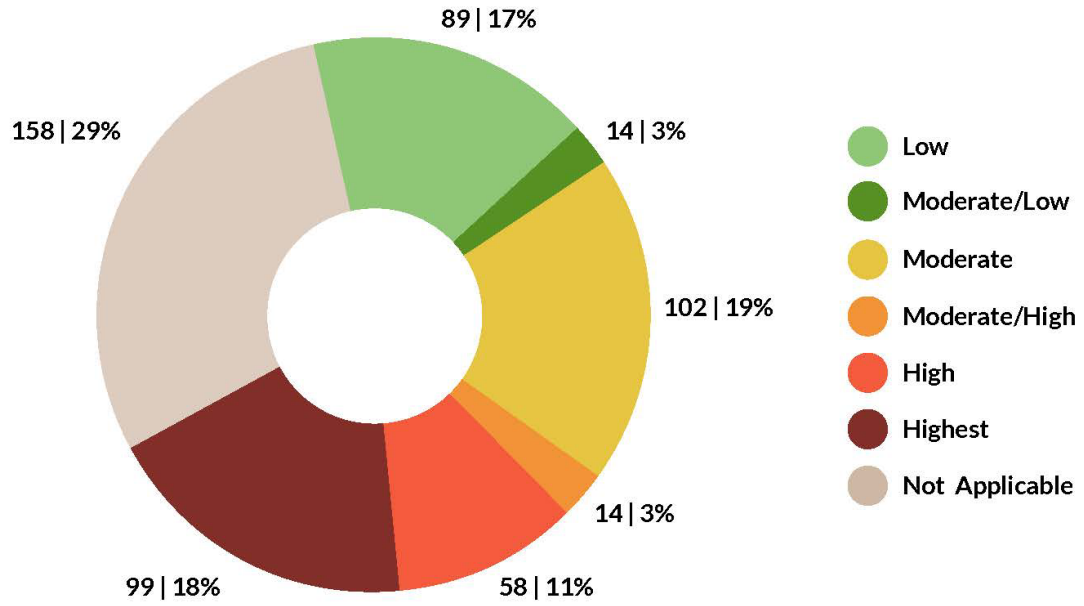
## Results

In total, the qualitative vulnerability assessment produced 534 final vulnerability scores. Of these, 58 ratings resulted in high vulnerability and 99 resulted in exceptionally high vulnerability (H\*). The qualitative vulnerability assessment ratings key is presented in Table 7 below. Ratings on individual asset groups by water system are documented below in Table 8 through Table 13, and additionally in **Appendix P: Qualitative Vulnerability Assessment Results**. A summary of total scores is displayed below in Figure 40.

The distribution of scores shown in Figure 40 indicates that vulnerability is spread across all categories rather than concentrated in a single level. The results of this qualitative assessment were used to distinguish the watershed's key vulnerabilities (focusing on those that scored higher) and inform prioritization of assets for additional analysis and development of adaptation strategies capable of reducing the identified vulnerabilities.

Figure 40 Breakdown of Final Vulnerability Scores

### Final Vulnerability Scores (Count | Percent)



**Table 7 Qualitative Vulnerability Assessment Ratings Key**

Code	Level	Color
L	Low	Green
M	Medium	Yellow
H	High	Red
H*	Highest	Dark Red

**Table 8 Qualitative Vulnerability Assessment Ratings for the Water Supply System**

Functional Group Components (Assets)	Extreme Heat	Extreme Precipitation and Flooding	Sea Level Rise and Storm Surge	Drought	Wildfire	Marine Fog
Lake Casitas, Robles Canal, Robles Diversion & Fish Passage Facility, Marion Walker Pressure Filtration Plant	M	H*	N/A	H	H	N/A
Ojai Water System Wells; San Antonio Manganese Filtration Treatment Plant	L	M	N/A	H*	M/L	N/A
San Antonio Manganese Filtration Treatment Plant Distribution Lines	L	M	N/A	H*	H	N/A
Foster Park Subsurface Intake*, Foster Park Subsurface Dam, Foster Park Wells	N/A	H	N/A	H	H*	N/A
Avenue Water Treatment Plant	N/A	M	N/A	H	H*	N/A
Avenue Water Treatment Plant Distribution Lines	N/A	H	N/A	H	H*	N/A
Wastewater conveyances to Ventura Water Reclamation Facility	N/A	L	H	M	M/L	L
Mira Monte Well (CMWD), Meiners Oaks County Water District Wells, Ventura River Water District Wells	L	M	N/A	H*	M/L	N/A
Senior Canyon Reservoir	H*	H	N/A	H*	H*	N/A
Unincorporated domestic and agricultural infrastructure (Matilija Creek and North Form Matilija Creek; Coyote Creek and Upper Ventura River; San Antonio Creek; Lower Ventura River Watershed)	L	L	N/A	H	L	N/A
	L	L	N/A	H*	L	N/A
	L	L	N/A	H*	L	N/A
	N/A	L	M	H	L	L
Matilija Reservoir	L	H*	N/A	L	H	N/A
Ojai Valley Sanitary District Wastewater Treatment Plant	L	H	N/A	L	H*	N/A
Ojai Valley Sanitary District Wastewater Treatment Plant Distribution Lines	L	H	N/A	L	H*	N/A

**Table 9 Qualitative Vulnerability Assessment Ratings for the Flood Management System**

Functional Group Components (Assets)	Extreme Heat	Extreme Precipitation and Flooding	Sea Level Rise and Storm Surge	Drought	Wildfire	Marine Fog
Matilija Creek and North Fork Matilija Creek, floodplains	L	L	N/A	L	M	N/A
Santa Ana Creek, Coyote Creek, floodplains	L	L	N/A	L	M	N/A
Lake Casitas, Robles Diversion, Robles-Casitas Canal	L	H*	N/A	M/L	H	N/A
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
Meiners Oak Floodplains, Ojai Meadows Preserve	L	L	N/A	L	M	N/A
Live Oak Creek Dam and Diversion Channel, Live Oak Acres Levee	L	H*	N/A	M/L	M	N/A
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
San Antonio Creek Floodplains (Mira Monte & East Ojai Alluvial Fans), Valley View Preserve	L	L	N/A	L	M	N/A
Ventura River Floodplain, Foster Park/Weldons/Ortonville SD Infrastructure (no levee)	N/A	H	N/A	L	M	N/A
Casitas Springs SD Infrastructure, Casitas Springs Levee, Fresno Canyon Debris Trap	N/A	H	N/A	M/L	M	N/A
Ventura SD Infrastructure, Ventura River Levee, Dent Debris Basin	N/A	H	H*	M/L	M	N/A
Surfer's Point Managed Shoreline Retreat; Ventura River Estuary, coastal beaches and wetlands	N/A	H	H*	L	M	N/A

**Table 10 Qualitative Vulnerability Assessment Ratings for the Groundwater Management System**

Functional Group Components (Assets)	Extreme Heat	Extreme Precipitation and Flooding	Sea Level Rise and Storm Surge	Drought	Wildfire	Marine Fog
San Antonio Creek Spreading Grounds; Private managed recharge	M	L	N/A	H*	H*	N/A
Matilija Creek and North Fork Matilija Creek fractured bedrock recharge areas, riparian areas	M	L	N/A	H	L	N/A
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
San Antonio Creek mountainfront recharge, fractured bedrock recharge areas, riparian areas	M	L	N/A	H*	M	N/A
Lower Ventura Ventura River alluvial recharge reach (Lower Basin floodplain/estuary corridor)	N/A	L	H*	H	M	N/A



**Table 11 Qualitative Vulnerability Assessment Ratings for the Ecosystems System**

Functional Group Components (Assets)	Extreme Heat	Extreme Precipitation and Flooding	Sea Level Rise and Storm Surge	Drought	Wildfire	Marine Fog
Beaches and Coastal Dunes	N/A	M	H*	M	L	M
Estuary	M	H	H*	H	M	M
Aquatic; Wetlands; Riparian Corridors - Matilija Creek and North Fork Matilija Creek	M/H	M	N/A	H	M	N/A
Aquatic; Wetlands; Riparian Corridors - Coyote Creek and Upper Ventura River	M/H	M	N/A	H*	M	N/A
Aquatic; Wetlands; Riparian Corridors - San Antonio Creek	M	M	N/A	H*	H	L
Aquatic; Wetlands; Riparian Corridors - Lower Ventura	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	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	M	L	N/A	H*	M	N/A
Valley floor and Foothills (grasslands, coastal sage scrub, chaparral, oak woodlands and savannas) - San Antonio Creek	M	L	N/A	H*	M	L
Valley floor and Foothills (grasslands, coastal sage scrub, chaparral, oak woodlands and savannas) - Lower Ventura	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	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	M	L	N/A	H*	H*	N/A
Headwater Forests and Mountainous Areas (mixed chaparral, Montane hardwood and coniferous forest) - San Antonio Creek	M	L	N/A	H*	H*	L
Agricultural Lands and Orchards - Matilija Creek and North Fork Matilija Creek	H	M	N/A	H	M	N/A
Agricultural Lands and Orchards - Coyote Creek and Upper Ventura River	H*	M	N/A	H*	M	N/A
Agricultural Lands and Orchards - San Antonio Creek	H*	M	N/A	H*	M	M
Agricultural Lands and Orchards - Lower Ventura	N/A	H	H*	H	L	M

**Table 12 Qualitative Vulnerability Assessment Ratings for the Water Quality System**

Functional Group Components (Assets)	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	M/L	H	N/A	L	L	N/A
Septic Systems/ Individual Septic Treatment systems - Coyote Creek and Upper Ventura River	M/L	H	N/A	L	L	N/A
Septic Systems/ Individual Septic Treatment systems - San Antonio Creek	M/L	H*	N/A	L	L	N/A
Septic Systems/ Individual Septic Treatment systems - Lower Ventura	N/A	H	N/A	L	L	N/A
Natural Waterways and Waterbodies - Matilija Creek and North Fork Matilija Creek	H	M	N/A	H	M	N/A
Natural Waterways and Waterbodies - Coyote Creek and Upper Ventura River	H	M	N/A	H	M	N/A
Natural Waterways and Waterbodies - San Antonio Creek	H	M	N/A	H	M	L
Natural Waterways and Waterbodies - Lower Ventura	N/A	H	N/A	H	M	M
Source-Water & Watershed Protection Areas - Matilija Creek and North Fork Matilija Creek	M	M	N/A	H	M/H	N/A
Source-Water & Watershed Protection Areas - Coyote Creek and Upper Ventura River	M	M	N/A	H	M/H	N/A
Source-Water & Watershed Protection Areas - San Antonio Creek	H	H	N/A	H	M/H	N/A
Source-Water & Watershed Protection Areas - Lower Ventura	N/A	M	N/A	H	M/H	N/A

**Table 13 Qualitative Vulnerability Assessment Ratings for the Cultural Resources System**

Functional Group Components (Assets)	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	M	H*	N/A	M	H*	N/A
Villages, Sacred Sites, and Ceremonial Places - San Antonio Creek	M	H	N/A	M	H*	L
Villages, Sacred Sites, and Ceremonial Places - Coyote Creek and Upper Ventura River	M	H*	N/A	M	H*	L
Villages, Sacred Sites, and Ceremonial Places - Lower Ventura	M	H	H	M	H*	M/H
Traditional Subsistence and Cultural Vegetative Resources - Matilija Creek and North Fork Matilija Creek	M	L	N/A	H	H*	N/A
Traditional Subsistence and Cultural Vegetative Resources - San Antonio Creek	M	L	N/A	H*	H*	L
Traditional Subsistence and Cultural Vegetative Resources - Coyote Creek and Upper Ventura River	M	L	N/A	H*	H*	L
Traditional Subsistence and Cultural Vegetative Resources - Lower Ventura	M	M/H	H	M/H	H*	H
Traditional Subsistence and Cultural Animal Resources - Matilija Creek and North Fork Matilija Creek	M	M	N/A	H	H*	N/A
Traditional Subsistence and Cultural Animal Resources - San Antonio Creek	M	M	N/A	H*	H*	L
Traditional Subsistence and Cultural Animal Resources - Coyote Creek and Upper Ventura River	M	M	N/A	H*	H*	L
Traditional Subsistence and Cultural Animal Resources - Lower Ventura	M	M	H	M	M	M/H
Coastal Beaches & Parks	N/A	H	H*	L	L	M
Rivers, Reservoirs & Trail Corridors - Matilija Creek and North Fork Matilija Creek	L	H*	N/A	M	H*	N/A
Rivers, Reservoirs & Trail Corridors - San Antonio Creek	L	H	N/A	M	H*	M
Rivers, Reservoirs & Trail Corridors - Coyote Creek and Upper Ventura River	L	H	N/A	M	H*	N/A
Rivers, Reservoirs & Trail Corridors - Lower Ventura	N/A	H	H*	M	M/H	M
Natural hot springs	M	H*	N/A	M	M/H	N/A

## Community Insight: Evolving Vulnerability Scores Through Asset Manager Review

Through review with asset managers and technical staff, vulnerability scores across the watershed were refined to more accurately reflect observed system performance, site-specific conditions, and evolving hazards. In the Lower Ventura watershed, exposure ratings for aquatic habitats, wetlands, and riparian corridors were increased from Low to Moderate, recognizing that even small increases in temperature can drive disproportionate ecological responses in these sensitive environments. At the same time, sensitivity scores for these assets were reduced where evidence shows that portions of the lower watershed have demonstrated resilience to extreme precipitation. Wildfire vulnerability for riparian systems in the San Antonio Creek area was elevated due to close adjacency to chaparral and sage scrub vegetation, increasing the likelihood of fire-related impacts.

Similar refinements were made across other water resource systems. Groundwater recharge areas were characterized as less sensitive to extreme heat and flooding, reflecting conditions where episodic flooding supports recharge and sediment impacts remain manageable. Water quality assets were reassessed and assigned lower wildfire sensitivity based on historical fire events that resulted in short-term, recoverable impacts. Cultural resource vulnerabilities were assigned higher scores to better capture exposure to extreme heat and marine fog, acknowledging that climate-driven changes can affect sacred sites and ceremonial places.

### *Key Vulnerabilities*

The qualitative vulnerability assessment identified 13 key climate-related vulnerabilities facing the Ventura River Watershed. These vulnerabilities do not occur in isolation; they interact across systems, where impacts in one area can trigger cascading effects on public health, ecological function, and emergency response. For example, wildfire can set the stage for damaging post-fire floods, and prolonged drought can degrade water quality and sensitive ecosystems. The following statements summarize the watershed's most significant climate-related vulnerabilities, highlighting where exposure, sensitivity, and adaptive capacity converge.

- **Wildfire and post-fire erosion pose severe risks to water infrastructure, cultural resources, and downstream communities** as fires damage tanks, pipes, power supply, access roads, and critical cultural resources. Destabilized slopes generate debris flows that threaten heritage sites, river corridors, and critical facilities during subsequent storm events, as occurred during and after the 2017 Thomas Fire.
- **Extreme precipitation and flooding overwhelm aging stormwater, flood control, drinking water, and wastewater systems**, leading to infrastructure failures, sewage spills, degraded water quality, and public health risks, particularly where levees, debris basins, and conveyance facilities, such as the Robles Diversion and Foster Park water production facilities and distribution lines which are already exposed to flooding impacts.
- **Drought and extreme heat reduce surface water flows and limit natural water availability**, increasing pressure on already local-dependent supplies during prolonged dry periods. These conditions can heighten competition among urban, agricultural, ecological, and cultural water needs, underscoring the importance of coordinated drought-resilience strategies as climate extremes intensify.
- **Water quality and wastewater treatment systems are increasingly vulnerable to compounded climate-driven hazards.** Prolonged drought reduces dilution capacity and allows pollutants to

accumulate, while wildfire introduces ash and sediment that can be rapidly mobilized during subsequent storms. Extreme precipitation can overwhelm stormwater drainage infrastructure, accelerating erosion, increasing maintenance demands, and generating high sediment loads that reduce diversion capacity and limit opportunities for stormwater capture and reuse. At the same time, centralized and onsite wastewater treatment systems face heightened risks of hydraulic overload, inundation, and physical damage from flooding and erosional processes, underscoring the need for integrated, climate-informed planning to protect water quality and system resilience.

- **Aquatic, riparian, groundwater-dependent, and other sensitive ecosystems are degraded by drought, extreme heat, and wildfire**, which contribute to reduced instream flows and shifts in seasonal flow timing, leading to higher water temperatures, reduced dissolved oxygen, declining habitat quality for sensitive species such as Southern California steelhead, and impacting sensitive species and habitat relied upon by Tribes.
- **Invasive species expansion is accelerated by climate extremes**, as drought-stressed native vegetation, post-fire runoff, and flood scouring create conditions for aggressive species like *Arundo donax* to proliferate, displacing native plants, increasing wildfire risk, and degrading cultural and ecological resources across the watershed.
- **Sea level rise and storm surge threaten the Ventura River estuary and coastal ecosystems**, driving saltwater intrusion, altered sediment dynamics, and habitat erosion that reduce estuarine function, compromise flood buffering capacity, and endanger culturally significant coastal landscapes and species.
- **Declining marine fog threatens cultural practices and exacerbates drought stress in coastal and lower-watershed ecosystems**, increasing irrigation demand on agricultural lands, reducing vegetation health, shortening windows for cultural burning and restoration, and weakening the resilience of fog-dependent habitats that historically moderated heat and water stress.
- **Agricultural lands are highly vulnerable to extreme heat, drought, flooding, and wildfire**, which increase irrigation demand, erode soils, damage infrastructure, affect farmworker health and livelihoods, and can permanently remove productive land from use, threatening local food security and the watershed's agricultural economy.
- **Legacy land use patterns and infrastructure decisions have altered natural river processes, reducing floodplain function**, sediment transport, and groundwater recharge. These changes amplify vulnerabilities for downstream communities, and unhoused individuals living in or near river corridors, who face heightened exposure to flooding, debris flows, and water quality hazards.
- **Recreational resources and public access points face increasing climate-related disruptions**, from flood-damaged trails and access points to wildfire-related closures and drought-limited water recreation, interrupting daily use and place-based cultural connections to the river, beaches, and outdoor gathering areas, with disproportionate impacts on residents who depend on these spaces for cooling, recreation, and community well-being.
- **Operational resilience of water and emergency services is undermined by power disruptions and access constraints**. Flood-damaged roads and limited backup power capacity can impair pumping, treatment, firefighting, and emergency response during climate events.
- **Chronic funding gaps, fragmented governance, and outdated permitting and insurance frameworks limit proactive climate resilience**, forcing agencies to respond reactively to disasters, constraining nature-based solutions, excluding Indigenous stewardship, and leaving critical infrastructure and overburdened communities exposed to escalating climate risks.

## Quantitative Assessment

As discussed in the Assessment Approach section above, the quantitative assessment centers on future flood conditions. This analysis models projected changes in flood magnitudes, frequencies, and compound storm sequences under multiple future warming levels.

Extreme precipitation and flooding increasingly strain aging stormwater, flood control, drinking water, and wastewater systems, a key vulnerability across the watershed, potentially leading to infrastructure failures, sewage spills, degraded water quality, and public health and safety risks. These risks are particularly relevant for flood management infrastructure such as levees, debris basins, and key conveyance facilities, such as Robles Diversion and Foster Park water production facilities and associated distribution infrastructure that are already experiencing flood impacts. As climate change intensifies hydrologic extremes, understanding system vulnerability under future flood conditions is critical for protecting both natural and built assets within the watershed.

The DWR Watershed Resilience Framework and Toolkit outlines an approach for conducting quantitative assessments of high-vulnerability water resource system components. Following this guidance, the analysis compares system performance under historical and future climate conditions, evaluates future performance without adaptation, and identifies opportunities for reducing vulnerability through natural system protection or infrastructure improvements. Results are intended to inform and strengthen the selection of adaptation strategies in watershed planning.

The flood-hazard quantitative assessment presented in this chapter was developed in response to the vulnerabilities identified in the qualitative assessment, guidance from DWR, the priorities raised during asset manager interviews, and a gap identified in existing quantitative studies. Across discussions with partners, the need to better characterize future flood conditions was consistently emphasized, leading to the focused hydrologic and hydraulic analysis that follows.

Several entities in the watershed have completed or are currently conducting related quantitative analyses that provide useful context for this assessment. An account of modeling tools assessed for potential use in this study are summarized in **Appendix Q: Quantitative Assessment**. Examples of such models include:

- **Matilija Dam Ecosystem Restoration Project:** Multiple studies (2003–2025) evaluating sediment loading, dam-removal impacts, and mitigation measures such as bridge replacements, levee improvements, and sediment-slucing modifications at the Robles Diversion.
- **Estuarine Coastal Modeling Study (2019):** Assesses the combined effects of variable river flows, sea-level rise, and sedimentation on estuary dynamics over a 50-year horizon after Matilija Dam Removal.
- **Lake Casitas Water Supply Analysis (2021):** Evaluates climate impacts on evaporation, storage loss from sedimentation, and sustainable yield under future conditions.
- **Upper Ventura River Groundwater Model (2022):** Assesses groundwater levels, surface-water depletions, and basin budgets under historical and future conditions.
- **Ojai Basin Groundwater Model (2022):** Assesses groundwater levels, surface-water depletions, and basin budgets under historical and future conditions.
- **Instream Flow Study (2024-2025):** Analyzes instream flow needs for anadromous fish under unimpaired, existing, and anticipated future conditions (including climate change, fire impacts, dam removal, and invasive species mitigation).

## System Performance Metrics and Thresholds

System performance metrics and thresholds were defined for specific hazard–system combinations. Multiple metrics can be used to assess flood management system performance, depending on duration, system component, and local conditions. To ensure the analysis was broadly applicable to the flood management system and usable by multiple flood management entities, annual maximum one- and three-day runoff events were selected as the threshold variables for the vulnerability analysis. Since GCMs do not represent instantaneous peak flows directly, daily average flows over one- and three-day durations were used to approximate peak discharges for different return events. This limitation reflects the scale constraints inherent in climate-driven hydrologic modeling. Historical flood records show that extreme river floods often involve elevated discharge sustained for 24 hours or longer, supporting the use of daily flow metrics in climate-scale flood assessments.

Described in detail in **Appendix Q: Quantitative Assessment**, the climate-driven increase in daily average flows is extrapolated to estimate corresponding changes in peak flows. This assumes that changes in daily averages are equivalent to changes in peak flows, though some uncertainty remains. Peak instantaneous flows could be higher than the daily averages presented, and it is not known whether this method overestimates or underestimates actual peak flows.

## Methodology

The approach includes hydrologic and hydraulic analysis of projected future watershed flood conditions under a range of climate scenarios. The evaluation was performed at selected locations within the watershed that correspond to key flood management systems in major subwatersheds. Locations of interest include points along the San Antonio Creek and the Ventura River. Utilizing a scenario-based approach, future flood hydrology was characterized at six locations. The hydraulic analysis was completed for two example hydrologic assessment locations, prioritizing high-vulnerability locations in the Ojai Valley and in the downstream region of the Ventura River near the City of Ventura. Assessment locations are identified in Figure 41.

**Figure 41 Quantitative Assessment Locations within the Ventura River Watershed**



Together, the analyses rigorously characterize future flood hazard and exposure under projected climate conditions. Because flood sensitivity varies by asset type and function, a detailed asset-level sensitivity analysis was not the focus of this watershed-scale evaluation. The intent of the quantitative assessment is to provide broadly applicable hazard information that is usable throughout the watershed. This is accomplished by providing projected future hydrology metrics alongside location-specific examples of application of the projected future climate hydrology metrics through the hydraulic analysis. Accordingly, recommendations for adaptation strategies focus on increasing adaptive capacity and reducing vulnerability across exposed assets. Detailed methodology and results are documented in **Appendix Q: Quantitative Assessment**.

## Hydrologic Projections

The goal of the hydrologic projections is to estimate how flood flow magnitudes could change under the influence of climate change. The method uses recent results from GCMs coupled with models of water runoff during high flow events. Climate and hydrology data were utilized from the recently developed California's Fifth Climate Change Assessment and include GCM outputs from the CMIP6 projections downscaled for California. The downscaled climate projections were used to drive Variable Infiltration Capacity hydrologic modeling, producing 21 hydrologic projections representing multiple GCMs and emissions pathways (i.e., Shared Socioeconomic Pathways) that reflect different future climate forcing assumptions (Bass 2023; Bass, Su, and Lettenmaier 2023). These results were processed to estimate runoff change from historical to two future periods (i.e., near and distant futures).

The hydrology projections provide simulated daily runoff throughout the watershed from water year 1951 to 2100. The projections were evaluated for flood hydrology metrics (i.e., annual maximum one- and three-day maximum flows) during historical, near future, and distant future periods, which revealed changes in flood hydrology metrics by either future period. While this is a robust and readily available dataset, use of the data is subject to limitations, discussed in **Appendix Q: Quantitative Assessment**.

## Hydraulic Assessment

Higher peak flows result in increased flood elevations. The potential increase in flood elevations due to the estimated increase in peak flow was evaluated using existing Federal Emergency Management Agency (FEMA) floodplain models. Existing FEMA models simulate the peak water surface elevations within the Ventura River Watershed for a large range of flow rates (FEMA 2024). These simulations identify maximum water surface elevations experienced along reaches for simulated peak flow events. Using this relationship between peak flow and water surface elevations, the increases in water surface elevation and flow depth during peak flows (10-year, 50-year, and 100-year return periods) under climate change were estimated.

The analysis computed the percentage change in annual maximum daily average flows over the future period 2025–2100. This change in daily average flows was extrapolated to estimate corresponding changes in peak flows up to the 100-year recurrence interval. There is significant uncertainty associated with this extrapolation, and extending the analysis beyond the 100-year flood was not considered methodologically useful. As a result, the analysis does not address the rarest events, including the 500-year flood extents used in FEMA flood mapping, which may be relevant for certain planning and risk-management decisions.

### *San Antonio Creek near City of Ojai*

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. Near-future climate conditions (2025–2057) generally correspond to the period when global warming levels approach ~1.5–2 °C, which aligns with the early- to mid-century timeframes shown for SSP2-4.5 and SSP3-7.0. In contrast, distant-future conditions (2058–2100) align more closely with ~2–3 °C warming, consistent with the later-century projections under higher-emissions scenarios such as SSP3-7.0 and SSP5-8.5. With a +60 percent increase in annual peak flow representing an average of the potential changes in the distant-future climate hydrology, water surface elevations (i.e. flood depth) during peak flow events are estimated to increase by 1.4 to 2.1 feet, varying by location and return period, across the studied reach.

### *Ventura River near City of Ventura*

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. With a +40 percent increase in annual peak flow representing an average of the potential changes in distant-future climate hydrology, water surface elevations (i.e., flood depth) during peak flow events are estimated to increase by 2.1 to 3.3 feet, varying by location and return period, across the studied reach.

## **Vulnerability Assessment and Priority Adaptation Strategies**

Floodplain inundation extents are affected by the projected changes in flood elevations, resulting in additional exposure to flooding in river-adjacent communities. Approximately 1,000 parcels in each of the watershed’s major cities (Ojai and Ventura) are located within current FEMA Flood Hazard Zones for the 100- and 500-year events. These zones will be affected by flooding more frequently, according to the distant-future hydrology projections. Long-term planning efforts should prioritize non-structural adaptation measures (e.g., flood easements, zoning restrictions, development controls, land buy-backs, establishment of open space in flood zones, and flood-anticipating building standards) to enhance adaptive capacity to future flood hazard in the Ventura River Watershed.

Due to the scale of vulnerability, nonstructural measures are needed to protect watershed assets from flooding that is projected in the distant-future climate. Site-specific flood management system structural improvements would complement non-structural measures. However, current projects (e.g., the Ventura River Levee Rehabilitation Project and Robles Diversion upgrades) alone are insufficient to prevent projected flooding. Reducing flood vulnerability in these river-adjacent communities in the current FEMA Flood Hazard Zones will depend on implementing non-structural measures over the next 30 years to prepare for the higher flood hazards projected later in the century.

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.

## Discussion

Projected mean-annual precipitation change reflects changes in all-weather types, from drizzle to downpours. The analysis of flood cases focuses on changes in downpours. GCMs show that warmer air holds more moisture (about 7 percent more moisture capacity per degree Celsius warming) which translates into potential increase in precipitation (National Aeronautics and Space Administration 2022). In addition, the relative increase in runoff is often greater than the relative increase in precipitation; for western U.S. basins, the increase in mean-annual runoff is typically a factor of two greater than the relative increase in precipitation (Tang 2012). Catchment-storm relationships suggest that smaller catchments may respond to warming more strongly than larger catchments because of a stronger relationship between increased temperature and increased precipitation. As a result, upper watershed areas often show larger increases in flooding than lower watershed areas (Sharma et al. 2018). Therefore, peak runoff increases of approximately 60 percent for San Antonio Creek and 40 percent for Ventura River for the one and three-day extreme events are conceptually reasonable.

### Key Findings

Key findings from the quantitative assessment are discussed below, along with the associated adaptation measures developed to help address key challenges. Measures referenced here are developed and discussed in **Chapter 6: Adaptation Strategies, Actions, and Implementation Roadmaps**.

- Annual peak flow events are projected to increase in magnitude by the end-of-the-century.
  - *Adaptation measure:* Modernize infrastructure design criteria to address projected increases in runoff (Strategy 4.1)
- Elevated flood depths are expected in areas adjacent to rivers throughout the watershed during floods.
  - *Adaptation measure:* Mitigate flood impacts in developed areas via non-structural adaptation (Strategy 4.2)
- While the increases in peak flow are significant, the flow events are expected to remain consistent in terms of timing during the year (winter and early spring) and approximate duration.
  - *Adaptation measure:* Where feasible and beneficial, pursue managed recharge or increase natural recharge potential (Strategy 4.2)
- Vulnerability due to flooding is likely to increase significantly by the end of the century.
  - *Adaptation measure:* Refine emergency response plans (Strategy 7.2)

## Chapter 6

# Adaptation Strategies, Actions, and Implementation Roadmaps

This chapter lays out the core strategies and actionable steps needed to build climate resilience across the watershed. It provides coordinated, multi-benefit actions spanning water supply, flood management, ecosystems, cultural resources, governance, and equity.

01 Introduction	02 Watershed Network	03 State of the Watershed	04 Climate Projections	05 Climate Change Vulnerability	06 Strategies and Actions	07 Resiliency Indicators	08 Next Steps
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## Introduction

This chapter provides an interrelated and implementation-focused set of climate adaptation strategies and actions that address the watershed’s key climate vulnerabilities (identified in **Chapter 4**) and reflect community insights and priorities gathered throughout the VRWRP process. These strategies and actions offer direction on how the watershed can reduce risk, strengthen resilience, and protect communities, ecosystems, and infrastructure as climate hazards intensify.

The strategies and actions were developed through an iterative and collaborative process that reflect technical assessment results, watershed conditions, climate-hazard projections, equity considerations, and sustained engagement with local agencies, Tribes, community-based organizations, and other watershed partners and members. While the full suite of strategies and actions contribute to watershed resilience, a subset of actions was selected for the development of Implementation Roadmaps because they are especially complex, cross jurisdictional, and require sustained coordination among multiple partners. Implementation Roadmaps provide more guidance on leadership roles, funding considerations, and practical next steps to support effective coordination and implementation.

## Approach

Adaption strategies and actions are organized under eight goal areas that structure the implementation framework for the VRWRP. The adaptation strategies and actions within each goal work together to reduce risk and deliver multiple benefits across water and groundwater supply reliability, water quality and ecosystem protection, flood and wildfire risk reduction, and protection and enhancement of agricultural lands, recreation, and Tribal resources. The goals envision a watershed that is resilient to climate hazards in recognition of the interconnected nature of the Ventura River system, where a myriad of components are closely linked, like the dynamic relationships between wildfire, extreme precipitation, sediment transport, and surface water diversions. This chapter describes the hazards addressed by each strategy, anticipated equity and co-benefits, and tracking metrics to measure performance of the strategy as actions are implemented.

Within each of the eight goals, one action was selected for more detailed implementation consideration based on its complexity and need for collaboration. These selected actions address multiple vulnerabilities simultaneously, and received strong support during VRWRP engagement events, including Advisory Group meetings and public watershed forums. For each selected action, an Implementation Roadmap provides clear steps, leadership roles, funding opportunities, performance metrics, and examples of existing efforts that can be leveraged to advance the action.

## Methodology

The climate adaptation strategies and actions were identified through a stepwise process that combined technical analysis, review of existing efforts, and community- and water resource-specific engagement. The intent of this approach was to strengthen and build on initiatives already underway across the watershed, while also identifying and addressing gaps through new or enhanced strategies and actions. Each strategy is intentionally designed to align with and complement existing planning frameworks, capital programs, restoration initiatives, and operational practices led by water agencies, land managers, Tribes, and community partners in the watershed. Strategies were further refined through iterative Advisory Group discussions, with feedback serving a formative role in shaping priorities, sequencing, and implementation pathways. Tribal partners co-developed select actions, particularly those related to

cultural resources, stewardship, and land management. In addition, forum-based voting and facilitated dialogue directly informed roadmap selection and helped identify actions with cross-sector support.

The following steps summarize the methodology used to develop the VRWRP adaptation strategies and actions.

### 1. Vulnerability and Risk Assessment

Findings from the qualitative climate vulnerability assessments (**Chapter 4**) provided the foundation for initial adaptation strategy development. The watershed’s most pressing vulnerabilities across climate hazards, water-resource system assets and features, and communities shaped the initial strategies. Particular attention was given to cross-cutting challenges such as the compounding effects of wildfire and post-fire flooding and debris flows; sediment impacts on reservoirs, diversions, and habitat; aging and exposed water infrastructure; water-quality degradation following extreme events; and uneven adaptive capacity among rural, Tribal, and wildfire-prone communities. These interconnected vulnerabilities informed strategies designed to address multiple risks simultaneously and emphasize upstream–downstream coordination.

#### Qualitatively Rank for Exposure, Sensitivity, and Adaptive Capacity:



### 2. Existing Adaptation Projects and Strategies

More than 40 relevant plans, studies, policies, and implemented or proposed projects within the watershed and surrounding region were reviewed as part of strategy development. This review included efforts related to water use efficiency, flood management and debris control, wildfire preparedness and post-fire recovery, surface- and groundwater-management, ecosystem restoration, land-use planning, and community capacity-building. **Understanding the breadth of existing initiatives ensured that new strategies build upon, rather than duplicate or undermine, ongoing work.**

### 3. Climate Adaptation Gaps Assessment

Existing projects and programs were evaluated to understand where current efforts may not fully address the present and future climate risks identified in the vulnerability and risk assessment. The review of gaps in current adaptation strategies identified limitations related to geographic coverage, the scale and timing of interventions, coordination across water-supply, flood-management, and land-use systems, and long-term operations and maintenance capacity. The review documented how existing efforts already address climate hazards, while also identifying where efforts are fragmented, geographically uneven, or may be insufficiently scaled for future conditions. These findings directly shaped the refinement of existing strategies and actions and the development of new ones.

**4. Community and Sector-Specific Input**

Adaptation strategies and actions were reviewed and refined with input from the VRWRP Advisory Group (AG), public watershed forum participants, and key watershed partners. Tribal partners from the Native Coast Action Network (NCAN) and the Barbareño/Ventureño Band of Mission Indians (BVBMI) led the development of strategies and actions focused on cultural resources, and contributed perspectives on equity, access to resources, stewardship priorities, and culturally significant landscapes across strategies. This input helped validate the vulnerability assessment with lived experience and operational realities, identify feasible adaptation measures, and ensure that strategies reflect local knowledge and on-the-ground capacity. Note, engagement occurred iteratively throughout the process and in each step of development; this step summarizes a single major point of review and refinement.

**5. Screening Criteria**

Adaptation strategies and actions were screened using criteria refined through (AG) engagement. These criteria were applied iteratively to ensure that proposed strategies and actions are both technically sound and responsive to community needs. This process resulted in a final set of strategies and actions that are risk-informed, gap-responsive, and structured to support near- and long-term implementation.

**6. Implementation Roadmaps**

After the final set of strategies and actions was identified, a subset of actions was selected for the development of Implementation Roadmaps. These actions were selected by applying the prioritization criteria (also refined through AG engagement) and through a voting exercise conducted during an in-person watershed forum, during which participants voted on which actions should receive expanded implementation guidance due to their complex or collaborative nature.

**Screening Criteria**

- Achieve VRWRP Vision, and Goals
- Reduce Risk to Communities
- Improve Performance of Water Resource System Infrastructure
- Does Not Cause Harm to Overburdened Communities
- Technical Feasibility
- Address Acute or Chronic Issues

**Prioritization Criteria**

- Cost and Benefits
- Funding Availability
- Regulatory / Permitting Complexity
- Political / Policy Feasibility
- Committed Leadership
- Achieve Equitable Outcomes
- Achieve Multiple Benefits
- Adaptable to Climate Uncertainty

## Adaptation Strategies and Actions

In the sections that follow, each strategy advances specific actions, which presented with a clear, an overview of which climate hazards each strategy responds to, how implementation can be tracked and measured, and what equity and co-benefits it provides. Each action is then detailed in tabular form, outlining its implementation timeframe, lead and partner agencies, project scale, type of action, and the water-resource systems affected. Actions are categorized by both scale (asset-level to watershed-wide) and type (governance, funding, projects, operations, studies, and programs) to clarify who leads implementation, where change occurs, and how actions function within the broader resilience portfolio (see Figure 42 for an overview). This framework also distinguishes short- and long-term timeframes (roughly 0-7 years and 7+ years, respectively), helping partners sequence near-term capacity-building efforts alongside longer-term capital and ecosystem investments. While each action is organized within a primary category, many span multiple scales and types.

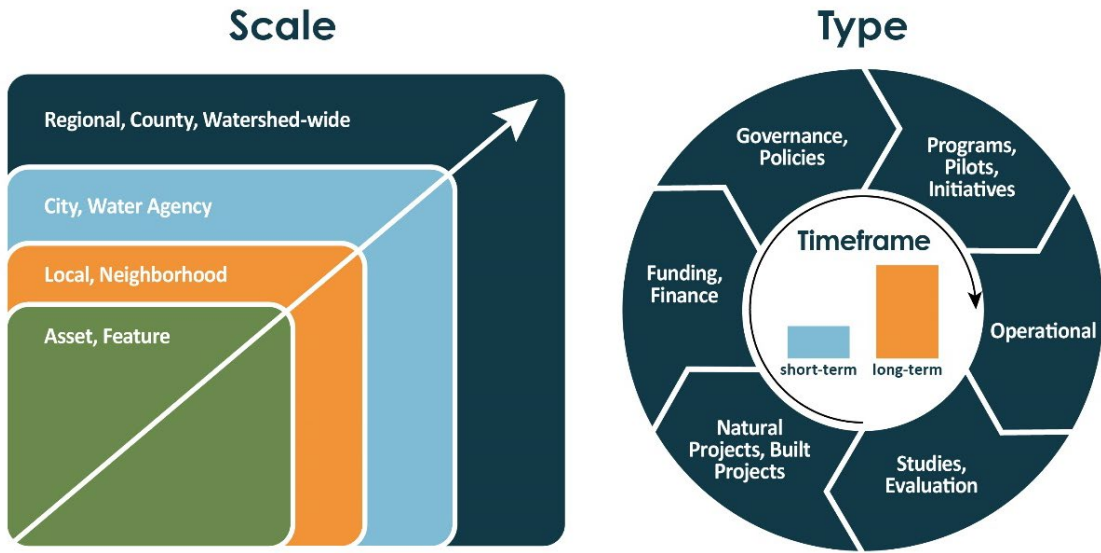
Although this chapter outlines a comprehensive set of strategies and actions, the VRWRP does not include cost information or cost estimates for all actions. Given the complex and multi-faceted and uncertain nature of the proposed adaptation strategies and actions, it was not feasible to include a full cost analysis but will be developed during implementation, when project scale and design are more defined. The Implementation Roadmaps do incorporate preliminary funding considerations (i.e. potential sources or mechanisms for funding) for a subset of priority actions, and a key next step in advancing the VRWRP will be to extend similar cost and funding assessments to the remaining actions.

To help provide context on potential order-of-magnitude costs, recent proposals and implementation experience in the watershed offer illustrative benchmarks. For example, Ojai Valley Land Conservancy's proposed Ventura River Watershed Riparian Resilience Program estimates approximately \$7.8 million for full-watershed invasive species removal and riparian restoration, covering work across an 800-acre project area and roughly 100 acres of *Arundo donax* removal, including early detection rapid response (EDRR), permitted monitoring, surveys and treatment, native plant restoration, and regulatory compliance (Strategy 1.3.a, detailed below). Based on comparable project experience in the Santa Clara River, monitoring and removal alone can cost on the order of \$25,000 per acre, or approximately \$2.5 million for 100 acres of removal, with the remainder associated with EDRR, planting, and permitting. These example costs illustrate the scale of investment required for watershed-wide actions and underscore the need for phased implementation, collaborative funding, and dedicated long-term financial planning as VRWRP actions move toward implementation.



Actions selected for Implementation Roadmap development are marked with a star in the strategy tables that follow. Figure 43 provides an overview of the full set of goals and strategies.

Figure 42 Action Scale and Type



## Figure 43 Goals and Strategies

### **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

## Strategy 1.1: Restore and Protect Native Forest, Woodland, and Upland Ecosystems

**Hazards Addressed:** Drought; Extreme heat; Extreme precipitation & flooding; Wildfire

**Potential Implementation Metrics:** Acres of upland and transitional habitat restored or maintained; Acres treated with prescribed fire, cultural burning, or targeted grazing; Reduction in fine-fuel loads; Time from disturbance event to treatment initiation (rapid response); Number of MOUs/agreements/protocols executed

**Anticipated Equity Benefits:** Sustainable green employment opportunities; Centers Tribal engagement and cultural resource protection

**Identified Co-benefits:** Erosion and sedimentation control; Improved water quality and supply; Improved soil health, Carbon sequestration, Increased biodiversity and wildlife corridors; Reduced disaster risks (floods, landslides, wildfire); Improved recreation

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>1.1.a Identify, restore, and maintain priority upland and transitional habitats, including native forest and woodland,</b> to improve ecosystem resilience to drought, wildfire, and other climate hazards through invasive species and weed removal and native revegetation. Focus on fire-impacted and erosion-prone areas, historic grazing lands, and agricultural lands taken out of production and prioritize hiring local restoration crews.</p>	<p><b>Potential Lead(s):</b> Ventura County Resource Conservation District (VCRCO)  <b>Partners:</b> California Department of Fish and Wildlife (CDFW); U.S. Fish and Wildlife Service (USFWS); Ojai Valley Land Conservancy (OVLC); Ventura Land Trust (VLT); CA State Parks; Los Padres National Forest (LP National Forest)</p>	<p><b>Timeframe:</b> Long-term</p>	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Natural Projects, Built Projects</p>	<p>Ecosystems; Flood management</p>
<p><b>1.1.b Implement prescribed fire, Tribal-led cultural burning, and targeted prescribed grazing</b> to reduce invasive annual grasses, weeds, and other fine fuels, enhance soil nutrient cycling, and support regeneration of native species. <b>Work with Tribal partners to integrate indigenous science</b> and prioritize sites that would reduce wildfire and post-erosion risks for sacred sites, ceremonial areas, and cultural-use landscapes. Integrate pre- and post-burn monitoring and follow-up invasive control where needed.</p>	<p><b>Potential Lead(s):</b> County of Ventura – WPD  <b>Partners:</b> Barbareño/Ventureño Band of Mission Indians (BVBMI); Native Coast Action Network (NCAN); LP National Forest; CDFW; CA State Parks; County of Ventura; VCRCO; OVLC; Ojai Valley Fire Safe Council</p>	<p>Short-term</p>	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Natural Projects, Built Projects</p>	<p>Ecosystems; Cultural resources; Flood management</p>

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>1.1.c</b> Following wildfire <b>implement rapid-response removal efforts and targeted restoration using local restoration crews</b> to maintain native vegetation structure, including in native forest and woodland areas. Prioritize high-risk destabilized slopes, aspects, and previously burned areas where regeneration is slow, using invasive-grass suppression, erosion control, native seeding, and vegetation management.</p>	<p><b>Potential Lead(s):</b> VCRCD County of Ventura – WPD  <b>Partners:</b> VLT; LP National Forest; CA State Parks; City of Ventura; OVLC</p>	<p>Long-term</p>	<p><b>Scale:</b> Local, Neighborhood   <b>Type:</b> Operational; Natural Projects, Built Projects</p>	<p>Ecosystems; Flood management</p>
<p><b>1.1.d</b> Develop management plans that: (1) <b>reduce erosion</b> through drainage improvements, slope stabilization, and post-fire treatments; (2) <b>reduce wildfire severity</b> through vegetation and fuel -management; and (3) <b>control invasive species spread</b> through coordinated surveys, removal, and follow-up monitoring.</p>	<p><b>Potential Lead(s):</b> LP National Forest  <b>Partners:</b> OVLC; VLT; County of Ventura; CA State Parks; CDFW</p>	<p>Short-term</p>	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Governance, Policies</p>	<p>Ecosystems; Flood management; Water quality</p>

Goal 1: Ecosystem Health is Strengthened Watershed-Wide

## Strategy 1.2: Improve Soil Health Across the Watershed

**Hazards Addressed:** Drought; Extreme heat; Extreme precipitation & flooding

**Potential Implementation Metrics:** Number of green-infrastructure or LID retrofits installed; Reduction in peak flows and runoff volume at hotspots; Area of impervious surface converted to permeable materials; Acres of land conserved or protected through acquisitions or easements; Improvement in soil-health indicators on conserved or restored lands

**Anticipated Equity Benefits:** Improves access to safe recreation and cooling in heat-burdened areas;

**Identified Co-benefits:** Urban heat-island mitigation and air-quality benefits; Habitat and biodiversity gains; Recreation and public health benefits; Reduced erosion and sedimentation impacts on infrastructure

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>1.2.a Expand flow-conditioned infiltration and green-infrastructure projects in areas where they can most effectively support instream flows,</b> guided by technical toolkits and plans such as the Ventura River Instream Flow &amp; Water Resilience Framework and Toolkit, municipal stormwater technical guidance manuals, and watershed management plans. Use complementary tools (such as the Integrated Water Strategies Toolkit Quantification) to identify locations with strong potential for runoff reduction, water-quality improvement, and infiltration to maximize any potential recharge benefits. Prioritize projects in overburdened communities and areas contributing to downstream instream stress.</p>	<p><b>Potential Lead(s):</b> County of Ventura; City of Ventura  <b>Partners:</b> VCRCD; City of Ojai; Community-Based Organizations involved in watershed stewardship, habitat restoration, environmental justice; commercial-center owners, redevelopment partners; OVLC</p>	Short-term	<p><b>Scale:</b> City, Water Agency; Local, Neighborhood  <b>Type:</b> Natural Projects, Built Projects</p>	Ecosystems; Flood management; Water quality; Groundwater management
<p><b>1.2.b Expand funding, incentives, and retrofit programs for permeable surfaces, climate-appropriate landscaping, and reduced hardscape in existing developed areas.</b> Prioritize voluntary retrofits of older neighborhoods and commercial corridors, with a focus on reducing heat-island effects, improving water quality, and enhancing urban habitat, with consideration for any potential recharge benefits. Target investments to heat-burdened, low tree-canopy, and overburdened communities, and identify sustained funding mechanisms to scale green infrastructure implementation beyond what is currently required under MS4 permits.</p>	<p><b>Potential Lead(s):</b> County of Ventura; City of Ventura  <b>Partners:</b> VCRCD; City of Ojai</p>	Short-term	<p><b>Scale:</b> City, Water Agency  <b>Type:</b> Programs, Pilots, Initiatives</p>	Ecosystems; Flood management; Water quality; Groundwater management

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>1.2.c</b> Advance land stewardship and conservation by <b>protecting high-value lands that support critical soil-health, hydrologic, ecological, and cultural functions through acquisitions and easements, and by restoring degraded lands through targeted, adaptive management.</b> To guide long-term conservation and restoration investments, identify and prioritize parcels that provide significant watershed or habitat benefits, or exhibit high erosion-reduction potential (such as steep or highly erodible slopes, areas with active sediment loss, or locations with degraded soils).</p>	<p><b>Potential Lead(s):</b> OVLC; VLT  <b>Partners:</b> VCRCD; BVBMI; NCAN</p>	<p>Long-term</p>	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Governance, Policies</p>	<p>Water supply; Ecosystems; Cultural resources</p>

Goal 1: Ecosystem Health is Strengthened Watershed-Wide


## Strategy 1.3 Restore Riparian Corridors and Enhance Habitat Connectivity

**Hazards Addressed:** Drought; Extreme precipitation & flooding; Wildfire

**Potential Implementation Metrics:** Acres of invasive species removed; Reduction in *Arundo* cover or regrowth; Acres of upland and transitional habitat restored or maintained; Increase in connected habitat corridors or linear miles of functional connectivity restored; Increase in native riparian canopy cover or shading; Reduction in bank-erosion rates at treated sites; Miles of floodplain or riparian habitat reconnected or restored

**Anticipated Equity Benefits:** Improves Tribal access to culturally significant aquatic species, riparian vegetation, and riverine habitats

**Identified Co-benefits:** Habitat and biodiversity gains; Reduced erosion and sedimentation impacts on infrastructure; Reduced water consumption by invasive plants and increased streamflows; Improved water quality and nutrient cycling; Reduced wildfire risk and restored natural fuelbreaks of riparian areas

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>1.3.a</b>  <b>Scale up watershed-scale removal and eradication of erosion-prone and water intensive invasive species that thrive under changing climate conditions, such as <i>Arundo donax</i>, using VCRCD's programmatic permits to expedite implementation. Prioritize upstream-to-downstream removal to prevent reinfestation, stabilize treated and fire-impacted banks with native riparian vegetation, and apply natural or engineered bio-stabilization techniques to reduce erosion, improve water quality, and prevent undercutting during high-flow events. <b>Monitor restored reaches to ensure long-term habitat recovery, increased shading, and reduced water loss.</b></b></p>	<p><b>Potential Lead(s):</b> OVLC; County of Ventura – WPD; VCRCD  <b>Partners:</b> OVLC; VLT; CA State Parks; Casitas Municipal Water District (Casitas MWD); Ventura River Water District (VRWD); Ventura River Groundwater Sustainability Agency (VRGSA); Surfrider; licensed vegetation-management and restoration contractors; local native-plant nurseries/seed suppliers; willing private riparian landowners; local trail stewardship groups</p>	Short- to long-term	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Natural Projects, Built Projects</p>	Ecosystems; Water supply; Water quality; Groundwater management

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>1.3.b Identify, restore, protect, and maintain priority transitional upland–riparian buffer habitats</b>, including Matilija Canyon, Upper San Antonio Creek, Coyote Creek tributaries, to <b>enhance wildlife movement, riparian shading, and long-term stewardship of riparian corridors</b>. Focus efforts where wildfire, erosion, or invasive species have reduced buffer function, and coordinate with landowners and Tribal partners to support stewardship of culturally significant ecological areas and resources within these corridors.</p>	<p><b>Potential Lead(s):</b> OVLC; VLT  <b>Partners:</b> U.S. Forest Service (USFS); VCRCD; BVBMI; NCAN; Casitas MWD; VRWD; VRGSA</p>	<p>Short-term</p>	<p><b>Scale:</b> Asset, Feature   <b>Type:</b> Studies, Evaluation; Natural Projects, Built Projects</p>	<p>Ecosystems; Cultural resources; Water quality</p>
<p><b>1.3.c Plan and implement wildlife and plant movement corridors along riparian corridors, tributaries, and upland ecotones</b> to maintain genetic flow, climate-driven species movement, and access to water during drought. Prioritize connectivity in infrastructure design, land management plans, and post-fire, flood-risk, and habitat-restoration planning, using tools such as conservation easements, wildlife-friendly crossings, and corridor restoration to create continuous pathways linking the upper watershed, riparian zones, and coastal areas.</p>	<p><b>Potential Lead(s):</b> VCRCD  <b>Partners:</b> CDFW; USFWS; OVLC; VLT; CA State Parks; LP National Forest; Casitas MWD; VRWD; VRGSA</p>	<p>Short-term</p>	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Natural Projects, Built Projects</p>	<p>Ecosystems</p>

Goal 1: Ecosystem Health is Strengthened Watershed-Wide

## Strategy 1.4 Enhance Aquatic Ecosystems and Steelhead Resilience

**Hazards Addressed:** Drought; Extreme heat, Extreme precipitation and flooding

**Potential Implementation Metrics:** Acres of mapped and protected aquatic cold-water and climate refugia; Number of aquatic invasive-species treatment sites; Reduction in aquatic invasive species abundance; Number of coordinated removal campaigns implemented; Miles of stream or habitat reopened to steelhead following barrier removal; Improvement in upstream habitat accessibility or quality

**Anticipated Equity Benefits:** Improves Tribal access to culturally significant aquatic species, riparian vegetation, and riverine habitats; Supports Tribal stewardship priorities through restoration of ecological functions essential to cultural practices

**Identified Co-benefits:** Habitat and biodiversity enhancements

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>1.4.a Identify, map, protect, and restore cold-water and climate refugia</b> (including north-facing slopes, shaded canyons, perennial pools, spring-fed reaches, and off-channel habitats) that buffer species from drought-reduced streamflows, extreme-heat-driven water-temperature increases, and flow intermittency now occurring in historically perennial reaches. Use climate, hydrologic, and habitat data to locate priority refugia and implement targeted actions such as riparian shading restoration, vegetation management, habitat connectivity improvements, and pool-stabilization measures to support species like steelhead whose migration cues and habitat availability are increasingly disrupted by warming streams and altered flow timing. Align implementation with ongoing instream-flow planning and outcomes of the Ventura River adjudication to ensure consistency with the watershed’s long-term water-management “physical solution.”</p>	<p><b>Potential Lead(s):</b> VCRCO  <b>Partners:</b> CDFW; USFWS; National Oceanic and Atmospheric Administration (NOAA) Fisheries; OVLC; VLT; CA State Parks; LP National Forest</p>	Long-term	<p><b>Scale:</b> Regional, County, Watershed-Wide</p> <p><b>Type:</b> Studies, Evaluation; Natural Projects, Built Projects</p>	Ecosystems

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>1.4.b</b> <b>Develop targeted aquatic invasive species removal campaigns</b> to remove species such as green sunfish, bullfrogs, crayfish, and carp, that proliferate under drought, extreme heat, and flood-driven habitat disturbance, and outcompete or prey on native species such as steelhead during warm, low-flow conditions. Partner with the USFWS and CDFW to implement mechanical removal efforts, and pair removal with riparian and instream habitat improvements (coordinated with related riparian restoration actions 1.3.a, 1.3.b, and 1.3.c) that address post-fire sedimentation, reduced shading, and warmer stream temperatures affecting steelhead and other native species. Integrate monitoring to evaluate effectiveness. Coordinate efforts with landowners, USFWS, CDFW, NOAA Fisheries, and Tribal partners.</p>	<p><b>Potential Lead(s):</b> VCRCD  <b>Partners:</b> CDFW; USFWS; NOAA Fisheries; BVBMI; NCAN; OVLC; VLT</p>	<p>Short-term</p>	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Natural Projects, Built Projects</p>	<p>Ecosystems</p>
<p><b>1.4.c</b> <b>Support coordinated planning, permitting, and implementation efforts to remove Matilija Dam</b>, restoring steelhead access to habitats farther upstream and reestablishing natural river processes that are increasingly important as drought reduces seasonal flows, extreme heat elevates water temperatures, post-fire sediment pulses reshape channels, and altered hydrologic cues disrupt steelhead migration and lifecycle timing. Dam removal also reconnects headwater cold-water refugia that help species withstand multi-year droughts and warming stream conditions.</p>	<p><b>Potential Lead(s):</b> County of Ventura – WPD; VCRCD  <b>Partners:</b> CDFW; USFWS; NOAA Fisheries; OVLC; CA State Parks; LP National Forest; Resources Legacy Fund; State Coastal Conservancy; CalTrout; Surfrider Foundation</p>	<p>Long-term</p>	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Governance, policies</p>	<p>Ecosystems;  Flood management;  Groundwater management;  Water supply;  Water quality</p>

Goal 1: Ecosystem Health is Strengthened Watershed-Wide

## Strategy 2.1 Improve Groundwater Basin Understanding and Monitoring

**Hazards Addressed:** Drought; Extreme precipitation & flooding; Extreme heat

**Potential Implementation Metrics:** Acres of non-SGMA groundwater-influenced and surface-water-supported ecosystems assessed; Number of domestic wells mapped or evaluated for drought vulnerability; Reduction in the number of domestic wells at risk during drought; Completion of a countywide drought resilience plan or equivalent guidance; Establishment and operation of a standing county drought and water-shortage task force

**Anticipated Equity Benefits:** Reduces drought, water-shortage, and water-quality risks for domestic well users, including low-income, rural, Tribal, and agricultural communities

**Identified Co-benefits:** Delivers habitat and biodiversity improvements; enhances climate resilience and heat-mitigation through groundwater-supported ecological functions; improves water-quality protection; improves multi-agency coordination and governance efficiency

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>2.1.a</b> Building upon existing efforts at UVRGA and OBGMA, and in accordance with GSP implementation, <b>assess and document non-SGMA groundwater-influenced and surface-water-supported ecosystems</b> in upland, riparian, and transitional areas of the watershed that fall outside formal groundwater basin boundaries or are not fully captured in current GSP monitoring networks. Coordinate with the GSAs to ensure consistency with basin-scale assessments, avoid duplication, and improve understanding of groundwater–ecosystem linkages across the full watershed.</p>	<p><b>Potential Lead(s):</b> VCRCD; OVLC; VLT  <b>Partners:</b> Ojai Basin Groundwater Management Agency (OBGMA); Upper Ventura River Groundwater Agency (UVRGA); CDFW; SWRCB; Ventura County; City of Ventura – Ventura Water; Casitas MWD; MOWD; VRWD; City of Ojai</p>	Short-term	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Studies, evaluation</p>	Ecosystems; Groundwater management
<p><b>2.1.b</b> Leverage UVRGA, OBGMA, the anticipated Ventura County Drought Resilience Plan, and domestic well assessment efforts to <b>map, characterize, and assess risks to domestic well users under drought conditions</b>, with emphasis on overburdened communities, low-income households, rural communities, Tribal residents, and agricultural workers who rely on shallow domestic wells and are disproportionately exposed to drought-related water shortages.</p>	<p><b>Potential Lead(s):</b> OBGMA; UVRGA; VRWD  <b>Partners:</b> Casitas MWD; Meiners Oaks Water District (MOWD); County of Ventura</p>	Short-term	<p><b>Scale:</b> City, Water Agency   <b>Type:</b> Studies, evaluation</p>	Water supply; Groundwater management; Water quality

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>2.1.c</b> Building on the work of the Ventura County Drought Resilience Task Force and anticipated Drought Resilience Plan, <b>develop a plan to improve long-term water resilience for domestic wells and small water systems</b> (prioritizing support for overburdened, low-income, rural, Tribal, and agricultural communities that face the highest risk of drought-related supply interruptions), and establish a County drought and water shortage task force to implement the recommendations of the Drought Resilience Plan, coordinate drought-response actions across agencies, and represent the needs of domestic well users and small water system operators during planning and emergency response within the county’s jurisdiction.</p>	<p><b>Potential Lead(s):</b> County of Ventura  <b>Partners:</b> OBGMA; UVRGA; Casitas MWD; VRWD; MOWD</p>	<p>Short-term</p>	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Studies, Evaluation; Governance, Policies</p>	<p>Water supply; Groundwater management</p>

Goal 2: Water Supply is More Reliable and Water Infrastructure is More Climate-Resilient


## Strategy 2.2 Implement Conjunctive Use and Demand Management

**Hazards Addressed:** Drought; Extreme heat

**Potential Implementation Metrics:** AF of water conserved; Reduced AF of water pumped during low-flow periods; Stabilization of shallow well levels; AF shifted to wet-season supply under conjunctive-use operations; Program participation (number of accounts, acres)

**Anticipated Equity Benefits:** Reduces water insecurity for domestic well users, small water systems, rural communities, and residents; Supports small growers, Tribal communities, and cost-burdened households through tailored participation pathways, incentives, and flexible demand-management options

**Identified Co-benefits:** Climate resilience and public-health benefits from more reliable water supplies during extreme heat and drought; Operational efficiency and coordination gains through integrated conjunctive-use and demand-management frameworks; Habitat and biodiversity improvements

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>2.2.a</b>  Pending the outcome of the adjudication process and aligning with GSPs, <b>utilize a new or existing watershed coalition to serve as a forum for transparent, watershed-wide coordination on water use.</b> Use the forum to support optimization of conjunctive-use and demand-management programs under worsening drought conditions, and help strengthen or expand existing measures such as shifting pumping to high-flow periods, limiting extraction from river-connected wells during drought, and addressing both direct and indirect streamflow-depletion effects, with focused consideration for overburdened communities, small growers, domestic well users, and Tribal and rural communities. The forum should also enhance transparency in water-management decisions by improving information-sharing across agencies and making key water-use data more accessible to the public.</p>	<p><b>Potential Lead(s):</b> UVRGA, OBGMA, City of Ventura – Ventura Water <b>Partners:</b> Casitas MWD; VRWD; MOWD</p>	Short-term	<p><b>Scale:</b> Regional, County, Watershed-Wide</p> <p><b>Type:</b> Governance, Policies</p>	Water supply; Groundwater management; Ecosystems

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>2.2.b Expand and better coordinate residential and municipal water conservation and demand-management programs in areas where additional savings remain achievable,</b> building on existing rebate, turf-replacement, water-wise landscaping, water-use survey, and leak-detection programs. For municipal purveyors, focus on sustaining and enhancing programs already required under the Making Conservation a California Way of Life regulation through long-term funding and targeted equity measures. In parallel, <b>develop a watershed-wide, climate-informed conservation framework for agricultural and commercial users</b> that sets long-term efficiency targets and supports expanded participation through targeted outreach and enhanced incentives for small farms, including flexible demand-management options that allow drought responses to be scaled to user capacity.</p>	<p><b>Potential Lead(s):</b> Casitas MWD; City of Ventura – Ventura Water; VRWD; MOWD</p> <p><b>Partners:</b> OBGMA; UVRGA; VCRCD; Farm Bureau of Ventura County; Ventura County Agricultural Irrigated Lands Group (VCAILG); University of California Cooperative Extension (UCCE); Central Coast Alliance United for a Sustainable Economy (CAUSE)</p>	<p>Short-term</p>	<p><b>Scale:</b> Regional, County, Watershed-Wide</p> <p><b>Type:</b> Programs, Pilots, Initiatives;</p>	<p>Water supply; Groundwater management</p>

**Goal 2: Water Supply is More Reliable and Water Infrastructure is More Climate-Resilient**

## Strategy 2.3 Evaluate and Protect Long-Term Water Supply Reliability

**Hazards Addressed:** Drought; Extreme heat; Extreme precipitation & flooding; Wildfire; Sea-level rise and storm surge

**Potential Implementation Metrics:** Completion of a quantitative climate-change analysis using CMIP6 watershed data supported by interagency workshops to review findings and implications; Development and adoption of climate-informed thresholds; Priority water-supply infrastructure sites assessed for climate resilience; Increase in protective measures implemented at high-risk infrastructure locations; Completion of feasibility assessments or pilot projects for beneficial reuse of OVSD treated effluent

**Anticipated Equity Benefits:** Supports reliable water access for all community members; Supports measures for most at risk infrastructure in overburdened areas of the watershed

**Identified Co-benefits:** Improves interagency coordination; Improves water availability for beneficial uses and users

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>2.3.a</b> Support coordinated hydrologic and climate-resilience studies led by Casitas MWD and the GSAs to <b>evaluate long-term water-supply reliability under changing climate conditions</b> using updated climate data (CMIP6). Studies should assess trends in surface and groundwater storage, inflows, evaporation, sedimentation, and operational performance under future climate scenarios to identify vulnerabilities and inform updates to GSPs, water-management plans, and capital investment decisions, including potential water storage opportunities. Emphasize a collaborative, interagency effort to build shared understanding of climate-change scenarios and implications for the watershed.</p>	<p><b>Potential Lead(s):</b> Casitas MWD; UVRGA  <b>Partners:</b> OBGMA; VRWD; MOWD; City of Ventura – Ventura Water</p>	Short-term	<p><b>Scale:</b> Regional, County, Watershed-Wide  <b>Type:</b> Studies, Evaluation</p>	Water supply; Water quality; Groundwater management

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>2.3.b</b> <b>Develop and update consistent, watershed-wide, climate-informed thresholds</b> that automatically initiate supplemental water supply actions or demand-management measures when hydrologic conditions fall below predetermined reliability benchmarks. These updated and newly-developed thresholds should incorporate the latest CMIP6 climate projections and build on existing drought-response tools already used in the watershed (including tiered pricing tied to Lake Casitas levels, Water Shortage Contingency Plan restrictions, and agency-specific drought-stage triggers) while aligning with analyses and criteria in the GSPs, the Water Management Plan, the Comprehensive Water Resources Report, the Water Efficiency and Allocation Program (WEAP), and Water Shortage Event Contingency Plan (WSECPP).</p>	<p><b>Potential Lead(s):</b> OBGMA; UVRGA  <b>Partners:</b> City of Ventura – Ventura Water; Casitas MWD; VRWD; MOWD; California Department of Water Resources (DWR)</p>	Short-term	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Operational</p>	Water supply; Groundwater management
<p><b>2.3.c</b> <b>Inventory and prioritize water supply infrastructure</b>, such as diversion structures, wells, conveyance systems, or treatment plants, <b>for protective measures to support their ability to withstand threats expected to increase due to climate change</b>, including extreme precipitation and flooding, wildfire, and sea level rise and storm surge. Use this inventory to inform asset management and operations priorities, with emphasis on facilities serving overburdened communities or those whose failure would disproportionately affect overburdened communities.</p>	<p><b>Potential Lead(s):</b> City of Ventura – Ventura Water; Casitas MWD; VRWD; MOWD  <b>Partners:</b> UVRGA; OBGMA; County of Ventura</p>	Short-term	<p><b>Scale:</b> City, Water Agency   <b>Type:</b> Studies, Evaluation</p>	Water supply; Water quality; Flood management
<p><b>2.3.d</b> <b>Evaluate feasible opportunities to beneficially reuse highly treated effluent from the Ojai Valley Sanitary District (OVSD)</b> in lieu of discharging it to the Ventura River. Coordinate with the City of Ventura (consistent with existing agreements) to assess purple-pipe (non-potable) reuse options such as agricultural irrigation, off-channel habitat enhancement (e.g., wetlands or shallow ponds), and other environmentally or community beneficial uses.</p>	<p><b>Potential Lead(s):</b> Ojai Valley Sanitary District (OVSD)  <b>Partners:</b> County of Ventura; City of Ventura – Ventura Water</p>	Short-term	<p><b>Scale:</b> City, Water Agency   <b>Type:</b> Studies, Evaluation</p>	Water supply

**Goal 2: Water Supply is More Reliable and Water Infrastructure is More Climate-Resilient**

## Strategy 3.1 Upgrade and Strategically Relocate Critical Infrastructure Exposed to Sea Level Rise and Flooding


**Hazards Addressed:** Extreme precipitation & flooding; Sea level rise & storm surge

**Potential Implementation Metrics:** Completion of coastal-hazard vulnerability and feasibility assessments for priority shoreline areas; Number of coastal facilities or infrastructure sites relocated, elevated, or adapted out of high-hazard zones; Reduction in exposure of critical water and wastewater infrastructure to coastal flooding, saltwater intrusion, or erosion; Acres of coastal land preserved or transitioned through conservation or rolling easements; Number of flood-prone properties addressed through voluntary non-structural approaches (e.g., acquisition, relocation assistance, land-use transitions)

**Anticipated Equity Benefits:** Maintains safe, reliable water and wastewater access for all communities; Protects coastal access and public amenities relied on by overburdened residents; Reduced flood risk in areas susceptible to flooding

**Identified Co-benefits:** Improves recreation and public-health access by relocating facilities to safer areas; Reduces erosion, sedimentation, and long-term infrastructure damage; Lower long-term maintenance costs

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>3.1.a Relocate coastal trails, restrooms, parking areas, beach access points, and recreation facilities exposed to future erosion and coastal-flood hazard zones</b> to safer inland or elevated locations. Prioritize infrastructure that provides essential coastal access and public safety benefits.</p>	<p><b>Potential Lead(s):</b> CA State Parks; County Parks; City of Ventura  <b>Partners:</b> County of Ventura – WPD; VLT</p>	Long-term	<p><b>Scale:</b> Local, Neighborhood   <b>Type:</b> Natural Projects, Built Projects</p>	Ecosystems
<p><b>3.1.b Evaluate alternatives for relocating, elevating, or armoring the Seaside Transfer Station</b>, which is located just outside the Ventura River Watershed but is critical to regional wastewater system performance and vulnerable to sea level rise, storm surge, and coastal flooding. The evaluation should assess technical feasibility, risk reduction benefits, lifecycle costs, and regulatory considerations, and support identification of funding pathways to advance implementation of this already-planned capital project. Where appropriate, this action may also <b>inform evaluation of other location-specific coastal infrastructure vulnerabilities within or adjacent to the watershed</b> (e.g., water supply or conveyance infrastructure exposed to flooding or erosion).</p>	<p><b>Potential Lead(s):</b> County of Ventura – WPD; City of Ventura  <b>Partners:</b> CA Coastal Commission</p>	Short-term	<p><b>Scale:</b> Asset, Feature   <b>Type:</b> Studies, Evaluation</p>	Water supply; Flood management; Water quality

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p> <b>3.1.c Use the Local Coastal Program’s coastal-hazard zones, sea level rise projections, and shoreline adaptation strategies, along with findings from evaluations conducted as part of action 3.1.b, to guide the hardening, elevation, or relocation of critical water and wastewater infrastructure, prioritizing aging assets and sites with a history of overtopping or saltwater intrusion.</b></p>	<p><b>Potential Lead(s):</b> County of Ventura – WPD and Planning Division; City of Ventura – Ventura Water; Casitas MWD;  <b>Partners:</b> CA Coastal Commission; CA State Parks; Caltrans; Ventura Port District; Surfrider Foundation; local coastal property owners and utility operators (e.g., Southern California Edison (SCE) and Southern California Gas Company (SoCalGas)).</p>	<p>Long-term</p>	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Natural Projects, Built Projects</p>	<p>Water supply; Flood management; Water quality; Groundwater management</p>
<p><b>3.1.d Use voluntary, non-structural flood-risk reduction strategies (such as conservation easements, land-use transitions, relocation assistance, and acquisitions) to reduce long-term flood and coastal-hazard exposure in coastal floodplains.</b> Prioritize areas where sea-level rise and storm surge make long-term development infeasible, as well as flood-prone neighborhoods where chronic flooding disproportionately affects overburdened communities.</p>	<p><b>Potential Lead(s):</b> County of Ventura – WPD; VLT  <b>Partners:</b> City of Ventura; CA Coastal Commission; CA State Parks</p>	<p>Long-term</p>	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Governance, Policies; Programs, Pilots, Initiatives</p>	<p>Flood management, Ecosystems</p>

**Goal 3: Communities, Infrastructure, and Ecosystems are Protected from Erosion, Flooding, and Shoreline Change Driven by SLR and Storm Surge**

## Strategy 3.2 Rely on Nature-Based Solutions to Protect Coastal Infrastructure

**Hazards Addressed:** Extreme precipitation & flooding; Sea level rise & storm surge

**Potential Implementation Metrics:** Acres or linear feet of dunes, cobble berms, or nature-based shoreline features restored or enhanced; Reduction in shoreline erosion or storm-damage indicators at treated sites; Number of coastal infrastructure assets protected or buffered through nature-based or hybrid solutions; Increase in vegetated or stabilized shoreline areas that improve habitat and public access; Number of adaptation actions reviewed for and found consistent with Local Coastal Program (LCP) coastal-hazard policies

**Anticipated Equity Benefits:** Reduced disruption of essential coastal infrastructure (pump stations, parking, restrooms, beach access) used by community members; Improved safety and reliable access to coastal areas for community members who depend on shoreline spaces for cooling, recreation, and stress-relief during extreme heat or poor air-quality days

**Identified Co-benefits:** Habitat and biodiversity improvements; Recreation and public health benefits; Reduced erosion and sedimentation impacts on infrastructure; Lower long-term maintenance costs; Ecosystem-service benefits

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<b>3.2.a</b> Where land use and geomorphology allow, <b>expand nature-based shoreline resilience strategies including dune stabilization, revegetation, and hybrid sediment-based solutions</b> in and around open space and parks near the mouth of the Ventura River to reduce coastal flooding, buffer storm surge, and protect public access. Use lessons learned from the Surfers Point Managed Shoreline Retreat Project to guide design and implementation.	<b>Potential Lead(s):</b> County of Ventura – WPD; City of Ventura <b>Partners:</b> City of Ojai; VLT; CA State Parks	Long-term	<b>Scale:</b> Asset, Feature  <b>Type:</b> Natural Projects, Built Projects	Ecosystems; Flood management; Water quality; Cultural resources
<b>3.2.b</b> <b>Implement or expand dunes, cobble berms, vegetated buffers, or hybrid nature-based features to protect vulnerable coastal pump stations, wastewater infrastructure, parking lots, roadways, and recreation facilities</b> from sea level rise and storm surge-driven erosion if feasible.	<b>Potential Lead(s):</b> County of Ventura – WPD; City of Ventura <b>Partners:</b> Caltrans (State Routes 33/150); OVSD; Regional Water Quality Control Board (RWQCB) Region 4 (Los Angeles); VLT; Ventura County Fairgrounds; State Parks	Long-term	<b>Scale:</b> Asset, Feature  <b>Type:</b> Natural Projects, Built Projects	Flood management; Water quality; Ecosystems

Goal 3: **Communities, Infrastructure, and Ecosystems are Protected from Erosion, Flooding, and Shoreline Change Driven by SLR and Storm Surge**


## Strategy 4.1 Upgrade Flood, Stormwater, and Wastewater Management Infrastructure

**Hazards Addressed:** Extreme precipitation & flooding; Wildfire; Sea level rise & Storm surge

**Potential Implementation Metrics:** Number of priority flood assets upgraded; Reduction in peak flows and runoff volume at hotspots; Cubic yards of sediment/debris managed; Number of operational resilience measures installed at priority infrastructure; Number of levee certifications completed

**Anticipated Equity Benefits:** Reduces flood and infrastructure-failure risks for overburdened and low-income communities; protects public health by improving resilience of wastewater and stormwater systems during extreme events; reduces disproportionate exposure to flood, debris-flow, and post-fire hazards; and prioritizes upgrades in neighborhoods historically under-served by infrastructure investment.

**Identified Co-benefits:** Habitat and biodiversity gains; Groundwater recharge and baseflow support; Reduced erosion and sedimentation impacts on infrastructure

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>4.1.a</b>  <b>Analyze how projected climate impacts</b> (such as higher peak flows, increased sediment and debris transport, wildfire burn-scar runoff, and prolonged inundation) <b>will affect flood-control facilities, municipal stormwater systems, and centralized wastewater infrastructure.</b> Identify where systems may be exceeded under future conditions and prioritize adaptation needs such as structural upgrades, sediment-removal programs, capacity expansions, asset protection, operational improvements, and emergency-preparedness measures, with emphasis on facilities serving overburdened communities.</p>	<p><b>Potential Lead(s):</b> County of Ventura – WPD; City of Ventura  <b>Partners:</b> County of Ventura; City of Ojai; OVSD; VCRCD; Caltrans; local utility operators (e.g., SCE, SoCalGas); County of Ventura (Economic Development); Ventura Chamber of Commerce; Ojai Valley Chamber of Commerce</p>	Short-term	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Studies, Evaluation</p>	Flood management; Water quality

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<b>4.1.b</b> Using findings from Action 4.1.a, <b>upgrade, enlarge, or retrofit flood management infrastructure</b> , including diversion structures, detention and debris basins, flood-control channels, culverts, and high-flow conveyance systems, to better accommodate more intense precipitation, debris flows, and post-fire flash-flood conditions. Incorporate design features that also enhance groundwater recharge where feasible, such as modifying basins or conveyance systems to increase infiltration and reduce stormwater loss. Prioritize assets with documented overtopping, sediment blockage, debris-flow vulnerability, or whose failure would disproportionately impact overburdened communities.	<b>Potential Lead(s):</b> County of Ventura – WPD; City of Ventura <b>Partners:</b> City of Ojai	Long-term	<b>Scale:</b> Regional, County, Watershed-Wide  <b>Type:</b> Natural Projects, Built Projects	Flood management; Water quality; Groundwater management
<b>4.1.c</b> Using findings from Action 4.1.a, <b>implement targeted upgrades to municipal stormwater infrastructure</b> , including storm drains, culverts, outfalls, and stormwater conveyance systems, to accommodate projected increases in rainfall intensity, debris loads, and post-fire runoff. Coordinate improvements with floodplain-reconnection, green-infrastructure, and sediment-management strategies where feasible to reduce flood risk and improve water quality.	<b>Potential Lead(s):</b> County of Ventura – WPD; City of Ventura <b>Partners:</b> City of Ojai; Caltrans (State Routes 33/150)	Long-term	<b>Scale:</b> Asset, Feature  <b>Type:</b> Natural Projects, Built Projects	Flood management; Water quality
<b>4.1.d</b> Using findings from Action 4.1.a, <b>upgrade, relocate, flood-proof, or provide redundancy for centralized wastewater facilities, collection systems, pump stations, and other critical components</b> located in flood- or erosion-prone areas. Implement operational resilience measures, including backup power, bypass controls, and emergency-response protocols, to maintain service and reduce public-health risks during extreme events.	<b>Potential Lead(s):</b> OVSD; City of Ventura <b>Partners:</b> County of Ventura – WPD; City of Ojai; RWQCB Region 4 (Los Angeles)	Long-term	<b>Scale:</b> Asset, Feature  <b>Type:</b> Operational; Natural Projects, Built Projects	Flood management; Water quality, Water supply
<b>4.1e</b> <b>Assess levee conditions and complete state and federal certifications to reduce flood risk and accommodate increasing storm flows anticipated from climate change.</b> Prioritize levees that protect overburdened communities and low-income agricultural areas. Supplement FEMA flood modeling with climate-adjusted hydrologic analyses and update design standards to reflect future flood conditions.	<b>Potential Lead(s):</b> County of Ventura – WPD; City of Ventura <b>Partners:</b> City of Ojai	Short-term	<b>Scale:</b> City, Water Agency  <b>Type:</b> Studies, Evaluation	Flood management

Goal 4: Flood and Erosion Risks to Communities, Infrastructure, Water Quality, and Ecosystems from Extreme Precipitation are Minimized

## Strategy 4.2 Enhance Erosion Control, Sediment Management, and Floodplain Function

**Hazards Addressed:** Extreme precipitation & flooding; Wildfire

**Potential Implementation Metrics:** Reduction in sediment and debris loads at priority hotspots; Miles of floodplain or riparian habitat reconnected or restored; Number of engineered or nature-based stabilization sites implemented and maintained; Reduction in bank-erosion rates at treated sites; Adoption of shared, cross-jurisdictional streambank and erosion-management guidelines

**Anticipated Equity Benefits:** Reduces flood and erosion risks for overburdened and rural/agricultural communities

**Identified Co-benefits:** Enhances habitat and biodiversity; Reduces sediment impacts on infrastructure; Strengthens climate resilience through restored floodplains and stabilized channels

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>4.2.a</b> <b>Implement a coordinated, watershed-wide sediment-management framework to guide where and how sediment-reduction interventions occur.</b> This includes upstream sediment capture, strategic sediment release (where ecologically beneficial), and post-fire sediment and debris protocols. Identify and catalogue sediment-generation and deposition hotspots to inform prioritization, and use shared sediment-transport data and consistent design assumptions to avoid downstream or opposite-bank impacts. Integrate and build on sediment analyses prepared for the Matilija Dam removal to support coordinated implementation.</p>	<p><b>Potential Lead(s):</b> County of Ventura – WPD  <b>Partners:</b> City of Ojai; City of Ventura</p>	Short-term	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Operational; Studies, Evaluations</p>	Flood management; Water quality
<p><b>4.2.b</b> Guided by the framework and findings from 4.2.a, <b>apply site-specific stabilization treatments to redirect flows, reduce sediment input, and protect natural features and infrastructure.</b> Treatments could include flow deflectors, rock vanes, or rootwad revetments. Use monitoring results to target interventions at the most active or vulnerable locations and to support ongoing, adaptive management across the watershed and, if necessary, to promote land acquisition/conservation of river bottom parcels.</p>	<p><b>Potential Lead(s):</b> County of Ventura – WPD  <b>Partners:</b> City of Ojai; City of Ventura; VCRCD; OVLC; VLT</p>	Long-term	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Natural Projects, Built Projects</p>	Flood management; Water quality

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<b>4.2.c</b> <b>Facilitate floodplain inundation on parcels adjacent to over-constrained river and creek reaches</b> , where feasible, by increasing storage capacity and restoring riparian and wetland habitats on parcels that commonly flood. These actions can reduce flood velocities and deliver ecological benefits, with groundwater-recharge benefits realized in locations where site conditions support them.	<b>Potential Lead(s):</b> County of Ventura – WPD; VCRCD <b>Partners:</b> City of Ventura; City of Ojai; OVLC; VLT; Groundwater Sustainability Agencies (GSAs)	Long-term	<b>Scale:</b> Regional, County, Watershed-Wide  <b>Type:</b> Natural Projects, Built Projects	Ecosystems; Flood management; Groundwater management
<b>4.2.d</b> <b>Develop a coordinated approach to streambank and erosion management</b> by establishing shared design guidelines, consistent stabilization standards, and a collaborative process for prioritizing and reviewing projects across jurisdictions. Enable agencies, landowners, and partners to align efforts, reduce reactive and piecemeal interventions, and address cross-bank and downstream impacts more effectively.	<b>Potential Lead(s):</b> County of Ventura – WPD; City of Ventura <b>Partners:</b> City of Ojai; VCRCD; OVLC; VLT; CA State Parks; LP National Forest	Short-term	<b>Scale:</b> Regional, County, Watershed-Wide  <b>Type:</b> Governance, Policies	Flood management
<b>4.2.e</b> <b>Use nature-based solutions and other non-structural flood-risk reduction strategies to reduce long-term flood exposure for communities, resources, and infrastructure in floodplains</b> , such as flood easements, land acquisitions, zoning updates, or development controls. Prioritize flood-prone neighborhoods where chronic flooding disproportionately affects overburdened communities.	<b>Potential Lead(s):</b> County of Ventura – WPD; City of Ventura; City of Ojai <b>Partners:</b> VCRCD; OVLC; VLT	Long-term	<b>Scale:</b> Regional, County, Watershed-Wide  <b>Type:</b> Governance, Policies	Flood management
<b>4.2.f</b> <b>Evaluate opportunities to enhance infiltration of increased runoff from extreme precipitation</b> in hydrogeologically suitable areas (e.g., upper-watershed alluvial fans), where increased recharge would be feasible and beneficial.	<b>Potential Lead(s):</b> UVRGA; OBGMA <b>Partners:</b> County of Ventura	Short-term	<b>Scale:</b> Watershed-Wide	Water supply; Groundwater management; Flood management; Water quality; Ecosystems

Goal 4: Flood and Erosion Risks to Communities, Infrastructure, Water Quality, and Ecosystems from Extreme Precipitation are Minimized

## Strategy 4.3 Manage Septic and Wastewater Risks on Water Quality

**Hazards Addressed:** Extreme precipitation & flooding, Sea level rise & storm surge

**Potential Implementation Metrics:** Reduction in pollutant concentrations at compliance/target sites; Improved water quality conditions downstream of conversions; Number of septic-to-sewer conversions, especially in overburdened communities and other high-risk areas of the lower watershed

**Anticipated Equity Benefits:** Reduces septic-related contamination risks for overburdened and flood-prone communities; Improves safety for households near streams, shallow groundwater, and drinking-water wells; Supports access to reliable wastewater services

**Identified Co-benefits:** Improves recreation and public health conditions by reducing pathogen and nutrient pollution in waterways

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>4.3.a</b> Conduct watershed-wide assessments to identify areas where septic systems pose elevated risks to water quality due to shallow groundwater, flood exposure, proximity to streams or wells, or high septic system density. Prioritize locations for coordinated septic-to-sewer conversions, with a focus on overburdened, flood-prone, stream-adjacent communities, and coordinate with LAFCo and County planning departments to ensure that priority areas can be served without creating growth-inducing sewer extensions. Build on and update the septic/onsite wastewater treatment system hotspot analyses generated through the State Water Resources Control Board Groundwater–Surface Water Model for the Ventura River Watershed, which included a forensic study to prioritize high-risk onsite wastewater treatment system areas.</p>	<p><b>Potential Lead(s):</b> Ventura County (Watershed Protection/Public Works/ Environmental Health Division)  <b>Partners:</b> City of Ventura; City of Ojai; OVSD; RWQCB Region 4 (Los Angeles)</p>	Short-term	<p><b>Scale:</b> Regional, County, Watershed-Wide  <b>Type:</b> Studies, evaluation</p>	Water quality; Groundwater management
<p><b>4.3.b</b> Using the assessments from 4.3.a, <b>implement septic-to-sewer conversions in overburdened communities and other prioritized areas</b>, including North Rice Road, Trusty Lane, and Casitas Springs. Develop these projects in close collaboration with OVSD, Ventura County, Ventura LAFCo, and the Regional Water Quality Control Board to ensure that sewer extensions, designs, and phasing align with water-quality objectives, community needs, and long-term asset management.</p>	<p><b>Potential Lead(s):</b> Ventura County (Watershed Protection/Public Works/ Environmental Health Division); OVSD  <b>Partners:</b> City of Ventura; City of Ojai; RWQCB Region 4 (Los Angeles)</p>	Short- to long-term	<p><b>Scale:</b> Local, Neighborhood  <b>Type:</b> Natural Projects, Built Projects</p>	Water quality; Groundwater management

Goal 4: Flood and Erosion Risks to Communities, Infrastructure, Water Quality, and Ecosystems from Extreme Precipitation are Minimized

## Strategy 5.1 Build Climate-Adaptive, Multi-Functional Public Spaces

**Hazards Addressed:** Extreme heat; Extreme precipitation & flooding; Wildfire

**Potential Implementation Metrics:** Acres of flood-adaptive parks or open spaces designed or retrofitted; Number of floodplain parks implementing Flood Operations & Public Safety Plans; Number of culturally focused or community-led spaces or programs created in partnership with Tribes and local organizations

**Anticipated Equity Benefits:** Expanded access to safe, climate-adaptive parks for all community members; Improved public safety for overburdened individuals in flood-prone areas

**Identified Co-benefits:** Heat-exposure reduction in developed or low-canopy areas and cooling benefits; Improved riparian and upland habitat quality; Enhanced recreation, public health, and community-wellbeing outcomes; Strengthened cultural connections and stewardship across communities and Tribes

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>5.1.a Retrofit existing parks and public open spaces</b> within mapped floodplains and wildfire hazard areas to safely accommodate climate hazards using materials, layouts, and native vegetation that can withstand periodic flood inundation and wildfire exposure, including Foster Park and Camp Comfort. Prioritize fire-resilient design features such as ignition-resistant structures, defensible-space layouts, and native, fire-adapted plant palettes. Prioritize locations in overburdened communities and where mapped heat-burdened, low-canopy conditions heighten the need for safe, climate-adaptive public spaces.</p>	<p><b>Potential Lead(s):</b> County Parks; State Parks  <b>Partners:</b> OVLC; VLT; USFS; City of Ventura - Ventura Water; VCRCD; CDFW; USFWS</p>	Long-term	<p><b>Scale:</b> Asset/Feature  <b>Type:</b> Studies, Evaluation; Natural Projects, Built Projects</p>	Ecosystems; Flood management
<p><b>5.1.b Develop and implement Flood Operations &amp; Public Safety Plans for floodplain parks, river access points, and trails</b>, including Foster Park and Camp Comfort. Identify closure protocols, signage, and emergency communication procedures that are culturally responsive and available in the primary languages spoken in surrounding communities. Coordinate with the Watershed Protection District and relevant public agencies to identify and implement longer-term strategies that address safety risks associated with encampments in flood-prone areas and support the relocation of vulnerable individuals out of hazardous zones.</p>	<p><b>Potential Lead(s):</b> County of Ventura – WPD; County Parks  <b>Partners:</b> City of Ventura; City of Ojai; OVLC; VLT; CA State Parks</p>	Short-term	<p><b>Scale:</b> Asset/Feature  <b>Type:</b> Operational; Studies, Evaluation</p>	Flood management

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>5.1.c Support opportunities for cultural, spiritual, and community-based connection</b> to watershed landscapes, recognizing the emotional and cultural impacts of environmental change, loss, and disruption from climate change. <b>Create and enhance spaces for reflection, education, and healing</b> that acknowledge environmental grief, foster stewardship, and strengthen relationships between people and place, such as interpretive areas, quiet-use zones, art installations, storytelling, and community-led programming. Prioritize inclusive engagement and co-creation with local communities, Tribes, artists, educators, and cultural practitioners, particularly in areas where communities have experienced repeated climate, wildfire, flood, or displacement impacts.</p>	<p><b>Potential Lead(s):</b> County of Ventura; BVBMI; Santa Ynez Band of Chumash Indians; Coastal Band of the Chumash Nation; NCAN  <b>Partners:</b> City of Ventura; CA State Parks; City of Ojai; OVLC, VLT</p>	<p>Long-term</p>	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Programs, Pilots, Initiatives</p>	<p>Cultural resources</p>

**Goal 5: Recreational Access for Community Enjoyment is Protected and Enhanced**

## Strategy 5.2 Enhance Recreation Management and Protect Sensitive Habitats


**Hazards Addressed:** Drought; Extreme heat; Extreme precipitation & flooding

**Potential Implementation Metrics:** Increase in tree-canopy coverage in priority low-canopy neighborhoods; Number of ADA-accessible and erosion-resilient river access points upgraded; Number of recreation management plans completed or implemented; Reduction in erosion or water-quality impacts at high-use recreation sites

**Anticipated Equity Benefits:** Expanded heat-relief and shaded recreation opportunities for all communities, especially overburdened and heat-burdened communities; Improved safe and accessible river access for residents who rely on low-cost outdoor spaces for cooling, mobility, and recreation

**Identified Co-benefits:** Urban heat-island mitigation and improved public health; Enhanced habitat quality and riparian vegetation protection; Reduced erosion and sedimentation from unmanaged recreation; Increased trail safety, accessibility, and long-term sustainability of high-use areas

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>5.2.a</b> <b>Design and implement a Ventura River Corridor Tree Canopy Expansion Program</b> to increase shade coverage along trails, parks, and river access points using drought-tolerant, native trees, prioritizing mapped low-canopy, high-heat neighborhoods such as Westside Ventura and Oak View where heat relief is a documented equity need. Partner with the City and County agencies to build upon existing active transportation and extreme heat projects.</p>	<p><b>Potential Lead(s):</b> City of Ventura; County of Ventura  <b>Partners:</b> City of Ojai; VCRCD; OVLC; VLT; CalFire Urban Forestry; State Parks; local school districts; CAUSE and other CBOs/Environmental Justice partners</p>	Long-term	<p><b>Scale:</b> Local, Neighborhood  <b>Type:</b> Programs, Pilots, Initiatives; Studies, Evaluation</p>	Ecosystems
<p><b>5.2.b</b> <b>Upgrade and standardize safe, ADA-accessible river access points</b> with clear signage, erosion control, and water safety features to support equitable recreation. Identify and incorporate lessons learned from the OVLC's Old Baldwin Trailhead Project at the Ventura River Preserve.</p>	<p><b>Potential Lead(s):</b> County Parks; CA State Parks;  <b>Partners:</b> City of Ventura; OVLC; VLT</p>	Long-term	<p><b>Scale:</b> Asset, Feature  <b>Type:</b> Natural Projects, Built Projects</p>	Ecosystems

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>5.2.c</b>  <b>Develop and implement site-specific Recreation Management Plans for high-use river areas</b> to balance public access with habitat protection in the face of more extreme precipitation, flooding, heat, and drought, and create or enhance alternative recreation hubs outside sensitive habitats to redistribute visitor pressure. Prioritize designs that protect sensitive vegetation, reduce erosion and water-quality impacts, and improve long-term ecological resilience to climate change while maintaining safe, sustainable access for the community. Leverage success of OVLC’s Ventura River Preserve and incorporate lessons learned in future projects. Ensure public access priorities are incorporated into long-term implementation of the Matilija Dam Ecosystem Restoration Project (MDERP).</p>	<p><b>Potential Lead(s):</b> OVLC; VCRCO  <b>Partners:</b> CDFW; USFWS; NOAA Fisheries; VLT; CA State Parks; LP National Forest; MDERP Partners</p>	<p>Short-term</p>	<p><b>Scale:</b> Asset, Feature   <b>Type:</b> Studies, Evaluation; Natural Projects, Built Projects</p>	<p>Ecosystems</p>

Goal 5: Recreational Access for Community Enjoyment is Protected and Enhanced

## Strategy 6.1 Promote Climate-Resilient and Water Efficient Cropping and Irrigation Systems

**Hazards Addressed:** Drought; Extreme heat

**Potential Implementation Metrics:** Increase in irrigation-efficiency upgrades adopted by growers; AF of water conserved; Number of deficit-irrigation or drought-resilient crop trials completed; Adoption of wildlife-protective irrigation practices

**Anticipated Equity Benefits:** Improved technical assistance and cost-saving opportunities for small growers and cost-burdened agricultural operations;

**Identified Co-benefits:** Reduced groundwater and surface-water demand; Improved ecological conditions through wildlife-protective diversion and irrigation practices; Enhanced soil health and long-term agricultural viability; Enhanced employment stability for farmworker communities through climate-resilient crop transitions

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>6.1.a</b> Advance climate-resilient irrigation practices by <b>expanding irrigation-efficiency programs</b> (e.g., micro-irrigation, soil-moisture sensors, optimized scheduling), <b>piloting deficit-irrigation strategies where agronomically feasible, and implementing wildlife-protective irrigation practices that reduce ecological conflicts during low-flow periods</b>. Provide technical assistance to growers, with a focus on small growers, to improve water-use efficiency, maintain agricultural productivity, and protect instream flows.</p> <p><b>Expand agriculture irrigation-efficiency programs</b> (micro-irrigation, soil moisture sensors, optimized scheduling) and provide technical support to maximize water savings per acre.</p>	<p><b>Potential Lead(s):</b> VCRCDC; UCCE</p> <p><b>Partners:</b> Farmers; Farm Bureau of Ventura County</p>	Short-term	<p><b>Scale:</b> Regional, County, Watershed-Wide</p> <p><b>Type:</b> Programs, Pilots, Initiatives</p>	Water supply; Water quality
<p><b>6.1.b</b> <b>Assess and pilot drought-resilient and lower-water-demand crop transitions</b> through a collaborative process with growers, UC Extension, and technical partners to protect farmer livelihoods in future climate conditions. Conduct agronomic, economic, and market viability evaluations; identify transition pathways that support grower capacity and farmworker employment stability; and pilot transitions on selected fields to evaluate performance and feasibility. Prioritize participation pathways for small growers and use pilot results to guide broader, climate-resilient crop adoption across the watershed.</p>	<p><b>Potential Lead(s):</b> VCRCDC; UCCE</p> <p><b>Partners:</b> Farmers; Farm Bureau of Ventura County</p>	Long-term	<p><b>Scale:</b> Regional, County, Watershed-Wide</p> <p><b>Type:</b> Studies, Evaluation</p>	Water supply; Water quality

**Goal 6: Agricultural Practices Are Adapted to the Effects of Climate Change and Sustain a Thriving Local Economy and Ag-Based Livelihoods**

## Strategy 6.2 Promote Regenerative Agriculture and Soil Health

**Hazards Addressed:** Drought; Extreme heat; Extreme Precipitation & flooding; Sea-level rise and storm surge

**Potential Implementation Metrics:** Number of growers and acres of farmland participating in soil-health and climate-resilient agriculture programs; AF of water conserved; Reduction in pollutant concentrations at compliance/target sites; Number of water-quality standard exceedances at compliance/target sites; Acres of agricultural-lined waterways restored/enhanced

**Anticipated Equity Benefits:** Reduces risk for rural/agricultural communities and domestic well users; Supports participation of small growers and cost-burdened households

**Identified Co-benefits:** Habitat and biodiversity improvements; Reduced erosion and sedimentation; Water quality improvements

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>6.2.a Collaborate with the Natural Resource Conservation Service (NRCS) Environmental Quality Incentives Program (EQIP) and the California Healthy Soils Program to expand grower participation in soil-health and climate-resilient agriculture programs.</b> Provide application support, site assessments, cost-share assistance, and technical support for practices such as cover crops, compost application, reduced tillage, hedgerows, buffers, pollinator habitat, perennial and drought-tolerant plantings, diversified cropping systems, and agroforestry to increase soil organic matter, reduce erosion, enhance water retention and water quality, and improve climate resilience. Provide targeted outreach and one-on-one application assistance to small and mid-sized farms, socially overburdened farmers and ranchers, and growers in priority overburdened and farmworker communities so they can access funding, reduce costs, and maintain livelihoods under increasing heat and drought stress.</p>	<p><b>Potential Lead(s):</b> VCRCD; UCCE  <b>Partners:</b> Farmers; National Resource Conservation Service (NRCS); Farm Bureau of Ventura County</p>	Short-term	<p><b>Scale:</b> Regional, County, Watershed-Wide</p> <p><b>Type:</b> Programs, Pilots, Initiatives; Funding, Finance</p>	Ecosystems; Water quality,
<p><b>6.2.b Identify priority locations along San Antonio Creek and the Ventura River to restore and establish native vegetated buffers, hedgerows, and filter strips along agricultural-lined waterways</b> to improve soil health, reduce erosion, and enhance resilience to climate-driven stressors such as extreme heat, intense precipitation, and drought.</p>	<p><b>Potential Lead(s):</b> VCRCD  <b>Partners:</b> Farmers; UCCE; Farm Bureau of Ventura County; OVLC; VLT</p>	Long-term	<p><b>Scale:</b> Asset, Feature</p> <p><b>Type:</b> Studies, Evaluation; Natural Projects, Built Projects</p>	Ecosystems; Water quality,

Goal 6: Agricultural Practices Are Adapted to the Effects of Climate Change and Sustain a Thriving Local Economy and Ag-Based Livelihoods


## Strategy 6.3 Reduce Agricultural Water-Quality Impacts and Runoff

**Hazards Addressed:** Drought; Extreme heat; Extreme precipitation & flooding; Sea-level rise and storm surge

**Potential Implementation Metrics:** Reduction in pollutant concentrations at compliance/target sites; Number of monitoring sites added, upgraded, or integrated; Number of growers and acres of farmland adopting BMPs

**Anticipated Equity Benefits:** Reduces water quality risks for rural/agricultural communities and domestic well users;

**Identified Co-benefits:** Habitat and biodiversity gains; Reduced erosion and sedimentation impacts on infrastructure

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>6.3.a</b>  <b>Conduct a Ventura River Agricultural Runoff Climate Vulnerability Assessment</b> focused on land uses and facility types with the greatest uncertainty in water-quality impacts under current and future climate conditions. Build on existing irrigated-lands monitoring (which shows relatively low recent impairments from irrigated agriculture) and prioritize evaluating nutrient, sediment, and pathogen loading risks from livestock, manure, and equine facilities. Map and characterize areas of concern, assess seasonal and storm-driven loading patterns, and evaluate how drought, extreme heat, extreme precipitation, and sea-level rise may alter future conditions, including downstream effects on sensitive reaches and the Ventura River estuary. Coordinate closely with VCAILG to align with existing monitoring and reporting programs and avoid duplication.</p>	<p><b>Potential Lead(s):</b> VCRCD; Farm Bureau of Ventura County; VCAILG  <b>Partners:</b> UCCE; RWQCB; State Water Resources Control Board; growers and packing houses; irrigation efficiency vendors; compost and soil amendment suppliers; UCCE</p>	Short-to mid-term	<p><b>Scale:</b> Regional, County, Watershed-Wide  <b>Type:</b> Studies, Evaluation</p>	Ecosystem; Water quality
<p><b>6.3.b</b> Leverage existing efforts at the Ventura County Resource Conservation District and partner agencies to <b>implement nutrient-management, erosion-control, and runoff BMPs on farms and orchards.</b> These practices help counteract climate-driven increases in water-quality risks, including more intense rainfall that mobilizes sediments and nutrients, prolonged drought that concentrates pollutants, and extreme heat that elevates evapotranspiration and salinity accumulation. They also reduce pollutant loading risks under sea level-rise and storm surge conditions, which elevate estuary water levels, increase backwatering during storms, and intensify the upstream mobilization of sediments and nutrients into the Ventura River estuary.</p>	<p><b>Potential Lead(s):</b> VCRCD; UCCE  <b>Partners:</b> Farm Bureau of Ventura County; City of Ventura; County of Ventura; City of Ojai</p>	Long-term	<p><b>Scale:</b> Regional, County, Watershed-Wide  <b>Type:</b> Programs, Pilots, Initiatives</p>	Water quality

Goal 6: Agricultural Practices Are Adapted to the Effects of Climate Change and Sustain a Thriving Local Economy and Ag-Based Livelihoods


## Strategy 7.1 Expand Coordinated Watershed-wide Data and Monitoring Capabilities

**Hazards Addressed:** Drought; Extreme heat; Extreme precipitation & flooding; Wildfire; Sea level rise and storm surge

**Potential Implementation Metrics:** Completion of a coordinated watershed-scale ecological monitoring framework and indicator set; Number of monitoring sites added, upgraded, or integrated; Integration of enhanced storm-forecasting or atmospheric-river tools into agency operations; Establishment and operation of a watershed-scale low-flow and water-quality monitoring network; Reduction in response time or improved preparedness for extreme storm or low-flow events

**Anticipated Equity Benefits:** Improves early warning, flood preparedness, and water-quality protection for all communities, especially those in flood- and fire-prone areas; Enhances Tribal access to monitoring data and supports inclusion of Traditional Ecological Knowledge in watershed decision-making

**Identified Co-benefits:** Improved habitat and biodiversity outcomes through better ecological trend detection; Increased public-health protection via enhanced storm-event forecasting and water-quality monitoring; Stronger cross-agency coordination and data sharing

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<b>7.1.a</b> Strengthen watershed-wide data coordination by <b>convening a quarterly data-management subgroup under the Ventura River Watershed Council to align ongoing data-collection efforts, improve data sharing, and explore development of a publicly accessible data hub on the Council’s website.</b> Ensure Tribal representation and follow Tribal leadership and guidance regarding the integration and protection of Tribal data.	<b>Potential Lead(s):</b> Watershed Council <b>Partners:</b> VCRCD; Watershed Council Member Agencies	Short-term	<b>Scale:</b> Regional, County, Watershed-Wide  <b>Type:</b> Studies, Evaluation	Water supply; Ecosystems; Flood management; Water quality; Groundwater management; Cultural resources
 <b>7.1.b</b> Using the coordinated data systems and data-management subgroup established in Action 7.1.a, <b>develop a watershed-scale ecological monitoring framework to track climate-driven change and inform adaptive management across upland, riparian, and aquatic habitats.</b> Build on existing monitoring programs and integrate appropriate indicators, including wildfire-driven vegetation change, post-fire sediment and debris dynamics, and sea level rise and storm surge effects on estuary and coastal habitats. Incorporate Traditional Ecological Knowledge where consented, to support restoration, land management, and protection of ecosystem and cultural resources.	<b>Potential Lead(s):</b> VCRCD; OVLC <b>Partners:</b> BVBMI; NCAN; VLT; CA State Parks; California State University Channel Islands (CSUCI); University of California, Santa Barbara (UCSB)	Short-term	<b>Scale:</b> Regional, County, Watershed-Wide  <b>Type:</b> Studies, Evaluation	Ecosystems; Cultural resources

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>7.1.c Enhance watershed forecasting capabilities by integrating advanced atmospheric-river, extreme-precipitation, post-fire debris-flow, and coastal-hazard forecasting tools into County and partner-agency systems.</b> Build on the coordinated data systems established through Action 7.1.a to ensure these forecasting improvements support adaptive management and multi-agency emergency response. Partner with academic and research institutions (such as the Center for Western Weather and Water Extremes (CW3E) at Scripps Institution of Oceanography or UC Santa Barbara) to incorporate research-driven forecasting tools and decision-support systems into local planning. Provide training for agencies and first responders to apply these enhanced tools in capital-improvement planning, flood and debris-flow preparedness, and emergency-response protocols.</p>	<p><b>Potential Lead(s):</b> County of Ventura – WPD  <b>Partners:</b> Scripps Institution of Oceanography – CW3E; CSUCI; UCSB</p>	Long-term	<p><b>Scale:</b> City, Water Agency  <b>Type:</b> Studies, Evaluation; Operational</p>	Flood management
<p><b>7.1.d Develop a watershed-scale low-flow and water-quality monitoring network to track conditions during extreme heat and drought,</b> with priority for stream reaches that rural domestic well users are reliant on, stream reaches with recreation areas used by overburdened communities, and locations identified as steelhead refugia identified as part of Action 1.4.a. Deploy monitoring equipment near flow-enhancement, stormwater capture, riparian restoration, and refuge-enhancement efforts to evaluate improvements in sustained baseflows and reduction in chronic water-quality risks. Coordinate with existing Ventura Countywide Stormwater Quality Management Program monitoring locations and UVRGA’s Aquatic Groundwater-Dependent Ecosystem study to avoid duplication and strengthen data integration within the watershed-wide system established in Action 7.1.a.</p>	<p><b>Potential Lead(s):</b> County of Ventura – WPD; VCRCD  <b>Partners:</b> City of Ventura; City of Ojai; OVLC; VLT; GSAs</p>	Short- to long-term	<p><b>Scale:</b> Regional, County, Watershed-Wide  <b>Type:</b> Studies, Evaluation</p>	Water supply; Ecosystems; Flood management; Water quality; Groundwater management

**Goal 7: Coordinated Watershed Resilience is Strengthened Through the Improvement of Governance, Funding, and Monitoring Tools**

## Strategy 7.2 Improve Interagency Coordination, Water System Preparedness and Emergency Response

**Hazards Addressed:** Drought; Extreme precipitation & flooding; Wildfire; Extreme heat, Sea level rise & storm surge

**Potential Implementation Metrics:** Number of agencies convening in interagency coordination meetings; Adoption of emergency response protocols; Number of cultural-resource salvage, digitization, or repatriation protocols established; Deployment of multilingual extreme-weather alert tools across jurisdictions; Improvements to cultural-resource information-sharing systems supporting Tribal ownership; Demonstrated reduction in emergency-response gaps or improved coordination during real or simulated events

**Anticipated Equity Benefits:** Improves emergency communication and preparedness for overburdened, farmworker, and unhoused communities; Strengthens Tribal sovereignty through enhanced cultural-resource protection and data ownership protocols

**Identified Co-benefits:** More efficient and coordinated cross-agency operations; Reduced loss or damage to cultural resources during extreme events; Enhanced public health and safety through clearer emergency protocols; Greater trust and collaboration among agencies, Tribes, and community partners

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>7.2.a Use the existing Ventura River Watershed Council as the primary forum for coordinating implementation of the Ventura River Watershed Resilience Plan, while exploring options to formalize governance structures</b> (e.g., interagency agreements or MOUs) to improve cross-jurisdictional decision-making. This includes overcoming administrative silos by better aligning stormwater, flood, groundwater, and land-use programs to support multi-benefit opportunities. The Council will track implementation and facilitate collaboration among agencies, Tribes, community organizations, and landowners as post-MDERP and adjudication needs evolve. Strengthened governance should prioritize overburdened and agricultural communities, coordinated permitting, long-term maintenance, adaptive management, sediment and debris management, co-management plans, and invasive-species control.</p>	<p><b>Potential Lead(s):</b> VCRCD  <b>Partners:</b> Watershed Council Members</p>	<p>Short- to long-term</p>	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Governance, Policies</p>	<p>Flood management;  Water quality;  Water supply;  Groundwater management;  Cultural Resources;  Ecosystems</p>

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>7.2.b Convene regular interagency coordination meetings across water providers to align on state emergency preparedness and response requirements</b> (e.g., AB 367 emergency preparedness planning for water systems), <b>share and coordinate emergency response plans, and develop a shared emergency preparedness checklist and mutual aid protocol.</b> Meeting frequency should be right-sized based on need (e.g., annual or biennial meetings with ad-hoc convenings during emerging risks or declared emergencies) to balance preparedness benefits with staff capacity. The Ventura River Watershed Council may serve as a standing forum to elevate cross-cutting preparedness issues, track shared risks across hazards, and maintain continuity between emergency planning cycles.</p>	<p><b>Potential Lead(s):</b> City of Ventura – Ventura Water; County of Ventura – WPD;  <b>Partners:</b> OBGMA; UVRGA; Casitas MWD; VRWD; MOWD; VCRCD; Watershed Council Members</p>	Short- to long-term	<p><b>Scale:</b> Regional, County, Watershed-Wide</p> <p><b>Type:</b> Governance, Policies; Operational</p>	Water supply; Groundwater management
<p><b>7.2.c Establish a cross-jurisdictional working group to develop and pilot a unified flood, fire, and extreme weather alert protocol,</b> including standardized message templates, multilingual content, and a shared dissemination platform, with particular emphasis on reaching overburdened communities, farmworker populations, unhoused residents, and other groups with limited access to traditional emergency communications. Building on the enhanced forecasting tools in action 7.1.b, expand warning systems to include sirens, better coordinated multi-agency alert protocols, and aerial notifications that take into account the multi-lingual and cultural diversity needs of the most overburdened communities in the watershed.</p>	<p><b>Potential Lead(s):</b> County of Ventura – WPD; City of Ventura  <b>Partners:</b> County of Ventura; City of Ojai; mass-notification providers; wireless carriers; local radio/TV; outdoor-siren vendors; Chambers of Commerce; Economic Development Collaborative of Ventura County</p>	Long-term	<p><b>Scale:</b> Regional, County, Watershed-Wide</p> <p><b>Type:</b> Programs, Pilots, Initiatives; Operational</p>	Flood management
<p><b>7.2.d Develop and strengthen cultural resource protection and information-sharing systems that support Tribal ownership, control, and stewardship</b> of cultural records and resources at risk from climate-driven hazards. This may include creating Tribal-led protocols for secure data management, digitization, and emergency salvage and repatriation; establishing culturally appropriate information sharing pathways among Tribes and agencies; and integrating these practices into existing cultural resource management programs and project-level Best Management Practices. Identify opportunities to align with existing Tribal, agency, and archival programs that already conduct cultural resource preservation, documentation, or emergency-response activities.</p>	<p><b>Potential Lead(s):</b> BVBMI; Santa Ynez Band of Chumash Indians; Coastal Band of the Chumash Nation  <b>Partners:</b> NCAN; CA Office of Historic Preservation; County of Ventura; City of Ventura; City of Ojai</p>	Long-term	<p><b>Scale:</b> City, Water Agency</p> <p><b>Type:</b> Governance, Policies</p>	Cultural resources

**Goal 7: Coordinated Watershed Resilience is Strengthened Through the Improvement of Governance, Funding, and Monitoring Tools**

## Strategy 7.3 Strengthen Funding Pathways for Implementation

**Hazards Addressed:** Drought; Extreme precipitation & flooding; Sea level rise & storm surge; Wildfire; Extreme heat

**Potential Implementation Metrics:** Amount of funding secured through Proposition 4 or other major state and federal programs that benefits overburdened communities; Number of joint, multi-benefit grant applications submitted or awarded; Number of Tribal Capacity Funding Plan initiatives implemented or funded; Dollars invested in coastal adaptation, wastewater upgrades, and climate-resilient infrastructure; Number of funded priority VRWRP projects; Dollars invested in overburdened communities

**Anticipated Equity Benefits:** Increases access to funding for overburdened communities; Strengthens Tribal leadership and cultural-resource stewardship through dedicated funding and capacity pathways

**Identified Co-benefits:** Improved readiness and implementation capacity for multi-benefit projects; Enhanced protection of critical water, wastewater, and coastal infrastructure; Greater efficiency through bundled, cross-agency funding applications

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>7.3.a</b> Create a long-term funding and coordination framework overseen by the Ventura River Watershed Council to encourage coordination among entities and <b>secure and sustain the resources needed</b> to implement actions in the Ventura River Watershed Resilience Plan. The framework should help identify and evaluate appropriate funding mechanisms (e.g., targeted ballot measures, bonds, dedicated fees, interagency cost-sharing, and state/federal grants) matched to specific program and project needs. Collaborative/multi-agency pursuits for funding should be coordinated through the Ventura River Watershed Council wherever feasible.</p>	<p><b>Potential Lead(s):</b> Watershed Council  <b>Partners:</b> VCRCD; Economic Development Collaborative of Ventura County; City of Ventura &amp; City of Ojai – Economic Development; CAUSE; Ventura County Community Foundation</p>	Short-term	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Funding, Finance</p>	Flood management; Water quality; Water supply; Groundwater management; Cultural Resources; Ecosystems
<p><b>7.3.b</b> Submit at least two joint, large-scale state grant applications through <b>Proposition 4</b> that bundle complementary flood, water supply, wastewater, water quality, and/or habitat projects, with a focus on overburdened communities. Applications should emphasize multi-benefit outcomes, interagency coordination, partnerships with non-traditional entities, and readiness to implement.</p>	<p><b>Potential Lead(s):</b> Watershed Council  <b>Partners:</b> VCRCD</p>	Short-term	<p><b>Scale:</b> Regional, County, Watershed-Wide   <b>Type:</b> Funding, Finance</p>	Flood management; Water quality; Water supply; Groundwater management; Cultural Resources; Ecosystems

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<b>7.3.c</b> In partnership with the Tribes, develop and implement a Tribal Capacity Funding Plan that includes grant applications, long-term revenue strategies, and formal partnerships to support Tribal leadership, staffing, and cultural resource protection efforts. Align the Plan and funding opportunities with Tribal priorities and needs.	<b>Potential Lead(s):</b> BVBMI <b>Partners:</b> Watershed Council; VCRCD; NCAN	Short-term	<b>Scale:</b> City, Water Agency  <b>Type:</b> Funding, Finance	Cultural resources
<b>7.3.d</b> Secure funding for coastal adaptation projects in the lower Ventura River Watershed and adjacent coastal HUC-12 watersheds that experience sea level rise, storm surge, and coastal erosion. Priority funding sources may include the State Coastal Conservancy Climate Ready Program, Ocean Protection Council grants, SB 1, California Coastal Commission LCP grants, and other applicable coastal adaptation programs. Efforts should focus on projects that reduce risk to communities, critical infrastructure, and coastal ecosystems, including assets located just outside the Ventura River Watershed boundary that are functionally connected to watershed resilience (e.g., areas within the Arundell Barranca–Frontal Pacific Ocean watershed).	<b>Potential Lead(s):</b> County of Ventura – WPD; City of Ventura; CA State Parks <b>Partners:</b> State Coastal Conservancy; CA Coastal Commission	Long-term	<b>Scale:</b> Regional, County, Watershed-Wide  <b>Type:</b> Funding, Finance	Ecosystems; Flood management
<b>7.3.e</b> Leverage state and federal funding programs—including the Clean Water State Revolving Fund (CWSRF), SAFER Program, IBank ISRF, and WaterTalks technical assistance resources—to support wastewater upgrades, septic-to-sewer conversions, flood-resilient sanitation infrastructure, and flood-, debris-flow-, and wildfire-resilient water-supply improvements. Where feasible, partner with the Regional Water Quality Control Board and other relevant agencies, and prioritize investments that reduce contamination, public-health, and climate-related risks for overburdened communities.	<b>Potential Lead(s):</b> City of Ventura; County of Ventura; City of Ojai <b>Partners:</b> Watershed Council; VCRCD; City of Ojai; RWQCB Region 4 (Los Angeles)	Long-term	<b>Scale:</b> City, Water Agency  <b>Type:</b> Funding, Finance	Water supply; Flood management; Water quality
<b>7.3.f</b> Assess increased operational, storage, and supply-related costs incurred by water and wastewater agencies during extended emergency conditions (e.g., drought, wildfire, flooding, power outages), including costs associated with emergency water purchases, treatment and pumping, temporary storage, backup power, staffing, debris management, and regulatory compliance. Where cost burdens are significant or recurring, evaluate and establish sustainable funding mechanisms such as reserve policies, rate structures, interagency cost-sharing agreements, or emergency financing tools to ensure continuity of service and fiscal resilience.	<b>Potential Lead(s):</b> Casitas MWD; City of Ventura – Ventura Water; VRWD; MOWD <b>Partners:</b> OBGMA; UVRGA; OVSD; VCRCD; SCE, SoCalGas; CAUSE; County of Ventura – Economic Development, Economic Development Collaborative of Ventura County	Long-term	<b>Scale:</b> City, Water Agency  <b>Type:</b> Operational; Funding, Finance	Water supply; Flood management; Water quality

**Goal 7: Coordinated Watershed Resilience is Strengthened Through the Improvement of Governance, Funding, and Monitoring Tools**

## Strategy 8.1 Strengthen Tribal-led Stewardship and Relationships by Building Tribal and Workforce Capacity

**Hazards Addressed:** Drought; Extreme precipitation & flooding; Sea level rise & storm surge; Wildfire; Extreme heat

**Potential Implementation Metrics:** Number of MOUs/agreements/protocols executed; Number of non-Tribal agency staff who have completed Tribal led trainings on land stewardship; Number of restoration projects with a Tribal co-lead; Number of Tribal stewardship crews or number of labor hours completed; Number of acres restored through by Tribal stewardship programs

**Anticipated Equity Benefits:** Strengthens Tribal leadership and cultural-resource stewardship through co-management opportunities; Increases education on Indigenous Knowledge and practices to non-Tribal agencies and their staff; Intergenerational knowledge transfer

**Identified Co-benefits:** Sustainable employment and revenue generation through Tribal stewardship programs; Enhanced biodiversity and watershed health; Reduced wildfire severity

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>8.1.a Engage with BVBMI (Chumash) leadership, knowledge keepers, and culture bearers to support respectful partnerships and collaboration with land managers, agencies, and Indigenous-led organizations.</b> This includes supporting Tribal participation in long-term planning, preparedness, and recovery efforts, integrating Indigenous Knowledge into climate adaptation planning and implementation, and fostering partnerships that build Tribal capacity and shared stewardship with Tribes and Indigenous Led organizations.</p>	<p><b>Potential Lead(s):</b> BVBMI; Santa Ynez Band of Chumash Indians; Coastal Band of the Chumash Nation; NCAN</p> <p><b>Partners:</b> VCRCD; City of Ventura; City of Ojai; Los Padres NP; OVLC; Ventura Land Trust; CA State Parks</p>	Long-term	<p><b>Scale:</b> Regional, County, Watershed-Wide</p> <p><b>Type:</b> Operational</p>	Cultural Resources; Ecosystems
<p><b>8.1.b Support the development and expansion of Tribal stewardship and workforce programs focused on climate adaptation, including cultural burning, ecological monitoring, post-fire recovery, and habitat restoration.</b> Build long-term capacity by expanding opportunities for Tribal participation and leadership within existing prescribed-fire trainings, restoration projects, and monitoring programs, and by developing pathways for Tribal stewardship crews and ecological monitors to lead or co-lead vegetation management and climate adaptation activities across the watershed.</p>	<p><b>Potential Lead(s):</b> BVBMI; Santa Ynez Band of Chumash Indians; Coastal Band of the Chumash Nation; NCAN</p> <p><b>Partners:</b> VCRCD; City of Ventura; City of Ojai; Los Padres NP; OVLC; Ventura Land Trust; CA State Parks</p>	Short-term	<p><b>Scale:</b> Regional, County, Watershed-Wide</p> <p><b>Type:</b> Programs, Pilots, Initiatives</p>	Cultural Resources; Ecosystems

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>8.1.c Support Tribes in expanding the dissemination of cultural burning and Tribal stewardship knowledge by enhancing existing training and developing new training opportunities</b> for agencies, land trusts, parks staff, fire agencies, and private landowners. Strengthen understanding across all land managers of cultural burning practices, Tribal stewardship methods, and cultural-resource protection protocols during land management and emergency response.</p>	<p><b>Potential Lead(s):</b> BVBMI; Santa Ynez Band of Chumash Indians; Coastal Band of the Chumash Nation; NCAN</p> <p><b>Partners:</b> VCRC; City of Ventura; City of Ojai; Los Padres NP; OVLC; Ventura Land Trust; CA State Parks</p>	Long-term	<p><b>Scale:</b> Regional, County, Watershed-Wide</p> <p><b>Type:</b> Programs, Pilots, Initiatives</p>	Cultural Resources; Ecosystems
<p><b>8.1.d</b> In coordination with Tribes, landowners, and agencies, <b>develop and implement formal strategies and collaboration frameworks</b> to partner with Chumash People, elevate Tribal leadership, support ecosystem stewardship, and move beyond minimum consultation requirements.</p>	<p><b>Potential Lead(s):</b> BVBMI; Santa Ynez Band of Chumash Indians; Coastal Band of the Chumash Nation</p> <p><b>Partners:</b> VCRC; NCAN; City of Ventura; City of Ojai; Los Padres NP; OVLC; Ventura Land Trust; CA State Parks</p>	Long-term	<p><b>Scale:</b> Regional, County, Watershed-Wide</p> <p><b>Type:</b> Operational</p>	Cultural Resources; Ecosystems

Goal 8: Native Leadership and Indigenous Knowledge Strengthen Climate Resilience of Cultural Resources, Sacred Sites, Subsistence Areas, and Heritage Assets

## Strategy 8.2 Protect Cultural Sites from Climate-Driven Hazards Such as Wildfire, Flooding, Erosion, And Coastal Hazards

**Hazards Addressed:** Drought; Extreme precipitation & flooding; Sea level rise & storm surge; Wildfire; Extreme heat

**Potential Implementation Metrics:** Number of MOUs/agreements/protocols executed; Certified Tribal monitoring workforce; Tribal-led inter-agency trainings; Finalized Cultural Resource Protection Action Plan

**Anticipated Equity Benefits:** Recognized Tribal sovereignty; Protected cultural resources; Tribal career pathways; Indigenous-led emergency recovery

**Identified Co-benefits:** Improved regional disaster resilience; Enhanced climate-adaptive watershed management; Increased multi-jurisdictional planning efficiency; Streamlined inter-agency emergency protocols; Reinforced land manager cultural literacy

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<p><b>8.2.a</b> Strengthen coordination among Tribes, land managers, and agencies to <b>support climate-responsive preparedness, emergency response, and recovery that protects cultural resources and respects Tribal leadership and knowledge</b>. Support training, partnerships, and capacity building that strengthen Tribal participation in preparedness, response, and recovery. This may include Tribal-informed emergency response, post-fire and post-flood recovery, and site protection protocols that reduce risk and protect cultural integrity as conditions change.</p>	<p><b>Potential Lead(s):</b> BVBMI; Santa Ynez Band of Chumash Indians; Coastal Band of the Chumash Nation; NCAN  <b>Partners:</b> VCRCD; County of Ventura; City of Ventura; City of Ojai</p>	Long-term	<p><b>Scale:</b> Regional, County, Watershed-Wide  <b>Type:</b> Operational</p>	Cultural Resources
<p><b>8.2.b</b> <b>Develop a Tribal-led cultural-resource protection action plan</b>, in partnership with appropriate Tribes and organizations trained in cultural-resource stewardship, <b>to build the workforce, capacity, and tools needed to protect sacred sites, village sites, archaeological sites, and other culturally significant places</b> against climate hazards. The plan should outline strategy, training needs, cultural-sensitivity protocols, and resource and budget requirements. Consult with Chumash Tribal leadership and engage knowledge keepers, culture bearers, and willing landowners to support respectful collaboration and long-term stewardship partnerships.</p>	<p><b>Potential Lead(s):</b> BVBMI; Santa Ynez Band of Chumash Indians; Coastal Band of the Chumash Nation  <b>Partners:</b> VCRCD; NCAN; County of Ventura; City of Ventura; City of Ojai</p>	Short-term	<p><b>Scale:</b> Regional, County, Watershed-Wide  <b>Type:</b> Programs, Pilots, Initiatives</p>	Cultural Resources

Goal 8: Native Leadership and Indigenous Knowledge Strengthen Climate Resilience of Cultural Resources, Sacred Sites, Subsistence Areas, and Heritage Assets

## Strategy 8.3 Sustain Traditional Subsistence Resources (Including Clean Drinking Water) Under Changing Climate Conditions

**Hazards Addressed:** Drought; Extreme precipitation & flooding; Sea level rise & storm surge; Wildfire; Extreme heat

**Potential Implementation Metrics:** Executed access agreements; Restored cultural stewardship acreage; Increased traditional species abundance; Integrated TEK management plans; Facilitated gathering events; Species-specific restoration metrics; Collaborative resource monitoring reports

**Anticipated Equity Benefits:** Executed access agreements; Restored cultural stewardship acreage; Increased traditional species abundance; Integrated TEK management plans; Facilitated gathering events; Species-specific restoration metrics; Collaborative resource monitoring reports

**Identified Co-benefits:** Enhanced watershed biodiversity; increased native plant resilience; improved soil water retention; climate-adapted habitat restoration; reduced invasive species cover; strengthened cross-jurisdictional partnerships; shared ecological monitoring data

Action	Implementation Lead(s) & Partner(s)	Timeframe	Scale / Type	Water Resource System(s)
<b>8.3.a</b> Improve Tribal access to culturally significant sites, traditional gathering areas, and subsistence resources across public and privately owned lands and waters, especially where climate change-driven flooding, drought, wildfire, or altered streamflows affect access. Work with Tribal governments, land managers, and landowners to identify priority locations and establish access protocols, agreements, or co-management approaches that protect cultural integrity and support continued gathering for food, medicine, materials, and ceremony.	<b>Potential Lead(s):</b> BVBMI; Santa Ynez Band of Chumash Indians; Coastal Band of the Chumash Nation <b>Partners:</b> VCRCD; NCAN; City of Ventura; City of Ojai	Short-term	<b>Scale:</b> Regional, County, Watershed-Wide  <b>Type:</b> Programs, Pilots, Initiatives	Cultural Resources
<b>8.3.b</b> Collaborate with land managers and Tribal partners to protect, restore, and enhance culturally significant plant and wildlife resources under changing climate conditions through Tribally led or Tribally informed stewardship areas, priority habitat restoration, and species-specific management actions (e.g., oak regeneration; willow, tule, and sedge restoration; basketry-material management). Integrate Traditional Ecological Knowledge into restoration and adaptive-management practices to guide long-term stewardship.	<b>Potential Lead(s):</b> BVBMI; Santa Ynez Band of Chumash Indians; Coastal Band of the Chumash Nation; NCAN <b>Partners:</b> VCRCD; City of Ventura; City of Ojai; Los Padres NP; OVLC; Ventura Land Trust; CA State Parks	Long-term	<b>Scale:</b> Regional, County, Watershed-Wide  <b>Type:</b> Programs, Pilots, Initiatives	Cultural Resources; Ecosystems

Goal 8: Native Leadership and Indigenous Knowledge Strengthen Climate Resilience of Cultural Resources, Sacred Sites, Subsistence Areas, and Heritage Assets

## Implementation Roadmaps

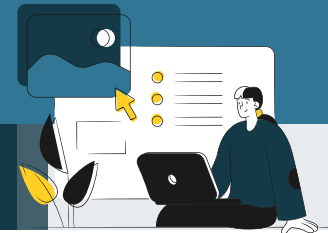
A subset of actions—one per goal—has been selected for deeper analysis through Implementation Roadmaps, presented below. These roadmaps translate high-level actions into clear implementation pathways, outlining key steps, roles and responsibilities, potential funding sources, hurdles to overcome, success metrics, and existing programs that can be leveraged.

The selected actions represent complex, multi-benefit efforts that require cross-agency collaboration and were elevated through input from Advisory Group members, Tribal partners, and the public. Together, the roadmaps provide a practical blueprint for moving priority actions from planning into coordinated, on-the-ground implementation while highlighting opportunities for permitting efficiency, coordination, and shared resources across partners.



# Action 1.3.a Implementation Roadmap

**Action 1.3.a:** Scale up watershed-scale removal and eradication of erosion-prone and water intensive invasive species that thrive under changing climate conditions, such as *Arundo donax*, using Ventura County RCD’s programmatic permits to expedite implementation. Prioritize upstream-to-downstream removal to prevent reinfestation, stabilize treated and fire-impacted banks with native riparian vegetation, and apply natural or engineered bio-stabilization techniques to reduce erosion, improve water quality, and prevent undercutting during high-flow events. Monitor restored reaches to ensure long-term habitat recovery, increased shading, and reduced water loss.



## Key Steps to Implementation

A watershed-wide *Arundo* eradication and long-term monitoring program requires consistent detection, coordinated removal, and committed long-term maintenance for effective eradication. The steps below outline a phased, repeatable process.

### Assessment and Prioritization

- Maintain an up-to-date watershed map of *Arundo* populations using drones, fixed-point photography, and INSAR/remote sensing.
- Evaluate site conditions (bank stability, access, fire history, recreation) to rank priority treatment areas from upstream to downstream.
- Establish annual workplans that adjust to hydrologic conditions and observed regrowth.
- Assess how anticipated changes in climate conditions will enhance the spread of *Arundo*.

### Treatment and Restoration

- Apply standardized removal methods (mechanical, chemical, biomass extraction).
- Implement Early Detection and Rapid Response to prevent new infestations.
- Install native riparian vegetation and bio-stabilization treatments immediately post-removal.

### Community Involvement and Monitoring

- Inclusive Outreach and Education efforts for inclusive community involvement.
- Leverage VCRC’s Programmatic Permit to enroll landowners, advance shovel-ready CEQA-compliant projects and readily apply to grant funding
- Coordinate with Tribal groups, neighborhood coalitions, underserved communities and landowners for access and early detection.
- Document progress with photo-points, drone surveys, and vegetation monitoring.



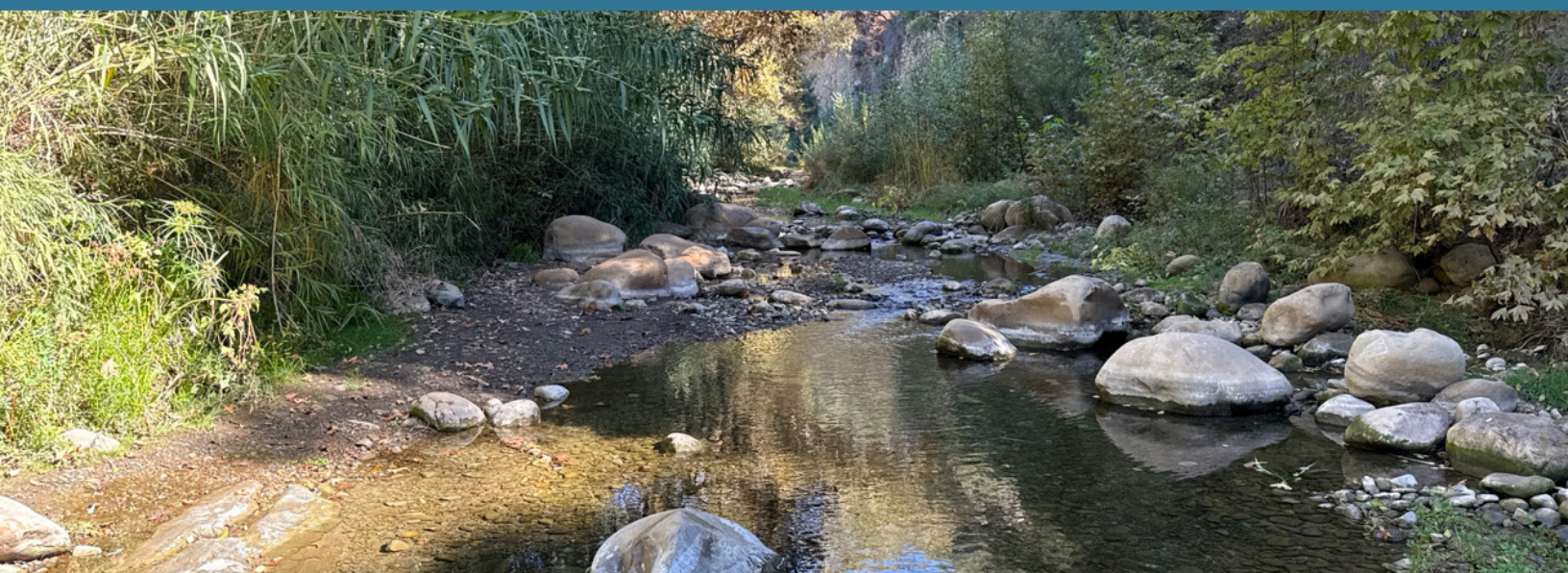
## Implementation Leads and Partners

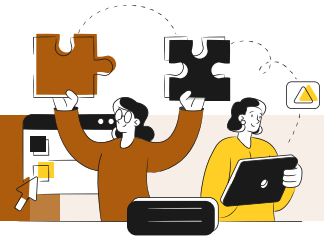
### Potential Leads:

- **OVLC:** Lead on field implementation, monitoring, and land stewardship in preserved lands.
- **VCRC:** Lead permitting, programmatic CEQA/NEPA, technical assistance, watershed-scale coordination.
- **VLT:** Implementation on lower watershed parcels; outreach and volunteer coordination.
- **County of Ventura – WPD:** Removal on County lands, integration with debris-basin and flood-management operations.

### Potential Key Partners:

- **CA State Parks, City of Ventura, Ventura County Parks:** Access permissions, in-park removal, restoration coordination.
- **Fire Departments (County/City):** Aerial flyovers to identify patches; community education.
- **Agricultural Commissioner, Farm Bureau:** Engagement with growers; best practices for riparian buffers and access.
- **Local landowners and neighborhood coalitions:** Access permissions, long-term monitoring, spread prevention.
- **GSAs (UVRGA, OBGMA):** Information conduit, basin-wide reporting (e.g., adding “Have you seen Arundo?” to annual water-use reports).
- **Sheriff’s Dept. Ventura PD, Ventura Human Services Agency, and CBOs serving unhoused:** Coordination around sites with unhoused populations.
- **Caltrans:** Removal at bridge crossings and transportation ROWs.





## Existing Projects and Efforts to Leverage

- **VCRC**'s **programmatic permits** provide the foundation for implementation, reducing the time and cost for invasive removal while allowing for real-time documentation of habitat resilience to extreme weather.
- **WPD's Matilija Canyon work** serves as a proof of concept for large-scale removal; implementation should build on this to track how cleared reaches respond to seasonal flow variability and drought stress.
- **OVLC and VLT riparian restoration projects** provide stewardship capacity, ensuring cleared areas transition into native-dominated communities that improve microclimate cooling and local heat island mitigation.
- **The regional Habitat Conservation Plan framework** simplifies compliance; efforts should align with these protocols to monitor how native species recovery supports regional climate adaptation goals.
- **INSAR, drone imagery, and AI mapping** should be integrated to detect Arundo patches and monitor climate-driven variables like fuel load accumulation and evapotranspiration changes across the watershed.
- **Community-based stewardship and neighborhood coalitions** can expand detection capacity, using community science to monitor shifts in phenology or water availability at the property level.



## Implementation Metrics

Successful implementation is measured by both the extent of Arundo removal and the durability of restored riparian systems.

- **Eradication Efficacy:** Track percent kill rates and regrowth density to ensure biomass reduction and minimal rhizome recovery.
- **Strategic Transition:** Shift priority reaches to maintenance once statistical probability of absence confirms eradication.
- **Footprint and Enrollment:** Monitor changes in percent canopy cover alongside new landowner participation rates.
- **Ecological Recovery:** Measure native recruitment and canopy shading to verify restored habitat and reduced water loss.
- **Advanced Monitoring:** Leverage advanced monitoring technologies such as AI-assisted mapping to automate data collection for GSA and watershed reporting.





## Funding Considerations

Arundo eradication requires a significant upfront investment because complete removal and multi-year retreatment are labor-intensive. After major stands are cleared, costs drop substantially, shifting to lower-cost annual maintenance focused on early detection and rapid response. Without this ongoing maintenance, reinfestation can occur quickly.

### Potential Funding Sources

- CalFire Wildfire Prevention Grants (significant scale for fuel reduction + riparian vegetation work).
- CDFW FRGP, WCB, Coastal Conservancy: Riparian restoration and species recovery.
- Local governments: Long-term maintenance allocations (County, City, State Parks).
- Federal earmarks: Watershed resilience and invasive species control.
- GSA rate structures (if justified through groundwater/surface-water benefits).
- MDERP alignment to integrate removal into floodplain restoration.



## Hurdles to Overcome

Arundo eradication is technically feasible but financially and logistically demanding.

### Landownership Challenges

- Highly parcelized river corridor; incomplete participation allows reinfestation.
- Need mechanisms to transfer access permissions when properties change ownership.
- Varied landowner motivations require clear communication of multi-benefits (fire safety, water savings, improved stream function).

### Implementation Challenges

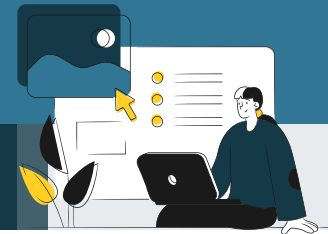
- Multi-year, labor-intensive removal with recurring regrowth.
- Potential replacement by other invasive species without sustained maintenance.
- Community concerns about herbicide use; need transparent best-practices guidance.

### Funding and Capacity

- Long-term maintenance rarely funded; grants typically end after 3–5 years.

# Action 2.2.a Implementation Roadmap

**Action 2.2.a:** Pending the outcome of the adjudication process and aligning with GSPs, utilize a new or existing watershed coalition to serve as a forum for watershed-wide coordination on water use. Use the forum to optimize conjunctive use and flexible demand-management programs under worsening drought conditions to protect instream flows and supply resilience. Consider actions such as shifting pumping to high-flow periods, limiting extraction from river-connected wells during droughts, and addressing both direct and indirect streamflow-depletion effects, while providing focused consideration for small growers, domestic well users, and Tribal and rural communities.



## Key Steps to Implementation

### Convene Coordinated Workgroup and Compile Foundational Technical Information

- Convene a multi-agency workgroup to guide development of a climate-informed management plan.
- Use GSA work products and local expertise to identify areas with strong surface-groundwater connections.
- Expand streamflow-gaging and well-monitoring in priority zones and update existing models as needed.

### Develop a Climate-Informed Conjunctive-Use Management Plan

- Define flow thresholds (high, normal, low) for each area and develop corresponding conjunctive-use rulesets.
- Create interactive maps and tools, and identify needed equipment upgrades to make hydrologic conditions data accessible to water users.
- Prepare adaptive management plans, including pumping rules tied to instream-flow thresholds, and develop a standardized annual reporting template.
  - Minimal restrictions during high-flow periods.
  - Conservation pumping rules during normal flows.
  - Severe restrictions during low flows; encourage use of stored water with allocations prioritizing small growers, domestic well users, Tribal communities, and overburdened users.

## Action 2.2.a

### *Key Steps to Implementation Continued...*

#### **Hold Public Meeting to Review and Refine the Plan**

- Convene water users and interest groups dependent on shallow groundwater.
- Share adaptive management plans and proposed rulesets.
- Develop and Refine tailored participation pathways for small and overburdened users based on input.

#### **Implement Management Plans and Monitor Performance**

- Member entities publish annual water-use reports using the standardized template.
- The workgroup meets annually to review compliance; non-compliant entities may receive reduced access to regional stored water.
- Update adaptive management plans annually to reflect new hydrologic data and climate information.





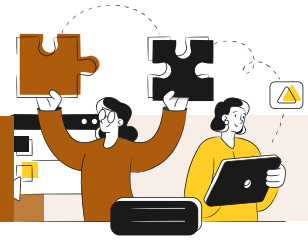
## Implementation Leads and Partners

### Potential Leads

- **UVRGA:** Convene Workgroup; develop area-specific management plans and pumping thresholds; ensure SGMA/GSP alignment; oversee compliance review.
- **OBGMA:** Provide basin-specific modeling and monitoring; identify high- connectivity zones; support threshold development.
- **Casitas MWD:** Lead conjunctive-use program coordination; integrate Lake Casitas storage and managed recharge; support stored water allocation during low-flow periods.
- **County of Ventura – WPD:** Expand and maintain streamflow monitoring; support watershed data and instream flow coordination.
- **VRWD, MOWD, City of Ventura - Ventura Water:** Implement pumping rules within service areas; conduct outreach; submit annual water use reports.

### Potential Key Partners

- **VCFB / VCAILG:** Coordinate engagement and participation.
- **Landowners and Agricultural Water Users:** Participate in pumping management, reporting, and recharge opportunities.
- **Small Grower and Rural Community Representatives:** Support equitable participation and protection of shallow domestic wells.
- **Friends of the Ventura River:** Represent instream flow and habitat protection interests; provide input on flow thresholds, ecological triggers, and public transparency tools; assist with community outreach.
- **OVLC:** Provide site-level habitat knowledge; help identify high surface- groundwater connectivity zones; support monitoring and restoration aligned with pumping rules.
- **BVBMI:** Provide monitoring support as applicable.
- **Ventura Hillside Conservancy and VLT:** Contribute conserved-land data and stewardship insights; coordinate recharge, habitat protection, and community engagement in priority areas.
- **California Trout:** Provide technical expertise on flow thresholds needed for steelhead and other aquatic species; support adaptive management tied to instream flow performance.
- **Surfrider Foundation:** Advocate for estuary and river-mouth flow protection; assist with water quality and public communication efforts.
- **California Native Plant Society:** Advise on groundwater-dependent riparian vegetation and ecological indicators for adaptive management triggers.
- **Ventura Audubon Society:** Provide input on riparian bird habitat needs; help track ecological response to flow-conditioned pumping.
- **DWR and SWRCB:** Provide regulatory guidance and funding support.



## Existing Projects and Efforts to Leverage

- **Lake Casitas operations and storage flexibility:** Align conjunctive-use rules with storage, release timing, and supply flexibility at Lake Casitas to reduce shallow groundwater pumping during low-flow conditions.
- **GSP implementation and modeling:** Integrate updates from UVRGA and OBGMA to refine high surface-groundwater connectivity mapping, utilizing real-time monitoring to establish defensible pumping thresholds and quantify water-yield benefits.
- **Streamflow and groundwater monitoring network:** Expand and coordinate existing gages and well monitoring operated by the County of Ventura Watershed Protection District and member agencies to support real-time flow conditioning and adaptive triggers.
- **Ojai Valley and Ventura River recharge studies:** Advance site-specific stormwater capture and managed aquifer recharge evaluations in the Ojai Valley and lower Ventura River corridor to increase high-flow recharge opportunities.
- **Watershed coordination forums:** Utilize existing collaboration venues such as the Ventura River Watershed Council to streamline outreach, transparency tools, and adaptive management updates across agencies and stakeholders.



## Implementation Metrics

- **Reduced pumping during low-flow periods:** Year-over-year decreases in extraction from shallow, river-connected wells during defined low-flow conditions.
- **Stabilized shallow well levels:** Maintained or improved groundwater elevations in high-connectivity zones, especially for domestic and rural community wells.
- **Instream flow protection:** Fewer days below ecological flow thresholds, informed by partners such as California Trout and Friends of the Ventura River.
- **Equitable participation:** Increased enrollment of small growers and overburdened users in tailored pathways and stored-water access programs.
- **Cost-share implementation:** Executed funding agreements and sustained multi-agency coordination.
- **Recharge and stormwater use:** Increased capture, recharge, and use of stored water during high-flow periods.





## Funding Considerations

- **State bond funding (e.g., Proposition 4):** Support monitoring, modeling, recharge infrastructure, and real-time data tools.
- **DWR grant programs:** Utilize SGM Grant Program, IRWM, and drought resilience funding administered by DWR.
- **SWRCB assistance:** Seek funding and technical support from the State Water Resources Control Board, especially for overburdened communities.
- **Local cost-share agreements:** Establish proportional funding for coordination, compliance, and adaptive updates.
- **Phased implementation:** Align capital investments with grant cycles to reduce upfront burden.



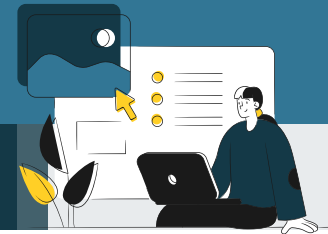
## Hurdles to Overcome

- **Ongoing litigation:** Consideration of legal disputes and outcomes will be important for adaptive rulemaking and require coordinated legal strategy.
- **Interconnected surface water guidance:** Evolving direction from DWR may require updates to thresholds, models, and monitoring.
- **Connectivity complexity:** Spatial and seasonal variability complicates threshold setting and trigger design.
- **Upstream–downstream impacts:** Pumping and recharge shifts may affect downstream users and instream conditions.
- **Administrative burden:** Reporting and compliance requirements may strain smaller agencies and growers.



# Action 3.1.c Implementation Roadmap

**Action 3.1.c:** Use the Local Coastal Program’s coastal-hazard zones, sea level rise projections, and shoreline adaptation strategies, along with findings from evaluations conducted as part of action 3.1.b, to guide the hardening, elevation, or relocation of critical water and wastewater infrastructure, prioritizing aging assets and sites with a history of overtopping or saltwater intrusion.



## Key Steps to Implementation

Coastal infrastructure adaptation should follow a phased, adaptive pathway built on Local Coastal Program (LCP) policies and mapped coastal hazard zones.

### Assessment and Prioritization

- Assess LCP coastal-hazard zones (sea-level rise, erosion, wave run-up, flood inundation, groundwater rise) with locations of water infrastructure vulnerable to overtopping, undermining, storm damage, or saltwater intrusion.
- Develop clear, infrastructure-specific thresholds that identify when and where upgrades or relocation need to occur based on climate conditions.
- Prioritize critical lifeline assets (pump stations, pipelines, intake structures, stormwater outlets, access roads) within hazard zones that necessitate retrofits.
- Where necessary, conduct site-specific vulnerability assessments using best available science.

### Design and Engineering

- Apply LCP-recommended adaptation strategies (protect, accommodate, hybrid, or relocate) based on feasibility, hazard severity, and infrastructure lifespan.
- Develop adaptation concepts such as elevating electrical components, armoring or relocating pipelines, elevating or flood-proofing pump stations, and rerouting vulnerable access routes.
- Align designs with Coastal Act standards and LCP development policies for public facilities and coastal resource protection.

### Permitting and Compliance

- Coordinate early with County Planning, Coastal Commission staff, and resource agencies to ensure consistency with the updated LCP amendments (currently undergoing certification).
- Integrate consideration of sea level rise related hazards into capital improvement plans and permit applications, as now required under Ventura County LCP policies.

*Key Steps to Implementation Continued...*

### Implementation and Monitoring

- Prioritize shovel-ready improvements and assess required permitting needs at locations with documented past failures (overtopping during storms, saltwater intrusion episodes, undermining of outfalls).
- Use adaptive management: monitor shoreline change, estuary inlet migration, groundwater rise, and structure performance after extreme events to refine the approach over time.



## Implementation Leads and Partners

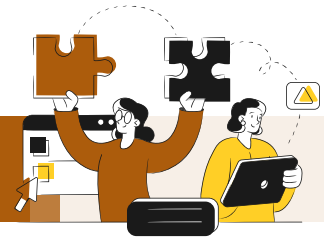
### Potential Leads:

- **County of Ventura – WPD:** Lead for flood-protection facilities, outfalls, and channel- adjacent structures; supports hazard modeling and emergency response coordination.
- **City of Ventura and Casitas MWD:** Lead for potable water, wastewater, and recycled-water infrastructure within hazard zones; integrate adaptation strategies into CIP planning.
- **County Planning Division (LCP administrators):** Ensures compliance with LCP hazard policies and guides consistent application of coastal-hazard maps and SLR requirements.



### Potential Key Partners:

- **California Coastal Commission:** Permitting and regulatory compliance—particularly where relocation, armoring, or land-use changes are proposed.
- **Caltrans:** Collaboration where water facilities are adjacent to Caltrans managed roadways.
- **State Parks and City of Ventura Parks:** Coordination on jointly managed coastal lands supporting water infrastructure or access routes.
- **VC Resilient Coastal Adaptation Project staff:** Provide hazard data, sea-level rise mapping updates, and adaptation strategy recommendations.
- **Private landowners and easement holders:** Support for access, construction staging, and long-term monitoring.



## Existing Projects and Efforts to Leverage

- **Site assessments and LCP-compliant designs must utilize the best available science**, such as the 2024 OPC Sea-Level Rise Guidance and Coastal Commission SLR Guidance, rather than relying on outdated projection data for CIP prioritization. These updated guidelines ensure coastal hazard planning reflects current state projections and risk scenarios. Ventura County LCP Amendments (2025 adoption) embed sea-level rise requirements directly into development review; water agencies should use these policies proactively to screen assets and design improvements that require fewer permit revisions later.
- **Coastal Area Plan hazard maps and shoreline-change datasets** help identify areas with documented overtopping, erosion, or historic flooding; these should guide early-phase prioritization of assets most at risk.
- **BEACON regional coastal adaptation work** (shoreline processes, sediment management, historical flooding) offers regional context for designing adaptation solutions that avoid unintended down-coast impacts.
- **City of Ventura’s shoreline and wastewater facility upgrades** (recent planning for the VenturaWaterPure project and wastewater system hardening) provide design precedents and opportunities for cost-sharing where infrastructure is co-located.
- **The California Coastal Commission’s Critical Infrastructure Sea-Level Rise Vulnerability Assessment and Adaptation Guidance** provides detailed best practices for evaluating infrastructure at risk from sea-level rise and offers recommended adaptation approaches, including protection, accommodation, and relocation strategies. It should be used to inform project design and long-term capital planning.





## Implementation Metrics

Success reflects both the reduction of infrastructure risk and the incorporation of long-term climate considerations into capital planning.

- **Number of critical assets** assessed using SLR projections.
- **Percentage of high-risk facilities** with adaptation designs completed and integrated into CIP budgets. Completion of priority upgrades (elevations, armoring, relocations) in high-hazard areas.
- **Reduced frequency of damage or overtopping** during high-tide and storm events.
- **Demonstrated compliance with LCP coastal hazard policies** in new and retrofitted projects.



## Funding Considerations

Adapting coastal infrastructure requires substantial near-term investment for facilities already at-risk or facing near-term coastal-related hazards. However, these near-term costs will help to reduce long-term losses from storm damage, erosion, or service disruption. As sea-levels gradually rise, established triggers will allow for continued upgrades and retrofits which, when programmed into capital improvement planning, can help limit emergency repair costs and unanticipated, larger-scale costs.

### Potential Funding Sources

- Ocean Protection Council (OPC) and SB1 Sea-Level Rise Adaptation grants, which provide targeted support for critical infrastructure, alongside State Coastal Conservancy funds for ecosystem-focused design and implementation.
- FEMA Hazard Mitigation Grant Program: Elevation, flood-proofing, and relocation of critical facilities.
- Proposition 4 (2024) Climate Resilience Bond: Eligible for water, coastal resilience, and adaptation infrastructure.
- Cal OES and BRIC funding: Pre-disaster mitigation for critical infrastructure.
- Local utility rate structures: Long-term capital planning for facility upgrades.





## Hurdles to Overcome

Adaptation of coastal water infrastructure intersects with complex regulatory, funding, and engineering challenges.

### Regulatory and Policy Challenges

- Multi-agency permitting involving the County, Coastal Commission, and State Parks remains lengthy for armoring or relocation, though the Ventura County RCD's programmatic permits offer a streamlined pathway for associated restoration activities.
- Local Coastal Program hazard policies emphasize avoidance and relocation where feasible; infrastructure owners may prefer hardening, requiring strong justification.

### Physical and Technical Challenges

- Limited land availability inland for relocation of water and wastewater systems.
- Aging infrastructure in difficult-to-access shoreline areas complicates construction logistics.
- Future groundwater rise can undermine infrastructure even before surface inundation.

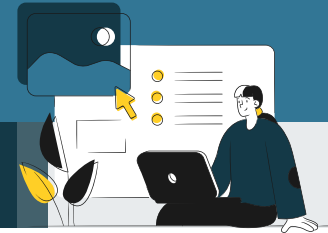
### Social and Funding Challenges

- Ratepayer and community concerns regarding costs, aesthetics, or temporary construction impacts.
- High upfront capital needs for infrastructure relocation.



# Action 4.1.a Implementation Roadmap

**Action 4.1.a: Analyze how projected climate impacts (such as higher peak flows, increased sediment and debris transport, wildfire burn-scar runoff, and prolonged inundation) will affect flood-control facilities, municipal stormwater systems, and centralized wastewater infrastructure. Identify where systems may be exceeded under future conditions and prioritize adaptation needs such as structural upgrades, sediment-removal programs, capacity expansions, asset protection, operational improvements, and emergency-preparedness measures, with emphasis on facilities serving overburdened communities.**



## Key Steps to Implementation

### Study Climate Impacts

- Using the latest climate projections, conduct regional studies that identify hazards and multi-hazard combinations for water infrastructure facilities
- Generate design guidance based on projected change in loading caused by hazards and hazard combinations (e.g. higher peak flows, increased sediment and debris transport, wildfire burn-scar runoff, and prolonged inundation) for relevant water resource systems.
- Develop performance metrics for climate impacts by adopting established standards from the DWR Climate Change Integrated Report and the OPC Sea-Level Rise Guidance to evaluate the resilience of relevant water resource systems.
- Itemize existing infrastructure and assets by adopting the American Society of Civil Engineers (ASCE) standardized rating system to generate interactive maps and online tools that report system health through consistent operational and maintenance performance metrics. Assess existing infrastructure and assets against updated design guidelines to establish compliance rating.

### Convene Workgroups

- Based on hazard-system combinations, convene targeted workgroups to address deficiencies.
- Identify and prioritize multi-benefit improvement opportunities.

### Generate Adaptation and Emergency Response Plans

- Assess failure pathways of at-risk, 'low- compliance', and other critical infrastructure.
- Develop adaptation pathways for at-risk systems (e.g., sediment management areas).
- Generate emergency response plans for communities reliant on at-risk infrastructure, ensuring these frameworks include pre- identified adaptation strategies that can be expedited through emergency permitting to bypass multi-year agency approval timelines following a disaster.



## Implementation Leads and Partners

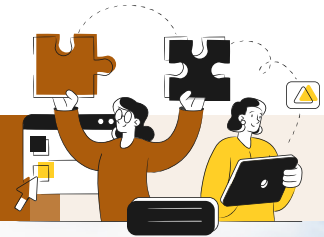
### Potential Leads

- **OVSD:** Assess and plan upgrades for wastewater infrastructure
- **City of Ventura - Public Works:** Evaluate and adapt municipal stormwater and flood-control assets.
- **City of Ventura - Ventura Water:** Assess climate risks to water supply infrastructure and incorporate updated design standards.
- **County of Ventura - WPD:** Lead flood-control facility assessments and update hydrologic/design criteria.
- **County of Ventura - Public Works:** Coordinate asset inventory, interagency planning, and integration into Hazard Mitigation Plans and CIPs.

### Potential Key Partners

- **Caltrans:** Coordinate adaptation of transportation drainage and related infrastructure.
- **County Parks:** Support multi-benefit project siting and public-facing resilience efforts.
- **BEACON:** Provide coordination support for regional grant applications and access to synthesized shoreline monitoring data and coastal process modeling tailored for the Santa Barbara and Ventura littoral cells.
- **OES:** Align infrastructure adaptation with emergency preparedness and response planning.





## Existing Projects and Efforts to Leverage

- Ventura County Watershed Protection District Flood Control Programs:** Existing design standards, debris-basin maintenance (e.g., Matilija Dam sediment management transition planning), and hydrologic studies for the Ventura River and tributaries (San Antonio Creek, Coyote Creek, Canada Larga).
- Stormwater and MS4 Programs:** Municipal and unincorporated stormwater system mapping, tide gate and outfall management near the Ventura River estuary, and sea-level rise adaptation planning.
- Ojai Valley Sanitary District Capital Improvement Planning:** Wastewater treatment and recycled water infrastructure upgrades relevant to floodplain exposure and wildfire-related sediment/debris risks.
- City of Ventura - Ventura Water Supply and Infrastructure Planning:** Ventura River diversion facilities, Foster Park wellfield, and integration with SWP reliability planning under climate stressors.
- Casitas Municipal Water District Dam Safety and Sediment Management Efforts:** Lake Casitas operations, dam safety reviews, sedimentation studies, and coordination tied to Matilija Dam ecosystem restoration and downstream flood capacity.
- Matilija Dam Ecosystem Restoration Project (multi-agency effort led by Ventura County):** Sediment transport modeling, channel evolution studies, and downstream infrastructure risk assessments directly applicable to climate-driven peak flow and debris scenarios.
- Ventura County and City Hazard Mitigation Plans:** Updated flood, wildfire, and post-fire debris flow hazard mapping specific to the Ventura River watershed and Ojai Valley.
- Ventura County Office of Emergency Services Emergency Response Frameworks:** Existing evacuation planning, burn-scar response protocols, and interagency coordination applicable to Ventura River flood and debris-flow risks.
- Regional IRWM Program – Ventura County Region:** Multi-benefit project funding and data-sharing platform supporting resilience upgrades in the watershed.





## Implementation Metrics

- **Reduced flood risk:** Fewer flood-related damage and service disruptions along the Ventura River corridor, Ojai Valley, and lower Ventura urban areas under high-flow events.
- **Improved performance of flood control facilities:** Increased compliance ratings and reduced overtopping or sediment-related capacity loss at facilities managed by WPD.
- **Resilient wastewater and stormwater systems:** Documented upgrades and reduced failure risk at systems operated by Ojai Valley Sanitary District and City of Ventura - Ventura Water and Public Works.
- **Protection of overburdened communities:** Prioritized capital improvements and emergency planning for facilities serving vulnerable neighborhoods in the Ojai Valley and West Ventura.
- **Watershed-wide asset inventory and mapping:** Completion of a shared, publicly accessible infrastructure inventory with performance ratings and climate stress indicators.
- **Adopted adaptation and emergency plans:** Formal adoption of facility-specific adaptation pathways and emergency response plans integrated into County Hazard Mitigation Plans and Capital Improvement Programs.
- **Expanded distributed retention and storage:** Increased number of public retention basins, green infrastructure retrofits, and household-scale water storage incentives within the watershed.



## Funding Considerations

- **DWR climate and flood grants:** Pursue resilience, flood management, and IRWM funding administered by DWR to support hydrologic updates, facility retrofits, and sediment capacity improvements.
- **FEMA Hazard Mitigation and BRIC:** Leverage Hazard Mitigation Assistance and BRIC funding through FEMA for high-risk facilities and community protection projects.
- **State coastal and watershed resilience funding:** Align lower Ventura River and estuary-related projects with state resilience programs where applicable.
- **Local capital improvement programs (CIPs):** Integrate adaptation upgrades into planned CIP cycles for wastewater, stormwater, and flood control agencies to reduce standalone costs.
- **Post-disaster recovery funding:** Position pre-identified projects for rapid funding access following declared disasters affecting the Ventura River Watershed.





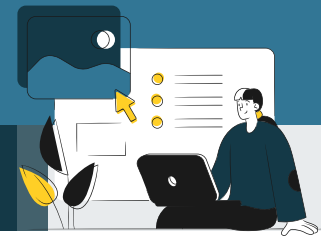
## Hurdles to Overcome

- **Built-environment constraints:** Limited space in developed areas of Ojai and Ventura, plus private property and easement limitations, restrict expansion of channels, basins, and sediment management areas.
- **Sediment and burn-scar management challenges:** Post-wildfire debris flows from upper watershed burn scars complicate siting, permitting, and long-term sediment removal planning.
- **Permitting complexity:** Multi-agency approvals for in-channel or floodplain work along the Ventura River may extend timelines and increase costs.
- **Funding competition:** High capital costs for retrofits and upgrades compete with other regional infrastructure priorities.
- **Emergency coordination gaps:** Need for clearer alignment between infrastructure operators and the Ventura County Office of Emergency Services for flood, debris flow, and prolonged inundation scenarios.
- **Public awareness and preparedness:** Limited community understanding of infrastructure limits and flood risk, particularly in historically flood-prone areas.



# Action 5.2.c Implementation Roadmap

**Action 5.2.c:** Develop and implement site-specific Recreation Management Plans for high-use river areas to balance public access with habitat protection in the face of more extreme precipitation, flooding, heat, and drought, and create or enhance alternative recreation hubs outside sensitive habitats to redistribute visitor pressure. Prioritize designs that protect sensitive vegetation, reduce erosion and water-quality impacts, and improve long-term ecological resilience while maintaining safe, sustainable access for the community. Leverage success of OVLC's Ventura River Preserve and incorporate lessons learned in future projects. Ensure public access priorities are incorporated into long-term implementation of the Matilija Dam Ecosystem Restoration Project (MDERP).



## Key Steps to Implementation

### Assess and Prioritize Sites

- Map high-use areas, informal access, sensitive habitats, erosion/vegetation impacts, and unmet recreational needs from underserved communities.
- Evaluate existing and projected future climate change risks (erosion, water quality, safety, habitat sensitivity).
- Classify sites: Protect and Harden, Redirect, or Relocate and Restore.
- Identify viable locations for alternative recreation hubs outside sensitive areas. Consider locations that serve overburdened communities.
- Establish an outreach and engagement plan to involve the broader community and interested parties, with input informing key milestones in the process.

### Plan and Design Improvements

- Develop site-specific Recreation Management Plans with access design, circulation, signage, and ADA accessibility needs.
- Apply low-impact and climate proofing standards:
- Hardened access points, sustainable trails, biostabilization, native planting, and stormwater BMPs.
- Create multilingual and culturally appropriate wayfinding and regulatory signage to guide visitors toward hubs and away from sensitive stream reaches.
- Integrate safety considerations from extreme weather events and water quality exceedances; consider emergency access and evacuation routes.

## Action 5.2.c

### *Key Steps to Implementation Continued...*

#### **Build Hubs and Manage Access**

- Construct or upgrade alternative hubs with parking, restrooms, shade, overlooks, and education/play features.
- Decommission informal access (social trails, ad hoc parking) and restore vegetation.
- Improve transportation access: signed routes, bike/ped links, EV charging ports, and seasonal shuttle/parking tools.
- Ensure equitable access: ADA compliance and multilingual signage.

#### **Implement and Phase Construction**

- Use programmatic permits (e.g., RCD, HCP frameworks) to streamline recurring work.
- Phase construction so hubs open before sensitive-site closures.
- Install erosion controls and revegetation immediately after access removal.

#### **Engage Community and Support Stewardship**

- Conduct co-design walks and workshops with users and Indigenous partners.
- Establish stewardship programs (trail adoption, planting days, ambassadors, youth crews).
- Provide behavioral nudges (QR info, condition updates, volunteer incentives).

#### **Monitor, Adapt and Report**

- Track performance via photo points, drone surveys, counters, parking data, water/vegetation indicators, and visitor surveys.
- Use adaptive triggers for temporary closures (bank stability, water-quality exceedances, nesting seasons).
- Provide transparent updates via dashboards and annual reports.





## Implementation Leads and Partners

### Potential Leads

- **OVLC:** Lead design/implementation on OVLC holdings; hub demonstration sites; volunteer programs; monitoring; lessons transfer from Ventura River Preserve.
- **VCRCD:** Programmatic permitting, CEQA/NEPA support, technical design standards, watershed coordination, contractor vetting.
- **County of Ventura – WPD:** Integration with flood and debris basin operations; bank stabilization alignment; hydraulic/sediment review.
- **City of Ventura / Ventura County Parks:** Public lands implementation, operations/maintenance of hubs, enforcement coordination.
- **VLT:** Lower watershed implementation; outreach; stewardship.

### Potential Key Partners

- **CA State Parks:** Access/amenities alignment; resource protection.
- **Tribal/Indigenous partners:** Cultural resource protection; interpretive programming; co-management opportunities. Fire agencies: Safety, evacuation coordination; red flag protocols for closures.
- **Public Health / Environmental Health:** Water quality advisories; signage templates.
- **Caltrans:** ROW treatments at bridges; parking safety; stormwater controls.
- **Local landowners and neighborhood groups:** Access agreements; stewardship; conflict resolution.
- **User groups (anglers, paddlers, equestrians, MTB, trail groups):** Co-design; volunteer maintenance days.
- **Schools and community orgs:** Education and ambassador programs.
- **MDERP partnership team:** Ensure public access designs align with restoration phasing, sediment management, and habitat goals.





## Existing Projects and Efforts to Leverage

- **OVLC's Ventura River Preserve:** Transfer lessons on trail hardening, social trail decommissioning, volunteer programs, and signage that effectively redirects behavior.
- **WPD bank stabilization and flood projects:** Leverage designs, hydraulic modeling, and construction windows; coordinate so improvements are complementary.
- **Programmatic permitting frameworks (e.g., RCD, HCP):** Use as the default pathway for recurring restoration and low-impact access work.
- **Community stewardship networks:** Neighborhood coalitions, volunteer groups, schools—scale up ambassadors and monitoring.
- **Existing datasets:** Drone/fixed-point imagery, vegetation mapping, trail counts—standardize into a shared monitoring dashboard.



## Implementation Metrics

- Percent of high-use sites with completed RMPs and implemented improvements Increased visitor use at designated hubs relative to sensitive sites, including visitors from underserved communities
- Reduced bank erosion at improved locations
- Measurable native vegetation recovery
- Decline in social trails and unauthorized access points Improved water-quality indicators at treated reaches On-schedule OandM completion and reduced incident trends
- Volunteer participation levels Public access improvements aligned with MDERP phasing Incorporation of RMP lessons into MDERP design updates





## Funding Considerations

- Pair capital grants (hub build-out, hardened access, bio-stabilization) with programmatic and OandM funding.
- Use phased projects with clear performance metrics to unlock subsequent funding.
- Align RMPs with public health, safety, and equity co-benefits to diversify funding.
- State: Coastal Conservancy, WCB Streamflow Enhancement, CDFW Prop 1/Restoration, CA State Parks LWCF/ORS.
- Federal: NOAA Restoration Center, USFWS Partners, FEMA BRIC/HMGP (for erosion/flood risk), FHWA TAP (active transportation to hubs). Regional/Local: County/City park funds, stormwater/water-quality funds, philanthropic foundations.
- MDERP: Integrate access elements into restoration work packages where appropriate.



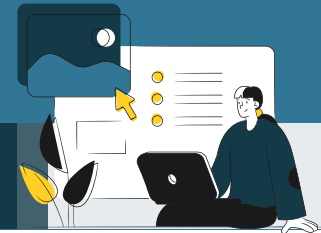
## Hurdles to Overcome

- Entrenched patterns of informal river access.
- Seasonal surges (holidays/heat) stressing capacity and OandM.
- Highly sensitive vegetation and unstable banks where “no access” is the only sustainable choice.
- Limited space for parking or restrooms near desired hubs.
- Multiple jurisdictions; cultural and biological constraints; construction window limitations.
- Post-project maintenance obligations not always covered by grants.
- Capital costs for hub build-out and durable access features.
- Long-term OandM, monitoring, and adaptive management funding.



# Action 6.3.a Implementation Roadmap

**Action 6.3.a: Conduct a Ventura River Agricultural Runoff Vulnerability Assessment that maps and quantifies nutrient, sediment, and pesticide loading hotspots and evaluates their impacts on downstream reaches and the Ventura River estuary by land-use type, season, and storm intensity, with a focus on how these conditions are expected to change with increasing drought, extreme heat, sea level rise, and extreme precipitation. Include current and anticipated water quality impacts and their cascading community effects from agricultural upstream contributions and livestock/equine facilities. Coordinate closely with the Ventura County Agricultural Irrigated Lands Group (VCAILG) to align with existing monitoring and reporting programs, avoid duplication of effort, and ensure the assessment supports rather than replicates regulatory requirements.**



## Key Steps to Implementation

A robust vulnerability assessment must integrate regulatory monitoring networks, agricultural community engagement, watershed science, and agricultural land-use and management patterns.

### Assessment and Data Integration

- Compile monitoring datasets from VCAILG’s historical Conditional Waivers and current Ag Order programs, including Responsibility Area (RA)-specific sampling results, trend data, and exceedance notifications from both Ag Order benchmarks and TMDL load allocations.
- Incorporate VCAILG’s RA boundaries, updated in 2025, which define compliance groups and determine when collective management obligations are triggered, such as required implementation of Management Practices, annual Farm Evaluations, or Management Practice Plans under TMDLs.
- Map agricultural parcels, crop types, irrigation methods, and horse facilities using GIS and land-use layers.

### Hotspot Mapping and Analysis

- Analyze nutrient, sediment, and pesticide loading by leveraging VCAILG’s long-term monitoring dataset (2006–present), to establish baselines for evaluating impacts under future climate projections.
- Identify pollutant source areas by vulnerable to climate change by overlaying existing storm-intensity hydrology, soil erosion potential, irrigation return flow pathways, and fertilizer application periods with projected shifts in precipitation and temperature.
- Ground-truth model outputs through targeted field verification and sampling utilizing current datasets and coordinating with VCAILG to avoid redundant monitoring.

## Action 6.3.a

### *Key Steps to Implementation Continued...*

#### **Impact Evaluation and Scenario Testing**

- Evaluate downstream impacts to the Ventura River, TMDL-listed reaches (e.g., algae/nutrient impairment), and the estuary under wet- and dry-weather regimes.
- Test scenarios reflecting climate-driven extremes identified in Resilient Agricultural Lands Initiative (RALI) and WRP (e.g., back-to-back storms, post-fire runoff, prolonged drought concentrating nutrients).

#### **Coordination and Reporting**

- Work with VCAILG to ensure the assessment complements their Water Quality Management Plan (WQMP) and RA-level management practice requirements.
- Ensure assessment outputs support growers' compliance pathways under the 2023 Ag Order (INMP/INMR reporting, Track 1 or Track 2 TMDL compliance).
- Share findings with agricultural community through Farm Bureau, UCCE, RCD, and RALI engagement channels.
- Integrate outreach, education, and coordination efforts early in the process.



## **Implementation Leads and Partners**

### **Potential Lead**

- **VCAILG / Farm Bureau of Ventura County:** Project management, regulatory alignment, access to monitoring data, outreach to growers, and integration with the WQMP.
- **VCRC:** GIS analysis, ag/horse facility engagement, integration with Agricultural Environmental Water Quality Assistance (AEWQA) program.

### **Potential Key Partners**

- **UCCE Ventura:** Agronomic and nutrient-management expertise; Irrigation and Nitrogen Management Plan education alignment.
- **Regional Water Quality Control Board:** Technical review; Ag Order and TMDL compliance coherence.
- **County of Ventura - WPD:** Hydrology, storm- event data, sediment modeling.
- **Horse facility operators and equestrian organizations:** Participation in source-area mapping and BMP identification.
- **Municipal Separate Storm Sewer System (MS4) permittees:** Urban runoff and estuary monitoring data.
- **RALI partners (Farm Bureau, Ag Commissioner, UC Extension, conservation groups):** Access to RALI datasets, community networks, and climate-resilient agriculture initiatives.



## Existing Projects and Efforts to Leverage

- **VCAILG Water Quality Management Plan (2025):** The assessment should build directly on RA boundaries, monitoring sites, and TMDL-driven obligations to avoid duplicative sampling and reinforce compliance pathways.
- **VCAILG Monitoring and Reporting Program:** Provides consistent nutrient, pesticide, and sediment data since 2006; integrate trend data and exceedance notifications to identify priority reaches.
- **Clearwater (parcel-by-parcel RA and review platform):** Use to align hotspot mapping with actual grower parcels and responsibility areas. [farmbureauvc.com]
- **AEWQA (RCD's watershed-wide BMP funding program):** Use assessment findings to target high-impact BMP projects for up to 60% cost-share grants.
- **RALI:** Leverage RALI's mapping, climate-risk findings, and farmer engagement network to frame the assessment within broader agricultural climate-resilience goals.
- **UCCE nutrient and irrigation management training:** Align assessment outputs with INMP/INMR grower training requirements and nutrient management benchmarks.
- **MS4 and TMDL monitoring and estuary data:** Integrate lower-watershed pathogen, nutrient, and sediment data for a complete source-to-estuary analysis.
- **State Water Resources Control Board Groundwater-Surface water Model:** An integrated tool developed to simulate the relationship between groundwater levels and surface water persistence to establish instream flow requirements for steelhead.
- **State Water Resources Control Board Nitrogen Transport Model:** A framework that tracks how nutrients move through the watershed to refine nitrogen load allocations and address algae and eutrophic conditions in the river.





## Implementation Metrics

- Completion of a watershed-wide pollutant hotspot map integrating VCAILG RA data, hydrology, and land-use patterns.
- Number of datasets integrated (VCAILG monitoring, TMDL exceedances, MS4 data, AEWQA site data, RALI spatial data).
- Field verification coverage, such as the number of sampling locations ground-truthed.
- Number of growers, ranchers, and horse-facility operators willingly participating in data collection or BMP scoping, facilitated by outreach and education efforts.
- Improved alignment with VCAILG WQMP implementation and future RA-level BMP recommendations.
- Actionable BMP opportunity maps that support future grant applications (e.g., AEWQA, SALC, Prop 4).
- Deployment of climate-informed strategies identified through the assessment (e.g., timing adjustments to fertilizer application, enhanced erosion-control measures, or targeted irrigation/BMP upgrades) in priority hotspot areas.



## Funding Considerations

Upfront costs include technical modeling, GIS work, and targeted sampling, but once the baseline assessment and hotspot map are completed, ongoing costs decline significantly. The assessment will form the foundation for future BMP targeting, regulatory compliance support, and grant-funded implementation, thereby providing long-term savings for growers and agencies.

- State Water Board 319(h) Nonpoint Source Grants: nutrient, sediment, pathogen source assessments. AEWQA Program (Ventura County Resource Conservation District): existing grant funding for nutrient, sediment, and irrigation BMPs across Ventura River.
- Prop 4 (2024 Climate Resilience Bond): watershed- scale water-quality and runoff mitigation planning. CDFA Healthy Soils and Nutrient Management grants: complementary grower incentives.
- NRCS EQIP: provides farmers with financial and technical aid to implement conservation practices that enhance water quality, soil health, and climate resilience.
- RALI Implementation Grants (SALC 2024): supports resilient agricultural land-use transitions and regional agricultural infrastructure planning.



## Hurdles to Overcome

### Data and Access Challenges

- Private property access for sampling and obtaining parcel-level data may be difficult and requires strong VCAILG–RCD–grower coordination.
- Some nutrient and pesticide records are proprietary; anonymization protocols may be needed.
- Climate data limitations such as coarse spatial resolution and uncertainty in localized precipitation intensity or timing, may constrain the precision of runoff, erosion, and nutrient-loading projections at the parcel or sub-watershed scale.

### Regulatory and Coordination Challenges

- Avoid duplicating VCAILG’s existing monitoring efforts and reporting; early, continuous coordination and adaptive management.
- Growers may be wary of assessments perceived as punitive; clear messaging via VCAILG and RALI networks is essential.

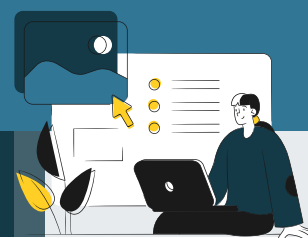
### Technical Challenges

- Storm-driven pollutant pulses vary widely, requiring multi-scenario modeling and high-resolution hydrology.
- Post-fire sediment and nutrient export complicates attribution in certain years.



# Action 7.1.b Implementation Roadmap

**Action 7.1.b:** Using the coordinated data systems and data-management subgroup established in Action 7.1.a, develop a watershed-scale ecological monitoring framework to track climate-driven change and inform adaptive management across upland, riparian, and aquatic habitats. Build on existing monitoring programs and integrate appropriate indicators, including wildfire-driven vegetation change, post-fire sediment and debris dynamics, and sea level rise and storm surge effects on estuary and coastal habitats. Incorporate Traditional Ecological Knowledge where consented, to support restoration, land management, and protection of ecosystem and cultural resources.



## Key Steps to Implementation

Climate-responsive ecological monitoring requires coordinated methods, shared data infrastructure, and multi-habitat indicators that can detect both long-term change and short-term impacts.

### Assessment and Framework Development

- Inventory and synthesize existing ecological monitoring efforts (riparian, aquatic, estuarine, upland) conducted by OVLC, WPD, RCD, State Parks, local Tribes, and other organizations. Evaluate gaps in monitoring related to climate-change indicators.
- Integrate datasets generated under the Ventura River Watershed Riparian Resilience Program, which includes multi-species, invasive-species, and habitat monitoring across the watershed.

### Indicator Selection and Methods

- Develop a cross-habitat set of indicators reflecting ecosystem health, climate sensitivity, and adaptive-management needs: Riparian indicators: canopy cover, invasive species extent, recruitment of native vegetation, groundwater-dependent ecosystem (GDE) condition.
- Aquatic indicators: baseflow persistence, stream temperature, benthic macroinvertebrates (BMI), steelhead passage metrics, sediment mobility.
- Upland indicators: post-fire vegetation trajectories, erosion susceptibility, slope stability, shrubland recovery.
- Cultural resource indicators (developed with Tribal partners): TEK-guided species observations, phenology, resource availability linked to cultural practices.

## Action 7.1.b

### *Key Steps to Implementation Continued...*

- Biological indicators: Population trends of keystone and sensitive species, including Southern California Steelhead abundance, California red-legged frog occupancy, and avian nesting success as proxies for broader ecosystem health and connectivity.
- Climate indicators: Water supply, drought frequency and duration, sea level rise, extreme heat, wildfire risk, fog conditions, etc.

Standardize protocols and establish a QA/QC and data-management plan shared across agencies.

### **Monitoring Implementation**

- Deploy a watershed-wide monitoring schedule with seasonal, event-based (e.g., post-storm, post-fire), and annual metrics.
- Integrate remote sensing (e.g., WPD’s LIDAR and GIS datasets) for vegetation change detection, sediment movement, and stream morphology.
- Engage community scientists and TEK practitioners, with pathways for culturally appropriate data sharing.
- Adaptive Management and Knowledge Sharing
- Establish a standing technical team (WRP Advisory Group + land managers) to review data annually and recommend habitat restoration, species-specific interventions, and bank-stabilization or flow strategies.
- Create “trigger points” (e.g., temperature thresholds, canopy loss levels) that automatically prompt management actions.
- Facilitate knowledge sharing by developing a centralized, user-friendly data portal—built on existing platforms such as the WPD GIS Data Hub—to provide partners, Tribal governments (as consented), and community scientists with consistent access to ecological datasets, monitoring results, and decision-support tools.





## Implementation Leads and Partners

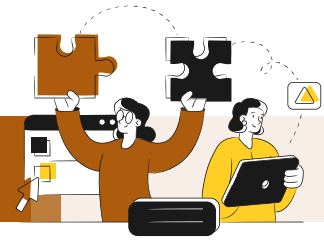
### Potential Leads

- **Ventura River Watershed Council:** Existing collaborative network serving the watershed, integrating sectors and stakeholder groups.

### Potential Key Partners

- **VCRC:** Framework coordination, data synthesis, community monitoring tools.
- **County of Ventura – WPD:** Hydrologic, geomorphic, and GIS data provision.
- **OVLC/VLT:** On-the-ground habitat monitoring, riparian/floodplain restoration sites.
- **CDFW:** Species-status data, ecological survey guidance, and alignment with riparian resilience program.
- **Local Tribes (with consent):** Integration of Traditional Ecological Knowledge, culturally important species and phenology indicators.
- **State Parks and U.S. Forest Service:** Upland and backcountry monitoring coordination.
- **Academic partners (UCSB, CSU, UC ANR):** Methodology development, long-term climate-ecology research.
- **Community groups and volunteers:** Photo-point monitoring, iNaturalist observations, and seasonal surveys.





## Existing Projects and Efforts to Leverage

- **Ventura River Watershed Riparian Resilience Program** (10-year initiative) — already performing species and habitat monitoring across multiple riparian corridors; this should form a backbone for riparian indicators and invasive-species tracking.
- **WPD GIS and Hydrology Data Hub:** provides LIDAR, flow data, and mapping tools to track geomorphic change, vegetation shifts, and hydrologic connectivity.
- **DWR Watershed Resilience Program pilot:** establishes performance indicators and monitoring expectations for watershed-scale climate resilience planning; the ecological monitoring framework should align directly with these metrics.
- **Land trust restoration sites (OVLC, VLT):** long-term vegetation plots, wildlife monitoring, and photo-points that can anchor habitat trend analysis.
- **Community science programs:** iNaturalist observations, volunteer weed-pull monitoring, and local bird and amphibian surveys.
- **Tribal environmental departments:** guidance on cultural-indicator monitoring and climate-sensitive culturally significant species.
- **CDFW State Wildlife Action Plan (SWAP):** Provides a regional conservation framework that identifies the Ventura River as a priority for conserving “Native Freshwater Aquatic Species Assemblages” and “Riparian Forest and Scrub,” offering specific strategies to mitigate climate-driven stressors like altered hydrologic regimes and habitat fragmentation.



## Implementation Metrics

Successful implementation is measured by the coverage, consistency, and integration of ecological monitoring across habitats.

- Completion of a watershed monitoring framework with standardized protocols across riparian, aquatic, and upland zones.
- Number of partner datasets integrated (e.g., riparian resilience program, WPD data hub, land trust vegetation plots).
- Monitoring coverage across priority reaches and representative upland and riparian sites.
- Annual ecological condition reports that identify trends, climate impacts, and priority adaptation actions.
- TEK integration measured by Tribal participation and culturally guided indicators, where consented.
- Adaptive-management decisions enacted in response to threshold exceedances or ecological triggers.



## Funding Considerations

Initial investment focuses on framework design, indicator selection, and building shared data systems. Once established, annual monitoring costs stabilize and become predictable, with long-term savings realized through earlier detection of ecological decline and more targeted, cost-effective restoration.

### Potential Funding Sources

- Proposition 4 (2024) Climate Resilience Bond, supporting monitoring and ecosystem adaptation.
- State Coastal Conservancy and Wildlife Conservation Board habitat-monitoring and restoration funds.
- CDFW riparian restoration funding, including ongoing support connected to the Riparian Resilience Program.
- DWR Watershed Resilience Program grants, emphasizing metrics and cross-sector monitoring.
- Federal sources: USFS, NOAA, USFWS climate-adaptation funds.
- Local philanthropy and land-trust grants for community science and upland monitoring.
- Cost sharing opportunities with stakeholders already implementing existing projects/efforts, as discussed below.



## Hurdles to Overcome

### Coordination and Data Sharing

- Different agencies use different monitoring methods; harmonization requires negotiation and training.
- TEK indicators require rigorous Tribal consultation and respected data-sovereignty agreements.

### Funding and Capacity

- Long-term ecological monitoring requires investment beyond project-based cycles.
- Remote-sensing analysis and climate-driven modeling require technical expertise and consistent staffing.

### Technical Challenges

- High interannual variability can obscure climate-driven trends without a multi-year dataset.
- Post-fire and post-storm disturbances require flexible monitoring schedules and rapid mobilization.

# Action 8.3.a Implementation Roadmap

**Action 8.3.a:** Improve Tribal access to culturally significant sites, traditional gathering areas, and subsistence resources across public and privately owned lands and waters, especially where climate change-driven flooding, drought, wildfire, or altered streamflows affect access. Work with Tribal governments, land managers, and landowners to identify priority locations and establish access protocols, agreements, or co-management approaches that protect cultural integrity and support continued gathering for food, medicine, materials, and ceremony.



## Key Steps to Implementation

Improving Tribal access to culturally significant sites, traditional gathering areas, and subsistence resources will require coordination and a long-term commitment across a broad sector of entities in the Watershed and will take time as relationships, trust and protocols are established. The steps below outline a plan to successfully achieve this.

### Build Meaningful Relationships

Initiate and sustain relationship-building between local Tribes, Tribal leadership, and cultural practitioners, in coordination with interested watershed land managers and landowners. Engagement should begin with listening and understanding Tribal priorities regarding access to culturally significant sites and traditional gathering areas.

### Establish Leadership Structures and Protocols

Clarify preferred leadership structures (Tribal-led, agency-supported, or co-led) and establish mutually agreed-upon protocols for handling culturally sensitive information. These protocols should define how culturally significant knowledge is protected and how access planning can proceed without compromising cultural integrity.

### Identify Priority Access Areas

Work with Tribal leadership and cultural practitioners to characterize watershed-scale access needs for culturally significant landscapes, gathering areas, and subsistence resources. Identify general geographic areas, resource types, and climate-related vulnerabilities without requiring parcel-level inventories or public disclosure of sensitive site information.

### Support Shared Learning and Understanding

Strengthen understanding among Tribal representatives, agencies, and participating landowners of Tribal engagement practices, climate resilient stewardship approaches, and the history of exclusion from traditional gathering areas. Shared understanding can help reduce barriers and support durable access agreements.

## Action 8.3.a

### *Key Steps to Implementation Continued...*

#### **Identify Access Pathways**

Conduct a high-level assessment of land ownership and management categories across priority landscapes (e.g., public agency lands, conservancies, private lands). Identify willing partners and evaluate which agreement mechanisms may be appropriate for different land types. This step translates priority needs into realistic access pathways.

#### **Develop and Pilot Access Agreements**

Work with willing landowners or agencies to develop and formalize access agreements (e.g., MOUs, easements, and cooperative stewardship arrangements). Where appropriate, begin with demonstration sites that can serve as case studies for future expansion. Develop templates and guidance documents to streamline future agreements.



#### **Institutionalize, Fund, and Scale the Framework**

Establish long-term coordination mechanisms, staffing roles (e.g., Tribal liaison or stewardship coordinator), and succession planning to ensure continuity and long-term planning. Identify funding pathways to support expansion of access and restoration where needed.



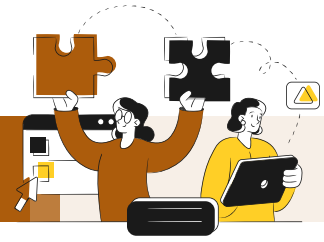
## **Implementation Leads and Partners**

### **Potential Leads**

- **Designated Tribal leaders or representatives:** Lead or co-lead identification of priority access needs, define cultural protocols, and guide the development of formal agreements and frameworks.
- **Land-managing agencies or conservancies** (e.g., OVLC, Ventura County, State Parks): Co-lead site-specific agreement development, support implementation, and help identify funding pathways.

### **Potential Key Partners**

- **VCRC:** Support convening and coordination; assist leads with framework development, facilitation of agreements, and funding identification.
- **Willing private landowners:** Provide access to priority landscapes and participate in establishing access agreements.
- **Legal and land-management advisors:** Provide legal counsel, conservation easement expertise, and land-status clarification for drafting agreements.

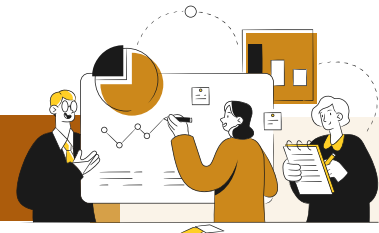


## Existing Projects and Efforts to Leverage

- **OVLC’s Rancho Cañada Larga Conservation Partnership:** The Trust for Public Land recently acquired the 6,500-acre Rancho Cañada Larga and is in the process of transferring the property to OVLC. OVLC and TPL are working with BVBMI on a cultural easement, which demonstrates how voluntary conservation agreements can incorporate early Tribal consultation and cultural access provisions. This model can inform future access agreements and stewardship arrangements
- **Matilija Dam Ecosystem Restoration Project (MDERP):** MDERP’s multi-agency coordination framework and long-term ecosystem restoration focus create opportunities to integrate Tribal stewardship and access considerations into planning and management in the upper watershed.
- **Partnerships among Land Conservancies and Stewardship Organizations:** Entities such as OVLC, Ventura Land Trust, and Ventura County RCD maintain long-standing stewardship capacity and relationships with landowners. These organizations may serve as early partners for pilot access agreements and demonstration sites.
- **Ventura River Watershed Council:** The watershed network provides a forum to coordinate with willing land managers, support Tribal access partnerships, and identify funding opportunities.



## Implementation Metrics



- Established inventory of priority access needs and opportunities within the watershed
- Development of guidance and templates to support access agreements
- Number of formalized access agreements (e.g., MOUs, easements, cooperative stewardship arrangements)
- Number of acres or sites where culturally appropriate access is established/restored
- Number of participating landowners or agencies engaged in access agreements
- Secured funding or dedicated staffing to support long-term coordination and implementation





## Funding Considerations

Anticipated costs include staff time for relationship-building, coordination, and development of access agreements. Additional expenses may involve legal review, land surveys or documentation support, and ecological or biological expertise to inform site conservation and monitoring. Ongoing liaison capacity will also be needed to maintain agreements and support continued Tribal access and stewardship.

### Potential Funding Sources

- State grants supporting Tribal stewardship and habitat restoration (e.g., California Natural Resources Agency Tribal Nature-Based Solutions Grant Program, Coastal Conservancy Tribal Capacity Building Program)
- Philanthropic foundations supporting Indigenous land access and stewardship
- Local open space or conservation funding
- Tribal capacity-building funding programs



## Hurdles to Overcome

- **Trust and Relationship Building:** This process takes time and can't be rushed.
- **Protection of Sensitive Information:** Sacred cultural sites and assets may not be appropriate to share with the public. Need to prevent broad access to this information.
- **Capacity and Staffing Limitations:** Tribal governments and non-profit entities may lack the staffing and capacity to help carry out these activities.
- **Ecological Stewardship Alignment:** Not all entities, including Tribes, share the same goals and priorities for stewardship efforts.
- **Institutional and Liability Constraints:** Public agencies and private landowners may require formal agreements that address liability, insurance, and internal policy requirements before granting access. Navigating these processes can extend timelines.



## Chapter 7

# Performance Indicators for Watershed Resilience

This chapter introduces indicators that track how watershed conditions change over time and measure progress toward resilience goals. The indicators support adaptive management, transparent reporting, and community engagement by showing where conditions are improving or where more action is needed.

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## Introduction

This chapter identifies watershed-scale resiliency indicators to track whether the Ventura River Watershed Resilience Plan (VRWRP) is achieving its intended long-term outcomes for people, ecosystems, and infrastructure. These indicators complement the action-level implementation metrics in Chapter 6. While implementation metrics track delivery of individual tasks (e.g., acres treated, meetings held), the resiliency indicators and metrics in this chapter measure broader system conditions and watershed-scale resilience outcomes, offering “vital signs” of watershed health for managers to consider through VRWRP implementation.

The indicators are organized by the VRWRP’s eight goals and aligned with the Department of Water Resources (DWR) Watershed Resilience Framework and Watershed Hub Resilience Indicators & Metrics guidance. This alignment supports statewide consistency, incorporation of equity lenses, and compatibility with dashboard-based reporting tools used across California.

The Watershed Council may use these indicators to produce an annual VRWRP progress report and maintain a simple online dashboard. This process provides a shared understanding of watershed conditions, strengthens adaptive management, and supports potential grant reporting requirements.

## Alignment with Statewide Indicators & Existing Local Monitoring

The VRWRP indicators align with DWR’s Watershed Hub resilience categories so local tracking can plug into statewide reporting tools. This ensures the Ventura River Watershed is speaking the same “performance language” as the California Water Plan and can demonstrate progress in terms familiar to funders and regulators.

The watershed already has strong monitoring programs that support can support the tracking of these indicators, including:

- **Groundwater & water supply:** Data collected by the Upper Ventura River Groundwater Agency (UVRGA) and the Ojai Basin Groundwater Management Agency (OBGMA).
- **Hydrology & floods:** United States Geological Survey and Ventura County Watershed Protection District stream gages and storm monitoring.
- **Water quality & ecology:** Ventura Countywide Stormwater Quality Management Program monitoring, Ventura County Agricultural Irrigated Lands Groups monitoring, MS4 programs, 303(d) listings, UVRGA temperature and water quality monitoring, State Water Resources Control Board GeoTracker database, Channelkeeper Stream Team sampling, Surfrider Foundation’s Blue Water Task Force, and land-trust ecological monitoring.
- **Equity & community vulnerability:** The Vulnerable Communities Platform, CalEnviroScreen, and local demographic datasets.

Remaining gaps, such as routine estuary habitat mapping, academic institution partnerships through OVLC’s Special Use Permit (SUP) program for specialized regional research initiatives, recreation access tracking, USGS Post-Wildfire Debris-Flow Hazard Assessment viewer for assessing wildfire-related debris flow risks, subsidence monitoring, integrated groundwater-surface water modeling, and culturally appropriate data for Tribal partners, can be filled over time through project-based monitoring or targeted grants.

## VRWRP Indicators

The resiliency indicators presented below build on the strategies and actions refined in **Chapter 6: Adaptation Strategies, Actions, and Implementation Roadmaps** by shifting the focus from implementation steps to watershed-scale outcomes. While the Implementation Roadmaps describe how partners will carry out priority actions, the indicators in this chapter describe how the watershed will change as those actions take effect. Together, they provide a consistent way to track long-term resilience across the Ventura River Watershed and provide alignment with DWR’s Watershed Resilience Indicators and Metrics.

To help partners clearly see how each indicator supports the goals of the VRWRP, the table below links every indicator to the VRWRP’s eight climate adaptation goals:

- **G1** – Ecosystem Health is Strengthened Watershed Wide
- **G2** – Water Supply is More Reliable and Water Infrastructure is More Climate Resilient
- **G3** – Communities, Infrastructure and Ecosystems are Protected from Erosion, Flooding, and Shoreline Change Driven by Sea Level Rise and Storm Surge
- **G4** – Flood and Erosion Risks to Communities, Infrastructure, Water Quality, and Ecosystems from Extreme Precipitation are Minimized
- **G5** – Recreational Access for Community Enjoyment is Protected and Enhanced
- **G6** – Agricultural Practices are Adapted to the Effects of Climate Change and Sustain a Thriving Local Economy and Ag-Based Livelihoods
- **G7** – Coordinated Watershed Resilience is Strengthened Through the Improvement of Governance, Funding & Monitoring Tools
- **G8** – Native Leadership and Indigenous Knowledge Strengthen Climate Resilience of Cultural Resources, Sacred Sites, Subsistence Areas, and Heritage Assets

The matrix shows which indicators align with which goals, allowing users to see how ecological, hydrologic, climate, cultural, and governance indicators collectively measure progress. Example metrics are included to illustrate how each indicator may be monitored. Some indicators support a single goal while others contribute to multiple goals, reflecting the interconnected nature of watershed resilience.

Ventura County Resource Conservation District  
**Ventura River Watershed Resilience Plan**

Indicator	Example Metrics	G1	G2	G3	G4	G5	G6	G7	G8
<b>Algal Stream Condition Index (ASCI)</b>	ASCI score based on benthic algal community condition	✓							✓
<b>CalEnviroScreen</b>	20 indicators across exposure, environmental effects, sensitivity, and socioeconomic factors		✓	✓	✓	✓	✓	✓	✓
<b>California Rapid Assessment Method (CRAM)</b>	CRAM wetland/riparian condition score (buffer, hydrology, physical structure, biotic structure)	✓							✓
<b>California Stream Condition Index (CSCI)</b>	CSCI score as defined by statewide bioassessment methods	✓							✓
<b>Cold water refugia / stream temperature trends</b>	Continuous summer stream temperature; days exceeding thermal thresholds at predetermined sites	✓							
<b>Connectivity for steelhead migration</b>	Miles of stream accessible to anadromous fish; number and location of passage barriers	✓							
<b>Debris flow susceptibility</b>	Assess post-fire landscapes for debris flow risk				✓				
<b>Flood risk for assets (coastal and inland)</b>	Asset exposure to 100-year flood events			✓	✓				
<b>Flood risk for people (coastal and inland)</b>	Population exposure to 100-year flood events			✓	✓				
<b>Funding landscape</b>	External funding secured; funds leveraged	✓	✓	✓	✓	✓	✓	✓	✓
<b>Groundwater levels</b>	Groundwater level trends over a representative monitoring network		✓				✓	✓	
<b>Heat and drought resilience</b>	Number of orchards in operation; acres of irrigated agricultural lands in operation						✓		
<b>Invasive plant species distribution</b>	Acres or % cover of <i>Arundo donax</i> and other invasives in priority reaches	✓							
<b>Communities vulnerable to climate hazards, as depicted through the Vulnerable Communities Platform</b>	Number of people living in highly vulnerable communities; number of projects or dollars invested in these communities		✓	✓	✓	✓	✓	✓	✓
<b>Potential disruption in supply during drought</b>	Number of dry wells		✓				✓	✓	
<b>Recreational area usage</b>	Park visitation rates; program participation					✓			
<b>Reliability of recreational access</b>	Days river access points and trails are open; water quality conditions					✓			
<b>Reliability of water supply for beneficial uses</b>	Domestic water supply reliability, including Lake Casitas level trends and instream flows		✓				✓	✓	

Indicator	Example Metrics	G1	G2	G3	G4	G5	G6	G7	G8
Sea level rise risk	Exposure to coastal flooding, shoreline retreat, estuary condition, infrastructure sensitivity			✓					
Strength and presence of Tribal partnerships	Funding allocated for Tribal organizations; number of partnerships								✓
Water conservation and efficient use	Average annual urban water use		✓						



## Using Indicators in Implementation

Implementation of the VRWRP will be carried out by the many partners identified in Chapter 6, with the Watershed Council serving as the coordinating body that maintains alignment on shared goals and helps track progress toward achieving them. The Watershed Council’s role is not to implement every action, but to support collaboration through topic-specific working groups, maintain the indicator dashboard, and facilitate regular review of watershed-wide conditions. By making these indicators publicly accessible, the dashboard also serves as a tool for transparency, allowing community members, Tribes, and partner agencies to see how watershed conditions are changing and how management actions are performing over time. This shared visibility helps strengthen accountability and builds trust in collaborative decision-making.

Indicators help partners:

- Understand how individual projects contribute to watershed-scale outcomes,
- Adjust priorities through adaptive management when trends reveal emerging risks or unmet needs, and
- Identify where cross-agency coordination is needed—for example, when indicators show persistent water-quality exceedances or localized flood-risk hotspots.

Maintaining a consistent indicator set also strengthens the watershed’s competitiveness for state and federal funding. Many grant programs now require clear baseline conditions, measurable outcomes, and demonstrated capacity to track results. By compiling indicator updates in an annual VRWRP progress report, the region can clearly show need, document benefits, and demonstrate a resilient, performance-based approach, making grant proposals more compelling and fundable.



## Chapter 8

# Recommendations and Next Steps

This chapter outlines key recommendations and next steps to advance implementation, emphasizing coordinated governance, inclusive partnerships, sustained funding strategies, and adaptive management through ongoing monitoring and collaboration.

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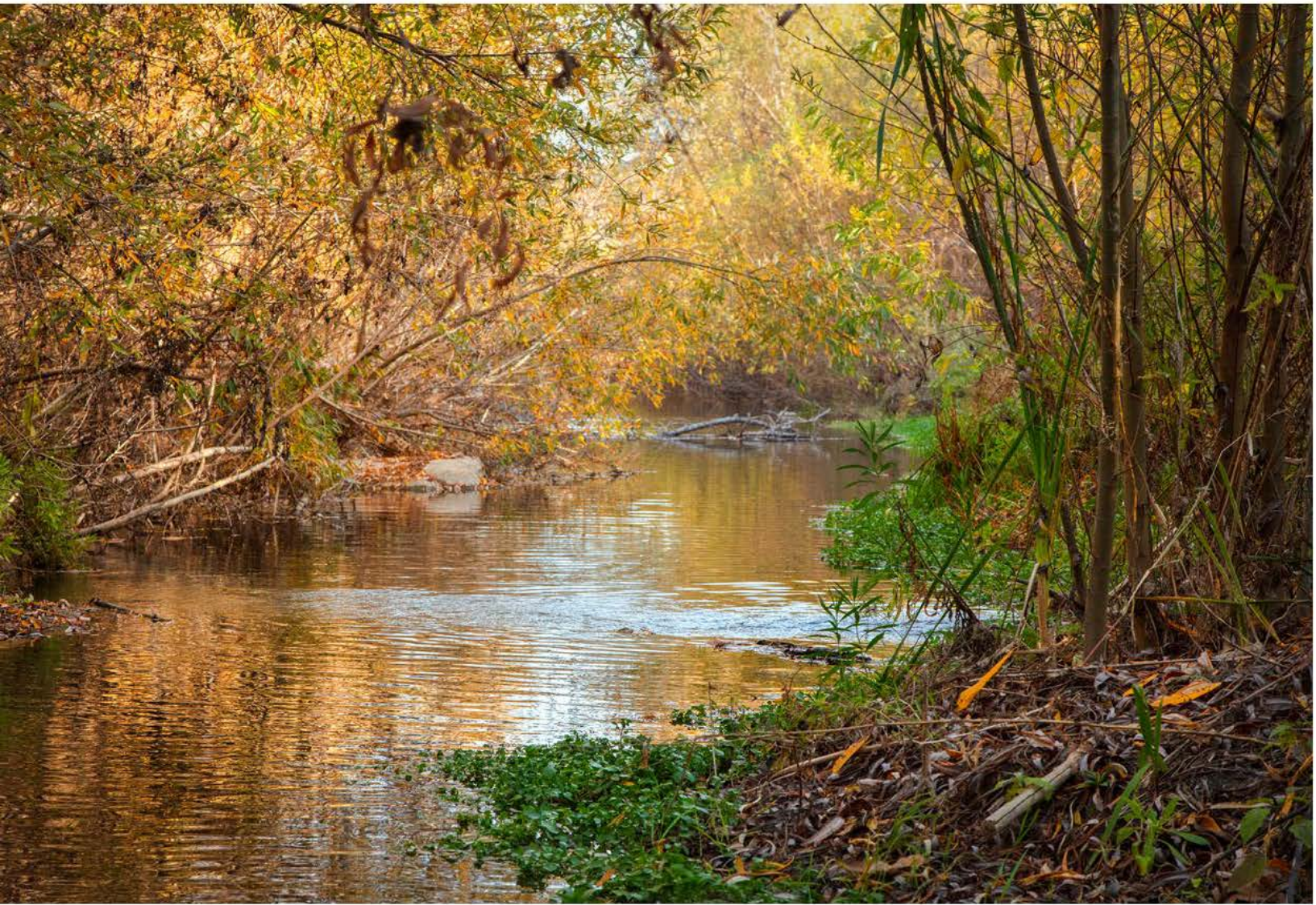
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## Recommendations and Next Steps

Successful implementation of the VRWRP will rely on strong collaboration across agencies, Tribes, and community organizations. The Ventura River Watershed Council is well-positioned to serve as the long-term convener and coordinator of this work, helping maintain alignment on shared goals, steward collaborative tools, and support collective progress. The following recommendations outline priority actions to strengthen the watershed network and advance VRWRP implementation.

### **Strengthen Multi-Agency Coordination Through the Watershed Council**

Strengthen the position of the Watershed Council as the central forum for watershed-wide coordination, ensuring consistent communication across jurisdictions, sectors, and organizations. Distributing leadership roles, identifying shared priorities and strengthening partnerships will reduce over-reliance on a small set of partners and improve the network's ability to address shared climate challenges. Continued support for collaborative planning efforts like the VRWRP will help maintain a common foundation of goals.

### **Maintain and Evolve Network Tools as Living Resources**

Utilize and reference the watershed's collaborative tools, including the Kumu network map and organizational profiles, to supplement existing collaboration and partnerships. Update and maintain these tools, as needed. These tools can support information-sharing, partner matching, and cross-sector coordination. Regular updates to the tools will ensure they reflect current partnerships, data, capacities, and needs.

### **Expand Inclusive Participation & Strategic Partnerships**

Expand the watershed network by better engaging underrepresented and less-connected organizations (including Tribal governments, small community-based groups, farms, and domestic well users) and supporting their participation through targeted training, technical assistance, and funding navigation. At the same time, deepen partnerships with Tribal governments and representatives, private landowners, land conservancies, grassroots groups, youth initiatives, research institutions, and state and federal agencies to broaden implementation capacity and incorporate diverse knowledge systems.

### **Coordinate Funding Strategies & Pursue Large-Scale Resilience Investments**

Develop a coordinated, multi-agency funding strategy that positions the watershed to compete effectively for Proposition 4 and other large-scale state and federal investments. Align priority actions with upcoming solicitations, identify joint funding opportunities, and support readiness for multi-benefit project proposals. Investing in both key anchor organizations and smaller, less-connected partners will strengthen overall network resilience and reduce funding disparities.

### **Establish an Annual Progress Reporting Process for Adaptive Management**

Following adoption of the VRWRP, convene an annual progress (convened through the Watershed Council) reporting meeting to review progress on strategy and action implementation, provide an update on performance indicators, and recalibrate priorities based on emerging conditions. This regular touchpoint will provide transparency, reinforce collaboration, and help partners adjust strategies as

climate, ecological, and community needs evolve. The Watershed Council can maintain a simple public-facing dashboard to track watershed-scale conditions and communicate progress year over year.

### **Follow a Clear Near-Term Timeline for Plan Adoption & Early Implementation**

In the immediate term, complete public review, finalize the VRWRP, and update the Council Charter to reflect implementation roles. Convene working groups to refine early action priorities, assess funding opportunities, and prepare near-term implementation roadmaps. By June 2026, the Council will vote on plan adoption, updated governance structures, and initial implementation priorities.

### **Maintain the Watershed Resilience Plan as a Dynamic Resource**

The VRWRP is a valuable resource reflecting a comprehensive, collaborative and intentional planning process made possible through the Watershed Resilience Pilot Program grant from DWR. To help ensure long-term relevance and successful implementation of the strategies and actions outlined in the VRWRP, engage targeted working groups focused on achieving and monitoring specific actions. These groups will support the work of the Coordinator and the Watershed Council's Leadership Committee in monitoring the ongoing performance of the VRWRP.



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