Summary Report on Improved Flood Risk Management in Sonoma County

FINAL DRAFT

Prepared by HDR Engineering, Inc.

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Prepared for:

Image: 2019 Russian River flooding at Monte Rio Bridge. Credit: Sonoma Water.

Table of Contents

List of Figures

List of Tables

Appendices

Attachments

Acknowledgements

This report represents the culmination of the Countywide Flood Risk Management Assessment Project. This report was prepared by HDR for all participating organizations and partners. The Countywide Flood Risk Management Assessment Project convened organizations and agencies with flood risk management roles and responsibilities in Sonoma County to have interactive discussions about opportunities to improve flood risk management through regional coordination. This report is based on input from participants representing many different organizations, perspectives, and roles. It does not signify consensus among participants.

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Relationship to Other Flood Risk Management Initiatives

This report presents recommendations to improve flood resilience throughout Sonoma County through regional coordination. Many of the participants, listed above, have long histories of planning, designing, and implementing flood risk management plans, programs, and projects. This report draws on this extensive knowledge and experience to identify priorities for regional coordination. Priorities of individual organizations and agencies may differ; the emphasis of this report is on activities that would benefit from greater interorganizational and interjurisdictional coordination at countywide scale.

Neither the proposed Countywide Flood Risk Management Partnership nor the recommendations contained in this report are intended to infringe upon, fulfill, or eliminate the legal obligations of members to provide specific flood risk management services.

Abbreviations

ABAG	Association of Bay Area Governments
AEP	annual exceedance probability
AFN	access and functional needs
AQPI	Advanced Quantitative Precipitation Information
CalEnviroScreen	California Communities Environmental Health Screening Tool
CBO	community-based organization
CNRFC	California-Nevada River Forecast Center
County	County of Sonoma
CRS	Community Rating System
CW3E	Center for Western Weather and Water Extremes
DEM	Sonoma County Department of Emergency Management
DAC Mapping Tool	Disadvantaged Communities Mapping Tool
DWR	Department of Water Resources
FEMA	Federal Emergency Management Agency
FIRO	forecast-informed reservoir operations
FloodMAR	flood managed aquifer recharge
FMDM	Flood Management Design Manual
H&H	hydrologic and hydraulic
JPA	joint powers authority
NFIP	National Flood Insurance Program
NGO	non-governmental organization
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
Partnership	Countywide Flood Risk Management Partnership
PG&E	Pacific Gas and Electric
RCD	Resource Conservation District
Sonoma Water	Sonoma County Water Agency

Introduction

Background

Sonoma County has the greatest recurrent flood damages of any county in California and the eleven western states.[1] Local, state, and federal agencies have invested in building flood control facilities, elevating structures, and employing other strategies to reduce flood risk within Sonoma County, yet severe floods continue to impact residents, businesses, and workers. In the past two decades, eight Presidential disaster declarations were issued for floods in Sonoma County—nearly one every two years.[2] More localized floods that are not captured by these declarations have impacted Sonoma County communities in intervening years, without federal assistance for recovery.[3]

The most recent events highlight the impacts that flooding can have on Sonoma County communities. The February 2019 floods impacted more than 2,000 properties, displaced vulnerable residents, and caused an estimated $155 million in damages countywide.[4] A series of atmospheric rivers in 2023 caused widespread power shutoffs for more than 4,600 households and businesses, which resulted in spoiled food, lack of heat, business closures, and lost wages. Flooded roadways made it difficult for residents to get to work and access fuel for vehicles, homes, and generators.

Flood events have a disproportionate impact on people and communities that have less ability to prepare and recover from flooding and/or that have heightened sensitivity to the impacts of flooding. Spoiled food and lost wages, and other flood impacts, have greater consequences for low-income households, which have fewer resources to recover from these losses. In addition, legacies of racial and ethnic discrimination, such as redlining and housing discrimination, mean that communities of color are more likely to reside in flood-prone areas and/or neighborhoods that are underserved by infrastructure and public services.[5] As wildfires, floods, and other disasters in Sonoma County continue to increase in frequency and intensity, the immediate and cumulative impact on residents and communities that have been traditionally underserved has generated significant interest and need for novel solutions and resources.

Damaging floods in Sonoma County are primarily caused by significant storm events known as atmospheric rivers.[6] Atmospheric rivers are long bands of moisture-laden air that flow from the Pacific Ocean, releasing precipitation at landfall. Atmospheric rivers can result in storm events lasting multiple days, interspersed with periods of torrential rainfall. Climate change projections indicate the region will experience greater atmospheric river activity in the future, including more frequent, longer duration, and higher intensity storms, exacerbating existing flood risks.[7] Tidally

[1] Corringham et al. (2019).
[2] Inventory from Tetra Tech (2021, pp. 4-4 – 4-5) updated with data from FEMA (2024).
[3] FEMA (2024) and National Academies of Sciences, Engineering, and Medicine (2019, p. 61).
[4] Tetra Tech (2021, pp. 10–11).
[5] Roos et al. (2018) and California Governor's Office of Planning and Research (OPR) (2018b).
[6] Corringham et al. (2019).
[7] Sonoma Water (2021, pp. 3-13 – 3-14).

influenced rivers and streams will also be increasingly susceptible to flooding due to sea level rise.[8]

Flood risk management responsibilities in Sonoma County are spread across multiple organizations, jurisdictions, and levels of government. Floods are driven by factors that do not often align with the scales at which individual organizations and jurisdictions have authority to act. Moreover, flood risk management needs greatly exceed available resources. Climate change impacts will put additional strain on these services and resources.

Purpose and Objectives

The purpose of the Countywide Flood Risk Management Assessment Project is to lay the foundation for a more coordinated, effective, and efficient approach to providing flood risk management services in Sonoma County. Led by Sonoma Water and DEM, the Countywide Flood Risk Management Assessment Project convened organizations and agencies with flood risk management roles and responsibilities in Sonoma County (hereafter, "partners") in pursuit of the following objectives:

- Clarify flood management responsibilities and opportunities;
- Improve interagency and interjurisdiction coordination;
- Improve positioning for state and federal funding;
- Reduce risk to life safety and property via enhanced organizational effectiveness; and
- Enhance environmental protection.

The County of Sonoma (County) has enacted a framework through the Racial Equity Toolkit for assessing the impacts of plans, programs, and projects on equitable outcomes. Additionally, Sonoma Water, through its 2023 Board-approved Energy and Climate Resiliency Policy, committed to advancing work that meets the needs of vulnerable communities and to designing solutions with and for community members facing the greatest climate burdens. To align with the County framework and Sonoma Water's Policy and address the disproportionate impacts of flooding on low income, rural, and communities of color, the Countywide Flood Risk Management Assessment Project sought to identify populations and communities that are more vulnerable to flooding due to underlying environmental, social, economic, and systemic factors and to consider strategies to address these vulnerabilities and work towards justice in flood management activities through regional coordination.

Approach

The Countywide Flood Risk Management Assessment Project convened partners at various points over six months to have interactive discussions about how flood risk management services are delivered to the public and opportunities for improvement (Figure 1). The findings and recommendations that follow draw on the ideas and input generated by these activities.

[8] OPC (2018).

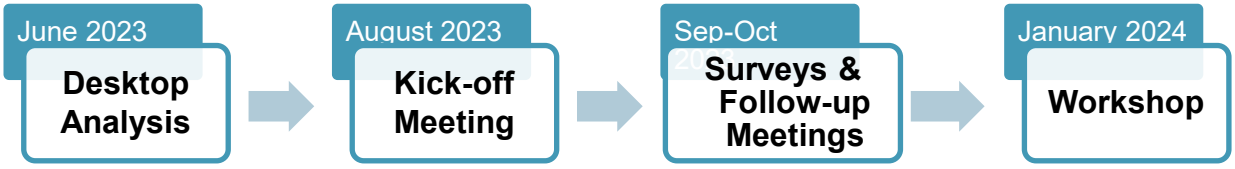

Figure 1. Overview of Project Approach and Timeline

Desktop Analysis

To lay the groundwork for an informed discussion among the parties, HDR reviewed information from a variety of existing resources; documented information about existing and future flood risk; and inventoried the existing authorities, roles, responsibilities, policies, and standards held by each organization with a flood risk management role in Sonoma County. Preliminary results were presented to partner organizations at the project Kick-off Meeting in August 2023 as the basis for discussion. An updated version of the Desktop Analysis was distributed to partners in September 2023 alongside a survey that requested additional information and input. The final Desktop Analysis is included as Attachment 1 to this report.

Outreach

Entities across the county that have flood risk management jurisdiction and responsibilities were contacted and invited to participate as partners in the Countywide Flood Risk Management Assessment Project. These included County departments, cities, special districts, and federal partners. In addition, resource conservation districts (RCDs) and community-based organizations (CBOs) that provide flood risk management services to Sonoma County landowners and residents, respectively, were notified of the project and invited to provide input. As the leader of a large-scale Flood Managed Aquifer Recharge (FloodMAR) project in the County, Dry Creek Rancheria was also invited to participate. Engagement with Tribal Nations is ongoing, and there is a need to strengthen government-to-government partnerships with Tribal Nations. As the project progressed, new interested parties were identified and invited to participate, including environmental nongovernmental organizations and additional state and federal partners. Some of the invited entities were not able to participate because of capacity constraints and availability. As discussed later in this report, there is a need to identify funding sources to support the involvement of these entities in future collaboration efforts.

Additional outreach was conducted through Flood Control Zone Advisory Committee meetings (Zones 1A, 2A, and 3A) to help introduce partners in each zone to the effort. These meetings will continue to act as a platform for coordination around flood management activities.

Additionally, thanks to this effort, Sonoma Water launched a set of Informational Briefings, with guest speakers on topics related to the Countywide Flood Risk Management Assessment Project. The Informational Briefings were open to all Countywide Flood Risk Management Assessment Project partners as a way to encourage information-sharing and collaboration.

Kick-off Meeting

In August 2023, partners were invited to attend a virtual meeting to introduce the project and share initial input on flood risk management priorities, challenges, gaps, and redundancies. The Kick-off Meeting Summary is included as Attachment 2 to this report.

Surveys and Follow-up Meetings

In September 2023, HDR distributed survey questionnaires requesting input on gaps in existing flood risk management services and on the challenges and opportunities to improve flood risk management in Sonoma County. Survey recipients included each of the incorporated cities and towns in Sonoma County, four County departments, three special districts (including Sonoma Water), five CBOs that provide flood recovery services, and other partners. Of the 25 organizations that received a survey, 14 provided a response. Meetings were held with a subset of the survey respondents to clarify responses and collect additional information. The survey responses and follow-up meetings were used to identify opportunities for improved regional coordination.

Workshop

A half-day workshop, “Conversation for a Better Flood Future,” was held on January 8, 2024, at Sonoma Water’s offices in Santa Rosa. There were 23 participants. Attendees participated in two rounds of breakout group discussions focused on different aspects of flood risk management. The breakout groups were asked to identify potential coordinated regional actions to improve flood resilience. Once the breakout group discussions were completed, participants had the opportunity to review ideas from other breakout groups and show support for actions that they felt would benefit the most from regional collaboration. Actions that received the most support were discussed in greater detail, and potential next steps were identified. The Workshop Summary is included as Attachment 3 to this report.

Flood Risk Management in Sonoma County

For purposes of this report, flood risk is defined as a function of the likelihood and consequences of a flood.[9] Likelihood is related to the flood hazard (frequency, stage, extent, depth). Consequences are dependent on the people and property exposed to flooding and their vulnerability. Flood risk management consists of decisions made by individuals and organizations to implement actions to reduce flood hazards, exposure, and vulnerability.

This chapter provides a high-level overview of flood risk and existing flood risk management in Sonoma County. More details are available in the Desktop Analysis (Attachment 1).

Overview

Sonoma County, California, covers more than 1,570 square miles. It is bordered by Marin County to the south, the Pacific Ocean to the west, Mendocino County to the north, Lake and Napa Counties to the east, and San Pablo Bay to the southeast. Sonoma County is home to approximately 488,000 people, concentrated in the cities of Cloverdale, Cotati, Healdsburg, Petaluma, Rohnert Park, Santa Rosa, Sebastopol, and Sonoma and the Town of Windsor.[10] Five federally recognized Southern and Southwestern Pomo tribes have ancestral territory and currently recognized trust (reservation) lands in Sonoma County: the Cloverdale Rancheria of Pomo Indians of California, the Dry Creek Rancheria Band of Pomo Indians, the Federated Indians of Graton Rancheria, the Kashia Band of Pomo Indians of the Stewarts Point Rancheria, and the Lytton Rancheria Band of Pomo Indians.

The majority of land in the county drains to the Russian River. The Russian River subbasin[11] is roughly equal in area to the county itself, at 1,500 square miles, extending from Mendocino County to Sonoma County, and west to the river's mouth at the Pacific Ocean. Within Sonoma County, the Russian River subbasin is composed of four watersheds: the Upper Russian River, Dry Creek, Laguna de Santa Rosa / Mark West Creek, and the Lower Russian River.[12] The North Coast and South Coast watersheds are situated to the north and south, respectively, of the Lower Russian River watershed and drain to the Pacific Ocean. The Petaluma River and Sonoma Creek watersheds are situated at the southeastern end of the county and drain to San Pablo Bay. A portion of the Petaluma watershed upstream of the Petaluma River is located in Marin County, to the south.

In 1958, under the authority of Sonoma Water's enabling legislation, the formation of nine geographical zones, each encompassing a major watershed, was proposed as a means of financing the construction and maintenance of flood risk management infrastructure within Sonoma County (Figure 3). In following years, Zones 1A, 2A, 3A, 5A, 7A, and 8A were formed.

At the time the existing zones were formed, the enabling act authorized Sonoma Water to impose an assessment of up to twenty-five cents ($0.25) on each one hundred dollars of assessed value. When Proposition 13 passed in 1978, total property taxes were limited to one

[9] Shabman et al. (2014) and USACE (2024).
[10] Approximately 73 percent of the population resides in incorporated areas of Sonoma County, according to the U.S. Census Bureau (2020a).
[11] At the 8-digit hydrologic unit scale (HUC-8) as defined by the U.S. Geological Survey.
[12] At the 10-digit hydrologic unit scale (HUC-10) as defined by the U.S. Geological Survey.

percent of each parcel's value. As a result, the share of property taxes that existing taxing entities would receive was frozen at the rate that existed at that time (the "Prop. 13 allocation"). To augment the limited funds resulting from this change in law, landowners in Zones 1A and 2A authorized the levying of special benefit assessments within these two zones in November 1986 and again in 1996, for 10 years each. These assessments expired in 2006. In 1996, Proposition 218 passed, further restricting local taxes and fees and imposing new requirements and procedures for benefit assessments.

Currently, five of the formed zones are funded through the Prop. 13 allocation within that zone ("Active"), and one does not receive any property tax ("Inactive"). Three zones have not been formed. If a new zone were formed now, Sonoma Water would not be able to follow the imposition process defined in its enabling act, and reallocating any portion of existing property tax revenue would require all the jurisdictions receiving property taxes within the zone to forego a portion of their shares. In addition, because of the significant constraints imposed by Proposition 218 since its passage, Sonoma Water has not pursued any new flood risk management revenue measures.

Cities may provide flood risk management services within their respective jurisdictions that are additional to any services provided by Sonoma Water and any other entities providing flood risk management services within the county.

Major hydrologic features and jurisdictional boundaries for each watershed and flood control zone are depicted in Appendix A, Figure 4 through Figure 11.

Flood Hazards

Atmospheric river events are the primary cause of riverine flooding in Sonoma County, and in California more broadly.[13] Riverine flood hazard areas mapped by the Federal Emergency Management Agency (FEMA) are depicted in Appendix A, Figure 4 through Figure 11. These areas have an estimated 1-percent annual exceedance probability (AEP) of flooding.

Urban areas within Sonoma County can also be impacted by shorter duration, high-intensity storms during which the capacity of urban drainage systems is exceeded, although stormwater flood hazards are typically not well represented on FEMA maps.[14, 15] This issue is exacerbated when high river stages prevent drainage systems from discharging flow.

Other drivers of flood hazards include backwater effects at confluence points between tributaries and main stem rivers (of particular concern along the Russian River) and backwater effects in tidal reaches of rivers and streams (of particular concern on the Petaluma River and Sonoma Creek). Ongoing and future sea level rise will worsen this existing condition and lead to more frequent tidally-influenced flooding.

Partners in Sonoma County implement a wide variety of actions to reduce flood hazards and manage waterways, including but not limited to:

[13] Corringham et al. (2019) and Dettinger et al. (2011).
[14] Tetra Tech (2021, p. 10-9).
[15] National Academies of Sciences, Engineering, and Medicine (2019, pp. 59–60).

- Designing, constructing, and maintaining facilities such as levees, dams, detention basins, rainwater catchment systems, channel setbacks, and channel reconfiguration, including inset flood terraces;
- Designing, constructing, and maintaining improvements to urban storm drain systems;
- Designing and implementing upland restoration projects and land management practices that reduce erosion and runoff in both rural and urban settings;
- Maintaining conveyance capacity through stream maintenance activities such as vegetation and sediment management, creek cleanups, and seasonal trash and debris removal; and
- Investing in monitoring, forecasting, and modeling systems to inform more effective use of reservoir management volumes.

Exposure

An estimated 7,768 people live in the riverine flood hazard areas mapped by FEMA within Sonoma County.[16] There are an estimated 4,570 buildings located in these areas, including 377 critical facilities (such as wastewater treatment plants, schools, and fire stations).[17] Additional people and property could be exposed to flood events that are not mapped by FEMA, including urban stormwater flooding and flood events with a lower probability of occurrence.

Partners in Sonoma County implement a wide variety of actions to reduce flood exposure, including but not limited to:

- Creating and updating models and maps to identify areas exposed to flooding;
- Adopting laws, regulations, and other standards that restrict certain land uses or set higher standards for development in flood-prone areas;
- Providing funding and technical assistance to property owners to elevate structures and equipment above base flood elevations;
- Issuing warnings to avoid travel and avoid areas subject to flooding; and
- Implementing road closures and evacuations during flood events.

Vulnerability

Vulnerability can be defined as a heightened risk of adverse consequences due to increased sensitivity and reduced ability to recover from flooding.[18] There are many populations and communities in Sonoma County with a heightened risk of adverse consequences to flooding.

> *"Sonoma County is the 17th largest of California's 58 counties, with a population of 488,863 and 187,701 total households, according to U.S. Census Data from 2020. The U.S. Census Bureau's 2019 American Community Survey reports the following data on race and national origin in Sonoma County: The racial composition of the planning area is predominantly white, at about 62.7%." [The largest racial and ethnic category in the Census data other than white is Hispanic or Latino (of any race) at 28.9%.] After that, "The largest racial categories in the Census data other than white are 'some other race' at 15.3% and 'two or more races' at 13.5%. Further racial composition includes the following: Black/African*

[16] Tetra Tech (2021, p. 10-17).
[17] Tetra Tech (2021, pp. 10-17 – 10-18).
[18] OPR (2018a).

American (1.6%), American Indian and Alaska Native (1.8%), Asian (4.7%), Native Hawaiian and Pacific Islander (0.4%). …16.9% of the population is foreign-born. An estimated 29,000 undocumented immigrants reside in the county, 87% of whom are from Mexico or Central America. The Census reports that 26.5% of residents speak a language other than English at home.

Based on U.S. Census data, 20.9% of Sonoma County's population is 65 years or older, and 22% of the population is 19 years or younger. An estimated 30.5% of the over-65 population in the planning area has disabilities of some kind, as well as 7.2% of those under 65. People with disabilities are more likely than the general population to have difficulty responding to a disaster. Those with Access and Functional Needs (AFN) (includes individuals with disabilities, seniors, children, limited English proficiency, and transportation disadvantaged residents) require greater government coordination efforts in times of emergency.

The Census estimates that 8.8% of all families in Sonoma County have incomes below the poverty level. Residents below the poverty level are less likely to have insurance to compensate for losses from natural disasters, and federal aid is designed to restore property to owners, not renters. Personal household economics also significantly impact people's decisions on evacuation.

As of February 2020, 2,745 individuals were experiencing homelessness in Sonoma County. 62% of county residents experiencing homelessness are unsheltered. About four in ten people in Sonoma County experiencing homelessness have access to temporary shelter (temporary shelter includes a vehicle, emergency shelter, or transitional housing)."[19]

Remote, unincorporated communities in Sonoma County are more vulnerable because of their physical isolation, which can make it more difficult to connect to preparedness and recovery resources. Communities along the lower Russian River can become physically isolated during flood events because of river stages and downed trees and power lines. Most populated areas in the Lower Russian River watershed are located in the 100-year floodplain, including the communities of Guerneville, Monte Rio, Villa Grande, and Duncan Mills.[20] Residents on the northern Sonoma Coast have to travel long distances to receive assistance.

As previously noted, communities of color are more likely to reside in flood-prone areas and/or neighborhoods that are underserved by infrastructure and public services because of structural discrimination and inequities.[21] Underserved communities might have more difficulty accessing resources like food, housing, and medical care in general. This lack of access could be exacerbated during and after floods.

Low-income households are more vulnerable because they have fewer economic resources to prepare for and recover from floods, for example by purchasing flood insurance and by covering the costs of evacuation and property damage.[22] Flood impacts like spoiled food and lost wages have greater consequences for low-income households, which have fewer resources to recover from these losses. Low-income households are also more likely to reside in older buildings, with fewer resources to make improvements to mitigate risk. According to metrics developed by the

[19] Sonoma Water (2024).
[20] Sonoma Water (2021).
[21] Roos et al. (2018) and OPR (2018b).
[22] OPR (2018b, pp. 11–12).

California Department of Water Resources (DWR), several census tracts within the Laguna de Santa Rosa / Mark West Creek watershed and the Lower Russian River watershed are economically disadvantaged.[23] At the smaller, census block group scale, there are communities designated as disadvantaged or severely disadvantaged in all but two watersheds (Appendix A, Figure 12 through Figure 18).

Vulnerability increases with reduced access to timely flood risk information and recovery assistance, such as for people with limited English proficiency, people experiencing homelessness, undocumented immigrants, and renters.[24] Outdoor workers are more likely to be exposed to flooding and more vulnerable because their income may be weather-dependent.[25]

As demonstrated above, vulnerabilities related to flooding are heightened for the housing, health, jobs, food access, and transportation sectors.

Partners in Sonoma County implement a wide variety of actions to reduce vulnerability, including but not limited to:

- Providing multilingual education about flood risk and resources to increase preparedness;
- Promoting the purchase of flood insurance by property owners and renters;
- Enabling property owners and renters to receive discounts on flood insurance premiums via participation in the FEMA National Flood Insurance Program (NFIP) Community Rating System (CRS), for participating cities;
- Coordinating directly with group homes and other access and functional needs populations before and during emergencies;
- Making flood emergency and clean-up kits, sandbag stations, and other preparedness resources available;
- Issuing alerts and warnings in English and Spanish through multiple warning and notification systems and media outlets; and
- Providing recovery support centers and individual assistance programs to connect impacted individuals to services and financial support.

[23] Defined as having a median household income less than 80 percent of the State median household income (DWR 2024).
[24] OPR (2018b, pp. 3–4, 6–7, 13–16).
[25] OPR (2018b, pp. 8–9).

Findings and Recommendations

While existing flood risk management services in Sonoma County are extensive, fragmentation across multiple organizations, jurisdictions, and levels of government can lead to gaps in services, confusion about which entities are responsible for specific services, and inefficiencies in the provision of certain types of services. These issues, and opportunities to address them through greater coordination at a regional scale, fit within the following four themes:

- Policies and Standards
- Monitoring, Modeling, and Decision Support
- Stream Maintenance
- Communication and Community Engagement

For each theme, the sections that follow summarize gaps, challenges, and opportunities and propose recommendations to improve flood risk management through regional coordination. Each recommendation is accompanied by example actions that were identified by partners during the surveys and workshop. The findings and recommendations are drawn from the Desktop Analysis and partner input.

Policies and Standards

Findings

Because city and county boundaries do not align with watershed boundaries, land use and infrastructure development decisions made in one jurisdiction can affect flood risk in another. For example, if a jurisdiction permitted a development that increased the volume of runoff to nearby stream channels, flood flows could increase within downstream communities. Similarly, if a jurisdiction permitted a development that filled a portion of the floodplain on one side of a river, the reduced floodplain capacity could increase water surface elevations in a community across the river. Thus, the effectiveness of local flood risk management policies and standards in one jurisdiction depends on the policies and standards in neighboring jurisdictions.

California law requires that the safety, land use, housing, and conservation elements of city and county general plans consider areas subject to flooding and that safety elements also consider climate change vulnerabilities and adaptation strategies (*Cal. Gov. Code* § 65302). Municipalities that participate in the NFIP are required to adopt codes that meet or exceed minimum standards established by FEMA in the Code of Federal Regulations (44 CFR 59.1 et seq.). For example, participating communities must set minimum standards for proposed construction within certain special flood hazard areas, including the 1-percent AEP floodplain (more commonly known as the 100-year floodplain) and the regulatory floodway. Special flood hazard areas are mapped based on existing hydrology and these minimum standards do not account for future risks posed by climate change. The floodplains and floodways mapped by FEMA in Sonoma County are depicted in Appendix A, Figure 4 through Figure 11.

Within unincorporated Sonoma County, Permit Sonoma is responsible for meeting the minimum standards. Permit Sonoma's role includes updating the County general plan; adopting zoning, building, and floodplain management codes; and issuing zoning, grading, and building permits. Within incorporated areas, these responsibilities are held by city planning, engineering, and/or

public works departments. Some of these agencies have adopted policies and standards that exceed minimum standards set by the State of California and by FEMA.[26] Some apply their policies to flood-prone areas beyond those mapped by FEMA.[27] Five have adopted stricter freeboard standards, requiring the lowest floor elevation of structures to be at least one foot above the base flood elevation. Permit Sonoma and the City of Petaluma have adopted no-net-fill policies in designated areas of the Laguna de Santa Rosa and the Petaluma River floodplain, respectively. Additionally, Permit Sonoma has designated a "Flood-Prone Urban Area" in low-lying areas upstream of the Laguna de Santa Rosa in which any placement of fill requires a drainage analysis and grading permit.[28] These policies and standards will be more effective if applied consistently throughout each watershed.

Sonoma Water's *Flood Management Design Manual* (FMDM) sets design criteria and provides guidance for the review of drainage and flood control facilities and private development designs. The FMDM, most recently updated in 2020, does not include future climate data. For unincorporated areas, Permit Sonoma reviews development projects for compliance with the FMDM. Most municipalities in Sonoma County outsource design reviews directly to Sonoma Water.[29] However, as a special district, Sonoma Water does not have land use authority, and its review is limited to technical consistency with FMDM guidelines.[30] The County and municipalities have the discretion to enforce or waive FMDM requirements when issuing permits, depending on their municipal codes. Many other local agencies review and comment on development designs and might have perspectives that differ from the FMDM. Interagency coordination and coordination with permitting authorities is essential to provide consistent, effective direction to project proponents, while not restricting local agencies from enforcing their particular, and sometimes more stringent, standards.

At an individual and household level, partners identified a variety of gaps and inequities in services, resources, and communication during flood recovery. Property owners are more likely to have flood insurance policies, and higher-resourced, documented, English-speaking households are better able to navigate financial assistance programs to get support.[31] Renters lack the control and might not have the means to compel landlords to make repairs to damaged homes. Flood impacts other than physical damage to a structure or its contents might not be reimbursable through flood insurance or state or federal individual assistance programs.[32] Examples include lost wages, spoiled food, and long-term health impacts associated with mold. Unless an event is a state- or federally declared disaster, local expenditures on disaster recovery assistance are not reimbursed. The Pacific Gas and Electric (PG&E) settlement funds

[26] Specific local policies and standards are detailed in the Desktop Analysis (Attachment 1).
[27] Flood-prone areas mapped by FEMA include, but are not limited to, the 1-percent AEP floodplain (more commonly known as the 100-year floodplain), with and without base flood elevations identified, and the regulatory floodway.
[28] Sonoma County Ordinance No. 4467. A map of the designated area is available at https://permitsonoma.org/Microsites/Permit%20Sonoma/Documents/Divisions/Administration/GIS/Downloadable%20Map/Flood-Prone-Urban-Area-Boundary-BlackWhite.pdf.
[29] Sonoma Water has agreements to provide reviews for the Cities of Santa Rosa, Rohnert Park, Sonoma, and Petaluma and the Town of Windsor.
[30] The Sonoma County Flood Control and Water Conservation District Act, Stats. 1949, c. 994., West's Ann. Cal. Water Code App. §§ 53-1 et seq.
[31] OPR (2018b).
[32] FEMA (2019).

that were used to provide financial assistance to impacted individuals and households in 2023 are not a long-term funding source. Partners signaled that policy and implementation options could be explored to address these inequities.

Recommendations

To address challenges related to the fragmentation of land use, design review, and permitting responsibilities across many different jurisdictions and public agencies and a shortage of policy solutions to support individuals and households in flood recovery, partners could consider the following recommendations.

Recommendation 1. Align and strengthen flood risk management policies and standards, where appropriate.

Example actions:

- Review key differences between local governments' floodplain management codes (e.g., freeboard, no-net-fill policies) to understand their purpose and effects and the potential opportunities for and value of amendments to align with approaches in adjacent jurisdictions.
- Review key differences between the FMDM and related policies, standards, and submittal requirements set by local governments to understand their purpose and effects and the potential opportunities for and value of increased alignment.
- Identify and assess policy approaches to mitigate the impacts of climate change on flood risk.

Recommendation 2. Coordinate planning and permitting activities.

Example actions:

- Coordinate during general plan updates to align future land use plans.
- Coordinate approaches to account for the impacts of climate change and sea level rise on flood risk in land use plans and other locally adopted plans.
- Create regular opportunities for agencies with land use responsibilities to share information on planned and proposed development projects.
- Provide courtesy referrals to jurisdictions that are downstream of a proposed development/encroachment and to agencies whose infrastructure might be affected by a proposed development/encroachment.
- Support coordinated watershed-level planning, including through collaboration on grant and other funding opportunities.

Recommendation 3. Update flood hazard area maps used for regulatory purposes, where appropriate.

Example actions:

- Pursue updates to Flood Insurance Rate Maps in coordination with FEMA and all agencies with jurisdiction covered by the maps, where appropriate.
- Coordinate approaches to account for the impacts of climate change and sea level rise on flood risk in land use plans and other locally adopted plans.

Recommendation 4. Explore options to improve flood risk management services and recovery resources for individuals and households.

Example actions:

- Explore options to provide legal aid and/or relocation assistance to tenants living in repetitive-loss structures and special flood hazard areas.
- Explore options to provide hazard mitigation assistance to low-income households living in repetitive-loss structures and special flood hazard areas (whether tenants or owners).
- Explore options to improve enforcement of substantial damage and home quality standards.
- Explore options to develop a long-term sustainable funding source for local disaster recovery assistance to supplement state and federal assistance programs.
- Explore interest in and options for funding unemployment insurance for hourly outdoor workers who lose wages during floods.
- Integrate new resources, as they become available, into risk communication products.

Monitoring, Modeling, and Decision Support

Findings

Monitoring and modeling are foundational to informing flood risk management decisions. Forecast models rely on near-term and real-time meteorological monitoring data to anticipate precipitation type, intensity, and other characteristics. Reservoir managers and local agencies use forecasted precipitation intensity thresholds to guide flood operations and response activities. Hydrologic and hydraulic (H&H) models can be used to estimate the probability of flooding in a given location; to evaluate and compare maintenance regimes and project alternatives; and to create flood extent maps for situational awareness, planning, regulatory, and insurance purposes. A variety of data are needed to develop input parameters and assumptions within H&H models. These can include long-term weather, rainfall, streamflow, soil moisture, and sediment records, among other types of data.

Existing monitoring systems used in Sonoma County include the U.S. Geological Survey's stream gauges, County- and city-owned rainfall and stream gauges, and the National Weather Service's (NWS) gauges (including the atmospheric river observatory). Sonoma Water publishes real-time and historical rainfall, river, and stream levels and reservoir levels and flow data for Lake Mendocino and Lake Sonoma on the Sonoma OneRain platform, and several city governments publish real-time rainfall, stream gauge and/or flood stage data on their webpages. For example, Petaluma provides real time stream gauge information on the City's website, https://cityofpetaluma.org/flood-alert-info. Sonoma Water is currently partnering with other San Francisco Bay Area water agencies, research scientists, and state and federal agencies on an Advanced Quantitative Precipitation Information (AQPI) initiative to improve high-resolution, low-level X-band and C-band radar coverage and storm-monitoring capabilities.

Near-term precipitation events are forecasted using monitoring data from radar, satellite, and other instruments to drive a variety of meteorological models and ensembles (which are combinations of models or model results). For example, the Scripps Institution of

Oceanography's Center for Western Weather and Water Extremes (CW3E) develops atmospheric river forecasts using a downscaled ensemble model called WestWRF.

When combined with real-time monitoring data and weather forecasts, H&H models can be used to develop flood forecasts that inform operation and management decisions. For example, the California-Nevada River Forecast Center (CNRFC) produces river stage and flow forecasts for specific forecast points that are used for flood operations and response activities. Some local governments also use forecast information to inform whether and where to implement road closures and issue warnings. Sonoma Water is currently partnering with the U.S. Army Corps of Engineers and other state and federal agencies to explore the feasibility of using forecast-informed reservoir operations (FIRO) at Lake Mendocino and Lake Sonoma to improve flood risk management and water conservation on the Russian River.

Along with city and County partner agencies, Sonoma Water has made considerable investments since 2017 in updating H&H models for the Santa Rosa Creek, Petaluma River, and Sonoma Creek watersheds. For example, the City of Petaluma made a strategic investment to convert its effective XPStorm-based model to HEC-based platforms. The resulting HEC-HMS and HEC-RAS models include projections of sea level rise and climate change impacts and will be used by Sonoma Water and other partners in the County for future upper watershed detention basin feasibility analyses and designs. The drainage areas and streams covered by local models are depicted in Figure 19, Figure 20, and Figure 21 in Appendix A. Partner survey responses suggest that many other drainage areas and streams in Sonoma County (including portions of the Upper and Lower Russian River and its tributaries) are not represented in H&H models or are represented by coarse or outdated model inputs. Additionally, many local governments in Sonoma County lack access to decision support systems capable of translating these forecasts into actionable emergency operations.

H&H models are also important tools for long-term planning and decision-making. H&H models can be used to evaluate the effects of potential management actions, plans, and projects to reduce flood risk relative to existing or projected future conditions. Downscaled climate change projections could be used in combination with H&H models to understand and inform long-term planning and investment decisions based on projected future conditions. Sonoma Water is currently developing a geodatabase of downscaled climate projections for 24-hour rainfall depths under a variety of future time periods, emissions scenarios, and recurrence intervals. These data are based on LOCA2 downscaling products developed for the 5th California Climate Assessment. Given the multiplicity of climate models and the inherent uncertainty of future emissions pathways, selecting appropriate datasets for use in H&H models and interpreting results would benefit from a consistent, robust approach that is coordinated across agencies and jurisdictions.

Finally, it is important to note that forecast models and H&H models are focused on identifying flood hazards and do not account for exposure or vulnerability. Myriad datasets and indicators have been developed at the local, regional, state, and federal levels to understand the distribution of vulnerable populations and support more equitable decision-making. These include, but are not limited to, the Sonoma County Human Development Index, the Association of Bay Area Governments' (ABAG) Equity Priority Communities, the DWR Disadvantaged Communities (DAC) Mapping Tool (see Figure 18. Disadvantaged Census Block Groups in the

North Coast Watershed in Appendix A), the California Communities Environmental Health Screening Tool (CalEnviroScreen), the CDC/ATSDR Social Vulnerability Index, Census and American Community Survey data published by the U.S. Census Bureau, and others.

Recommendations

To address the gaps in existing monitoring network and model coverage and the challenges translating data and models into information for decision-makers, partners could consider the following recommendations.

Recommendation 5. Improve coverage and uptake of existing monitoring, forecast modeling, and H&H modeling capabilities.

Example actions:

- Foster regional knowledge of existing monitoring networks for relevant observations (e.g., temperature, rainfall, streamflow, sediment) and coordinate to identify and fill gaps.
- Foster regional knowledge of existing forecasting capabilities and initiatives, such as AQPI.
- Coordinate with state, federal, and research partners involved in weather monitoring and forecasting to maintain an up-to-date understanding of available research, tools, and data.
- Assess interest in updating, integrating, and augmenting sediment, hydrologic, and hydraulic models and implement, as appropriate.
- Collaborate to identify available datasets, data-sharing opportunities, and priority data collection needs (e.g., topography, bathymetry, land cover) to support model updates, expansion, and integration.

Recommendation 6. Leverage modeling and forecasting capabilities for improved flood operations.

Example actions:

- Identify and implement changes to improve accessibility of forecast information products to end users (e.g., through processing of precipitation forecast information for ready import and application in models; hosting of technical webinars; technical assistance).
- Develop decision-support tools that use forecasts to aid in identifying and adjusting locations for emergency operations centers, road closures, detours, evacuations, and other flood operations while accounting for vulnerable populations that might require special assistance during flood operations.

Recommendation 7. Leverage modeling capabilities to identify, evaluate, and select management actions to reduce flood risk.

Example actions:

- Establish shared criteria to identify priority locations for interjurisdictional or interagency flood risk management plans and projects while accounting for underserved communities and vulnerable populations that might be disproportionately impacted by flooding.

- Identify potential management actions (e.g., changes to policies and standards, changes to operations or maintenance, physical projects) and use H&H models to evaluate the effects of potential management actions on flood risk.
- Collaborate to pursue implementation of management actions that are shown to reduce flood risk, while accounting for underserved communities and vulnerable populations that might be disproportionately impacted by flooding.

Recommendation 8. Evaluate the availability and appropriate use of downscaled climate change projections for flood risk management planning and projects.

Example actions:

- Establish an online platform to share downscaled climate change projections, user guidance, sample work products, and tools among partners and with the public.
- Develop a coordinated communication strategy to disseminate the online platform and to convey consistent and robust information about future flood risk to decision-makers and the public.
- Explore coordinated approaches to use downscaled climate change projections for land management, infrastructure design, and investment decision-making within the region.
- Coordinate with state, federal, and research partners involved in climate change research, climate modeling, and downscaling to maintain an up-to-date understanding of available research, tools, and data.

Stream Maintenance

Findings

Flood risk can increase over time because of sediment build-up, vegetation growth, and the presence of trash and debris in stream channels that reduce conveyance capacity or alter erosion dynamics. Changes in upstream channel geometry can also affect flood risk downstream. Although sediment has important ecological value for building wetlands, beaches, and mudflats, which provide habitat and coastal flood risk management, it can also exacerbate riverine flood risk. Coarse sediments can mobilize during high flows, driving bank failure and scour around infrastructure in the channel. Mobilization of gravel along the Russian River has caused bank failures and major damage to public infrastructure. Fine sediment is deposited in lower gradient reaches downstream, where it reduces channel capacity and contributes to overtopping. Culverts, drainage outfalls, and other infrastructure located within channels can exacerbate these issues.[33]

Stream maintenance reduces flood risk by removing debris and sediment, thinning vegetation, and stabilizing channel banks. Many different agencies and organizations have a role in the maintenance of stream channels and associated infrastructure:

- Sonoma Water is responsible for maintaining the engineered flood control channels that it owns (which are a subset of all stream channels), as well as access roads, drop inlet culverts, outfalls, flap gates, and road crossing culverts constructed in association with these engineered channels.
- Sonoma Water also maintains select engineered, modified, and natural channels (a subset of all stream channels) through permissive easement agreements where another jurisdiction or private landowner owns the channel feature. Easements authorize, but do not require or obligate, Sonoma Water to conduct maintenance or to maintain to any specific standard.[34]
- Cities are responsible for maintaining stream channel reaches and associated infrastructure that they own. Most cities also delegate some responsibility for stream channel maintenance to property owners.[35]
- Transportation agencies, including the California Department of Transportation (Caltrans), County of Sonoma Public Infrastructure, and city public works agencies are responsible for maintaining infrastructure that they own, which can include roadside drainages (ditches, swales, etc.), drainage outfalls, road crossing culverts, and bridges within stream channels.
- The University of California Cooperative Extension, the Resource Conservation Districts, and many non-governmental organizations (NGOs) provide technical assistance and project management on multi-benefit restoration projects and land management practices to reduce erosion at the source.

[33] Sonoma Water (2020b, pp. 3-15 – 3-30, 5-1 – 5-2).
[34] Sonoma Water (2020b, p. 1-5).
[35] Local codes delegating maintenance responsibility are identified in the Desktop Analysis (Attachment 1).

According to survey responses, a lack of mutual understanding of ownership, roles, and responsibilities hampers effective stream maintenance by both public agencies and private property owners. Agencies might not engage in maintenance in order to avoid liability when ownership, permit coverage, or responsibility is unclear. Agencies might also be hesitant to incentivize or enforce property owners to maintain channels that traverse their properties without confirmation of the specific locations subject to maintenance or regulatory requirements. Without adequate maintenance, sediment build-up, vegetation growth, and the presence of trash and debris in stream channels can reduce conveyance capacity and cause overtopping, road and bank failure, and scour around infrastructure in the channel.

Additionally, the cost of permitting and implementation often exceeds available resources. Sonoma Water's Stream Maintenance Program is primarily funded through the share of property tax received within active Flood Control Zones (see Appendix A, Figure 3, for a map of active and unformed Flood Control Zones). Even within active Flood Control Zones, no single entity has jurisdiction or resources to maintain all stream channels. Inactive and unformed Flood Control Zones lack substantial dedicated funding for stream channel maintenance, even though cities and transportation agencies (as mentioned above) carry some responsibility for maintaining stream channels and drainage infrastructure. New funding sources could raise revenue for increased or expanded maintenance in areas where a lack of maintenance is hindering effective flood risk management.

Recommendations

To address the fragmentation of responsibility and lack of resources for stream maintenance, partners could consider the following recommendations.

Recommendation 9. Clarify roles and responsibilities related to maintenance of stream channels and associated infrastructure.

Example actions:

- Identify strategies to obtain, verify, and exchange information about ownership of stream channels, maintenance easements, and associated infrastructure among partners.
- Develop and maintain a directory of staff contacts for agencies and organizations that are responsible for maintenance of stream channels and related infrastructure.
- Where local governments have delegated stream maintenance responsibilities to private property owners, develop materials to educate property owners of their responsibilities.
- Develop a shared communication strategy to respond to inquiries from the public about ownership and maintenance responsibility for stream channels and associated infrastructure, and resources available to address property owner concerns.

Recommendation 10. Coordinate stream channel and associated infrastructure maintenance activities, where helpful.

Example actions:

- Create regular opportunities for responsible agencies to share information on planned stream channel and infrastructure maintenance activities, share priorities, identify multi-benefit project opportunities, and learn about issues and needs outside their jurisdiction.

- Create regular opportunities for responsible agencies to share stream maintenance resources, such as permitting strategies, example scopes of work and protocols, and asset management and work order strategies.
- Coordinate regularly with the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), the University of California Cooperative Extension, and other organizations on programs, projects, and funding opportunities.
- Coordinate with resource and permitting agencies to facilitate a proactive approach to permitting river management and stream maintenance programs and projects.

Recommendation 11. Explore alternative governance and funding strategies to improve and expand stream maintenance activities.

Example actions:

- Identify priority locations for increased frequency or intensity of stream maintenance and critical gaps where new stream maintenance activities are needed.
- As appropriate, explore interest and property owner and/or voter support for forming and funding the inactive or unformed Flood Control Zones, recognizing that formation of a zone does not itself generate funding.
- As appropriate, explore interest and property owner and/or voter support for new sustainable funding mechanisms, recognizing legal constraints on funding options.
- Explore interest in alternative governance and funding strategies to support stream maintenance delegated to private property owners (e.g., Community Facilities Districts and Geologic Hazards Abatement Districts), developing cost share and enforcement programs to incentivize private maintenance and providing technical assistance with permitting.
- Explore interest in establishing joint powers authority (JPA) or other governance models at a watershed scale to consolidate funding, planning, and permitting for stream maintenance under a single legal entity.
- Explore interest in establishing a workforce development program to fill gaps in existing stream maintenance services.
- Consider affordability and the effects of different funding options on equity.

Communication and Community Engagement

Findings

Raising public awareness of flood risk and flood risk management resources provides individual residents, business owners, workers, and property owners a greater opportunity to engage with flood risk management service providers and improve their resilience to floods—whether by mitigating the hazard (e.g., by flood-proofing a business) or increasing preparedness (e.g., by purchasing flood insurance, avoiding flooded roads). Precedents for effective risk communication include the FEMA High Watermark Initiative and the DWR Annual Flood Risk Notifications. Individual organizations and agencies in Sonoma County provide public outreach on flood risk and flood risk management resources, but developing a strategy that is shared across jurisdictions could reach more people, including those who travel to different parts of Sonoma County for work, school, recreation, and tourism.

In Sonoma County, and in California more generally, flood risk is not communicated equitably. Flood risk is communicated to property owners during most real estate transfers within 1-percent AEP (100-year) floodplains mapped by FEMA (*Cal. Gov. Code* § 8589.3, 44 CFR 59.2). The 1-percent AEP floodplains in Sonoma County are depicted in Appendix A, Figure 4 through Figure 11. California law also requires property owners who carry flood insurance and those who have received flood risk notifications to disclose known flood risks to their tenants entering into leases on or after July 1, 2018 (*Cal. Gov. Code* § 8589.45). However, tenants with existing or informal leases are not covered. With 38 percent of Sonoma County housing units occupied by renters,[36] a large portion of the residential population might be unaware of flood risks until flooding happens. People experiencing homelessness are more likely to be unaware of flood risk because they lack a permanent, formal address. Other hard-to-reach populations, such as limited-English-proficiency households, also have reduced access to risk communication.[37] Even with accessible risk communication, people have varying abilities and capacity.[38] Partners identified a variety of additional services that could address these inequities.

Public communication is also critical before and after individual flood events to share information about road closures, sandbag stations, biohazards, medical services, food, water, and shelter and about the availability of local, state, and federal financial assistance. The Sonoma County DEM shares much of this information on its website. The DEM Emergency Information website on flooding in Sonoma County provides information on sandbag stations, community resource centers, road closures, food safety, evacuation assistance, animal services, and links to other news alerts and updates. While the County and each of the cities in Sonoma County provide this type of information to residents on their individual websites and social media, consolidating information into a single hub could strengthen the message and reduce confusion about which residents are eligible to receive services at which sites.

Engaging CBOs and residents directly in flood risk management activities can support two-way communication, in which CBOs and residents receive information directly from flood risk

[36] U.S. Census Bureau (2020b).
[37] OPR (2018b, pp. 3-4, 6-7, 13-16).
[38] OPR (2018b, pp. 3-4, 6-7, 13-16).

management agencies and flood risk management agencies learn and receive guidance from CBOs and residents on strategies to improve flood risk management. Partners identified a lack of resources for robust community engagement. This Countywide Flood Risk Management Assessment Project primarily focused on engaging the many entities and jurisdictions that provide flood risk management services in Sonoma County as a critical starting point for improved coordination. However, throughout the process, partners identified a need to expand efforts to additional entities and to strengthen government-to-government partnerships with Tribal Nations. Broader and deeper engagement will likely require additional funding sources and the ability to compensate participants for time spent engaging in regional flood risk management efforts.

Recommendations

To fill existing gaps in public awareness of flood risk, to address challenges related to the accessibility of emergency preparedness, response, and recovery information, and to address a shortage of resources for partnerships and community engagement, partners could consider the following recommendations.

Recommendation 12. Develop and implement a risk communication strategy.

Example actions:

- Develop a public art campaign to increase public awareness of high-water marks, existing flood exposure, and/or future flood exposure.
- Ascertain repetitive-loss properties and residences and businesses that are located within designated flood hazard areas and develop means of notifying individuals of their flood risk and availability of flood insurance for structures (available to owners) and contents (available to owners and tenants).
- Tailor risk communication for hard-to-reach populations, such as renters, people who speak languages other than English, and people experiencing homelessness.

Recommendation 13: Expand accessibility and effectiveness of pre- and post-flood public safety messaging.

Example actions:

- Conduct a comprehensive audit of the current "sure bet" messages used for public safety communication before and after flood events. Evaluate the effectiveness of these messages in reaching linguistically isolated households, people with disabilities, and households with limited access to technology.
- Identify gaps in existing messaging and develop additional "sure bet" messages that address broad public safety concerns related to flood events. Engage with CBOs and residents to confirm that messages are clear, concise, and culturally sensitive and resonant.
- Translate both existing and newly developed "sure bet" messages into the multiple languages spoken in Sonoma County. Explore innovative methods for increasing digital accessibility, such as audio recordings, video captions, and text-to-speech options.
- Collaborate with CBOs and other interested parties to distribute translated and accessible messages. Utilize existing communication channels, such as

SoCoEmergency.org and social media platforms, to reach people who access information from different sources.

- Establish a notification tree and database to facilitate the rapid dissemination of emergency messaging to relevant entities. Develop a procedure to maintain up-to-date contact information to enable swift and coordinated responses during flood events.

Recommendation 14: Pursue external funding to expand community engagement and partnerships to refine and add recommendations, including those that prioritize equity.

Example actions:

- Strengthen government-to-government partnerships with Tribal Nations to advance coordinated flood risk management activities.
- Pursue external funding to support members' participation in the continued flood risk management coordination efforts through the proposed Partnership (outlined in the next chapter), including the staff time of Partnership members who are unable to participate in the Partnership without dedicated resources.
- Pursue external funding to develop an outreach plan to engage CBOs and others representing communities vulnerable to flooding for the purpose of formulating additional flood risk management recommendations and actions.

Countywide Flood Risk Management Partnership

A primary objective of the Countywide Flood Risk Management Assessment Project was to improve coordination across the many entities and jurisdictions that provide flood risk management services in Sonoma County. Interorganizational coordination was also a common theme during partner engagement. Partners expressed the need for stronger relationships with other agencies, organizations, and Tribal Nations that provide flood risk management services, for a clear understanding of roles and responsibilities, and for individual points of contact within partner organizations. To expedite the formation of these institutional relationships and to help address issues stemming from the fragmented nature of flood risk management services in Sonoma County, a new collaboration framework is recommended: a Countywide Flood Risk Management Partnership ("Partnership").

Partnership

All partners would be invited to join the Partnership, which would meet quarterly to build relationships across flood risk management functions and jurisdictions, facilitate interorganizational communication, and carry out the recommendations identified in this report. The Partnership itself would not be a formal legal entity and would have no legislative powers or legal authorities. The premise is that regional coordination of key aspects of flood risk management services can lead to better overall outcomes as well as improved service delivery by individual entities. Participation in the Partnership would be voluntary and guided by a charter that is agreed to by its members. The charter would serve as documentation of the agreed-upon goals, structure, and decision-making process for the Partnership. Members would be able to selectively participate in meetings and working groups of their choosing.

The primary goal of the Partnership should align with the primary objective of the Countywide Flood Risk Management Assessment Project: to build relationships and improve coordination across the many organizations and jurisdictions that provide flood risk management services in Sonoma County. The Partnership would serve as a platform for information-sharing and shared continued learning about tools, ideas, and concerns related to flood risk management. While the Partnership would be primarily interested in flood risk management, the Partnership should approach its activities from an integrated water resources management perspective—recognizing that coordinated management of water, land, and ecosystems is often more efficient and sustainable than a single-purpose approach. Coordination across sectors to identify and pursue multi-benefit plans and projects could also help to address root causes of flood risk and other water resource management challenges.

The Partnership would also serve as a way to connect agencies involved in flood risk management with existing collaboratives and groups focused on this work, to reduce duplicative efforts. There are numerous existing systems to facilitate emergency response and recovery communications, such as through Emergency Operations Briefings. The Partnership is not intended to duplicate those existing structures. Rather, the Partnership is intended to create a structure by which flood risk management agencies and other interested parties can collaborate to address gaps in existing services, as identified by the Recommendations.

The Partnership could explore alternative governance structures, develop funding strategies, and seek external funding for projects identified by its members. Potential federal, state, and regional funding programs are identified in Appendix B.

In addition, in light of the County's and Sonoma Water's equity policies and the findings of this report, the Partnership should consider establishing one or more goals to bring an equity lens into its work. These could include meaningful engagement with entities that represent and/or serve underrepresented and impacted communities, targeting funding and activities to better serve underserved communities and/or pursuing resources to reduce flood risk among the most vulnerable populations.

Proposed Structure

The structure of the Partnership is intended to be flexible to meet the needs of its members. Though the structure and format of the proposed Partnership will be shaped organically by its participants, several ideas for structuring the Partnership are described below. Partnership members should document the selected Partnership structure in the charter.

Working Groups: Members of the Partnership could form working groups to coordinate and advance work within specific focus areas. This report proposes an initial set of four working groups corresponding to the four sets of recommendations identified above:

1. Policies and Standards
2. Monitoring, Modeling, and Decision Support
3. Stream Maintenance
4. Communication and Community Engagement

Partnership members could revise, vet, and agree upon the preferred set of working groups prior to their formation. Over time, Partnership members could opt to dissolve a working group when the work is complete or no longer a priority and could form new working groups as new coordination needs arise. Additional working groups could include:

- **Project-specific Working Groups** to coordinate planning, design, permitting, and implementation of physical risk-reduction projects that involve multiple jurisdictions.
- **Event-specific Working Groups** to provide situational awareness and support for response and recovery activities during and after flood events and to discuss lessons learned.
- **Funding-specific Working Groups** to coordinate applications for external sources of funding or to provide focused effort to advance specific funding strategies to support implementation of other Working Group activities. Potential federal, state, and regional funding programs are identified in Appendix B.[39]
- **Area-specific Working Groups** to address localized areas of concern where there are no existing watershed entities or partnerships.

Working groups would be encouraged to make communications accessible to all interested Partnership members, to provide transparency as well as opportunities for cross-cutting work

[39] Additional funding and financing options are described in Appendix E of the *Sonoma Water Climate Adaptation Plan* (Sonoma Water 2021).

across groups. Working groups that are focused on watershed-scale issues would be encouraged to coordinate with the active Flood Control Zone Advisory Committees and other existing watershed entities and partnerships.

Steering Committee: A steering committee or similar leadership body could be formed to support the administration of the Partnership, including meeting scheduling and communications among participants.

Once the Partnership forms, members could elect to form a steering committee and to join it to take an active role in the planning and direction of the Partnership. Taking a leadership role through a steering committee would not be a prerequisite to join the broader Partnership.

The proposed steering committee could help lead the following tasks:

- Formulating a draft charter for circulation and approval by the members. The charter should define the size, composition, role, and responsibilities of the steering committee, and the structure of the overall Partnership, with input from members. A proposed Partnership structure is illustrated in Figure 2, below.
- Developing a funding strategy to support members' participation in the Partnership, including the staff time of Partnership members who are unable to participate in the Partnership without dedicated resources.
- Developing funding strategies to advance projects and programs identified by the working groups. As discussed above, this objective could also be addressed by a funding-specific working group and/or the greater Partnership.
- Reviewing overall Partnership and individual working group activities for consistency with adopted equity goals, as defined in the charter.

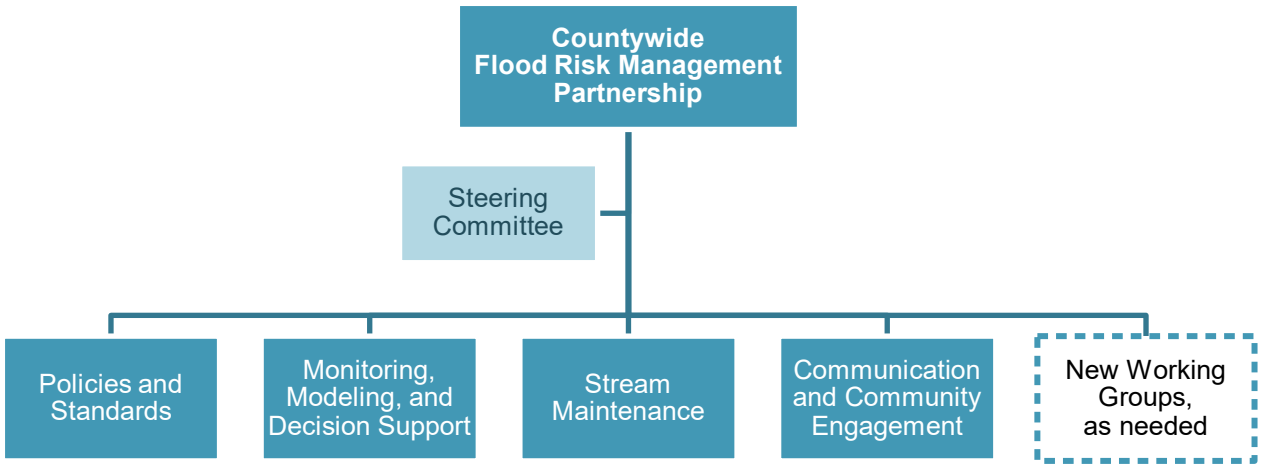

Figure 2. Example Organizational Chart of Proposed Partnership

Conclusion

The recommendations described in this report are intended to address the gaps and challenges associated with managing flood risk when roles and responsibilities are spread across many jurisdictions, organizations, and levels of government. The recommendations are inherently dependent on interorganizational coordination within watersheds and across the county. Therefore, this report proposes a new Countywide Flood Risk Management Partnership structure to pursue the implementation of recommendations and support future coordination beyond the life of the Countywide Flood Risk Management Assessment Project.

Partners are asked to consider the following next steps:

- Review and receive the findings and recommendations of this report.
- Indicate interest in participating in the proposed Partnership and, if interested, attend a planning workshop to consider the breadth, scope, format, and structure of a Partnership. This may include the development of a draft charter to articulate the role of the Partnership and optional working groups and steering committee, for circulation and approval by Partnership members.
- Seek funding to support staff participation in the Partnership and any related working groups or committees that are created.

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Appendix A. Maps

Figure 3. Hydrologic and Flood Control Zone Boundaries in Sonoma County

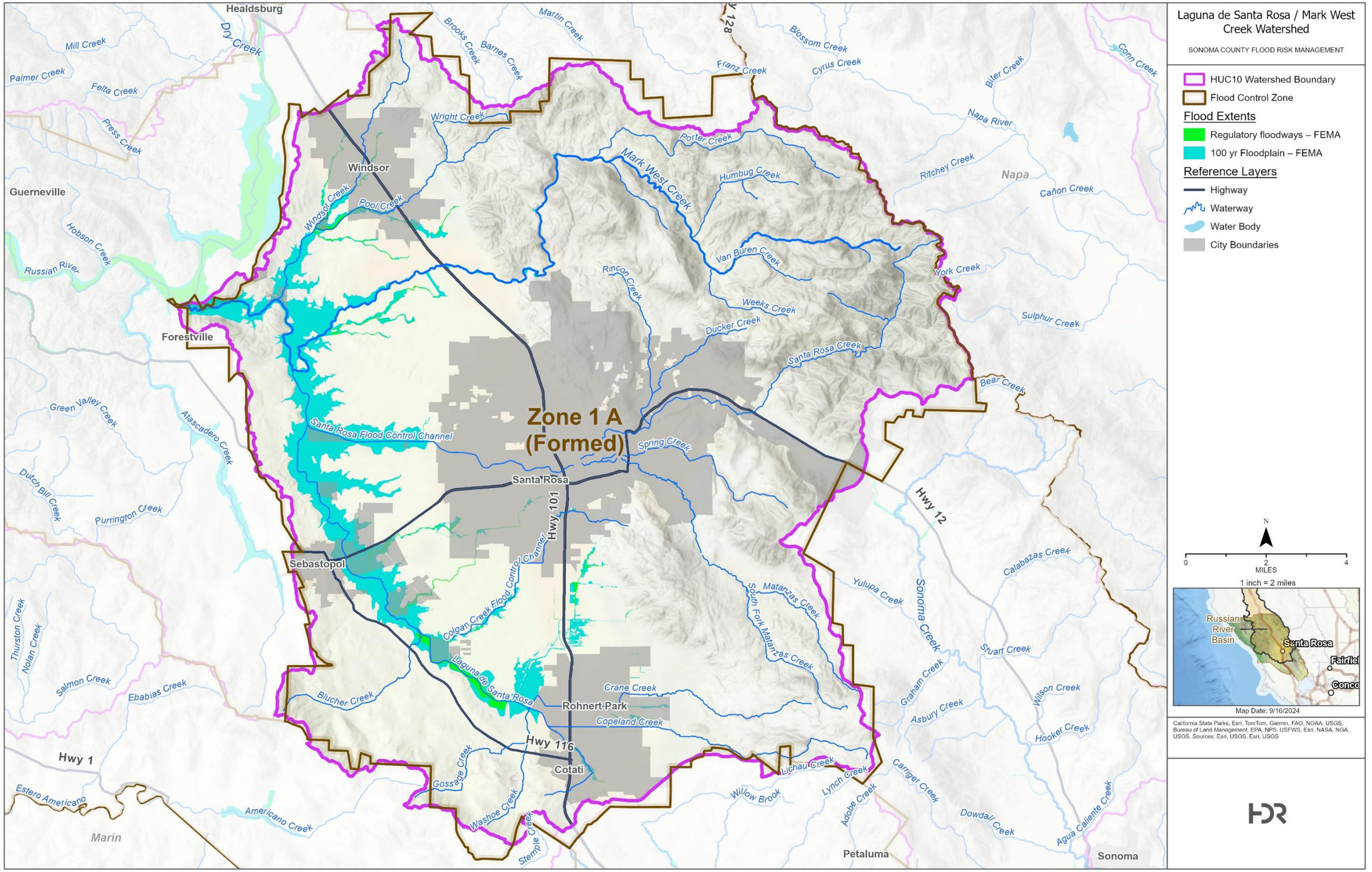

Figure 4. Hydrologic and Flood Control Zone Boundaries in the Laguna de Santa Rosa / Mark West Creek Watershed

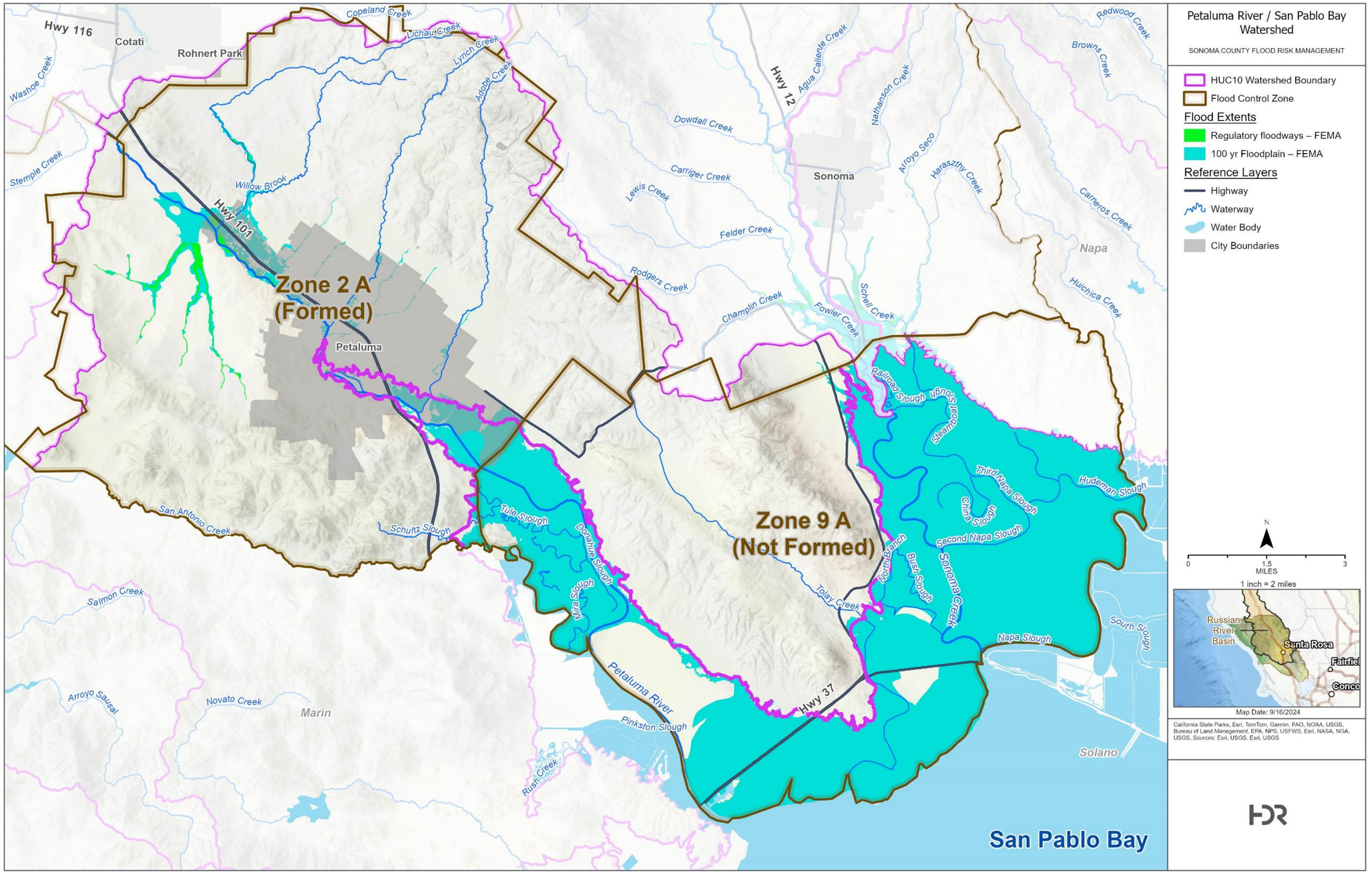

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Figure 5. Hydrologic and Flood Control Zone Boundaries in the Petaluma River Watershed

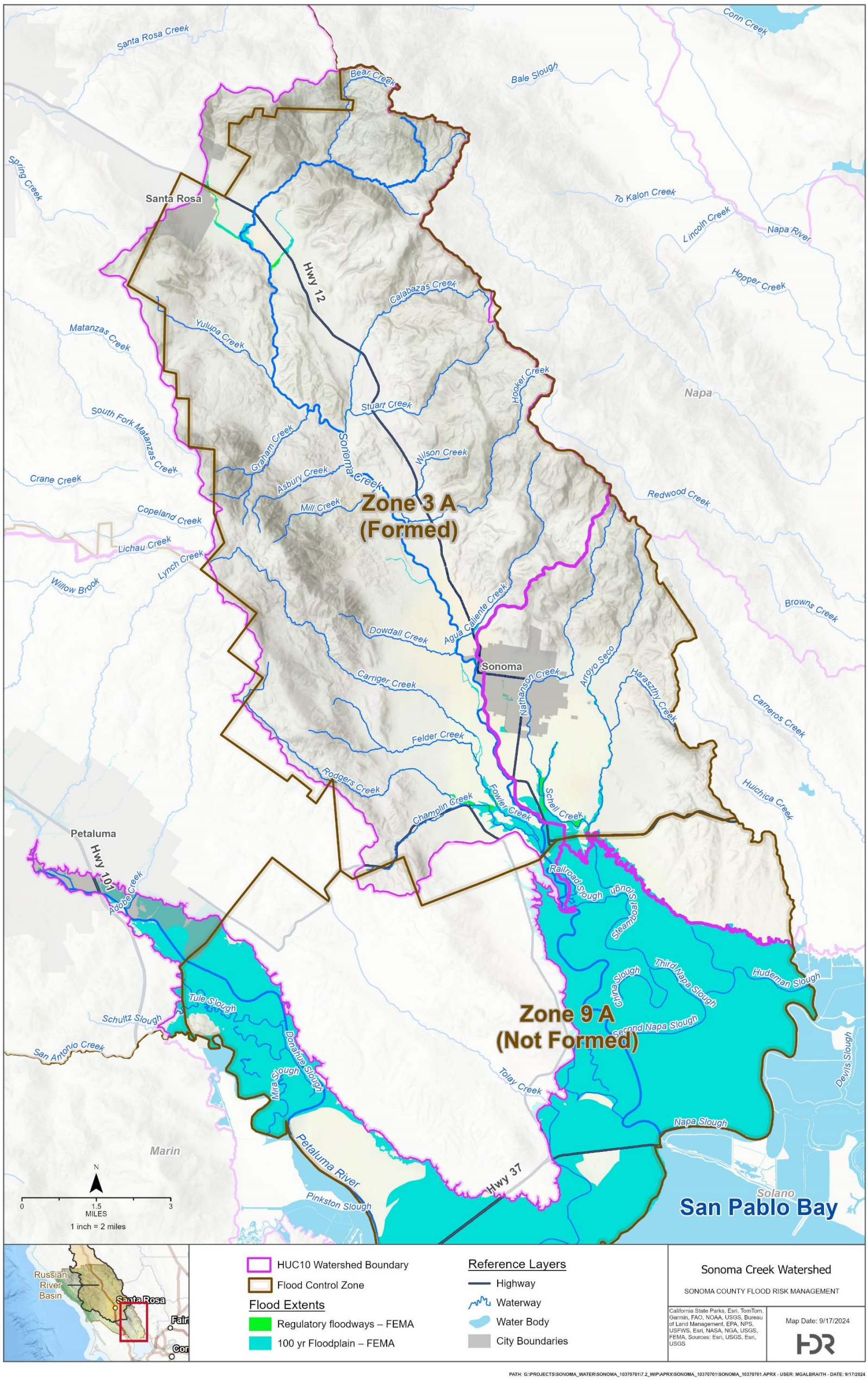

Figure 6. Hydrologic and Flood Control Zone Boundaries in the Sonoma Creek Watershed

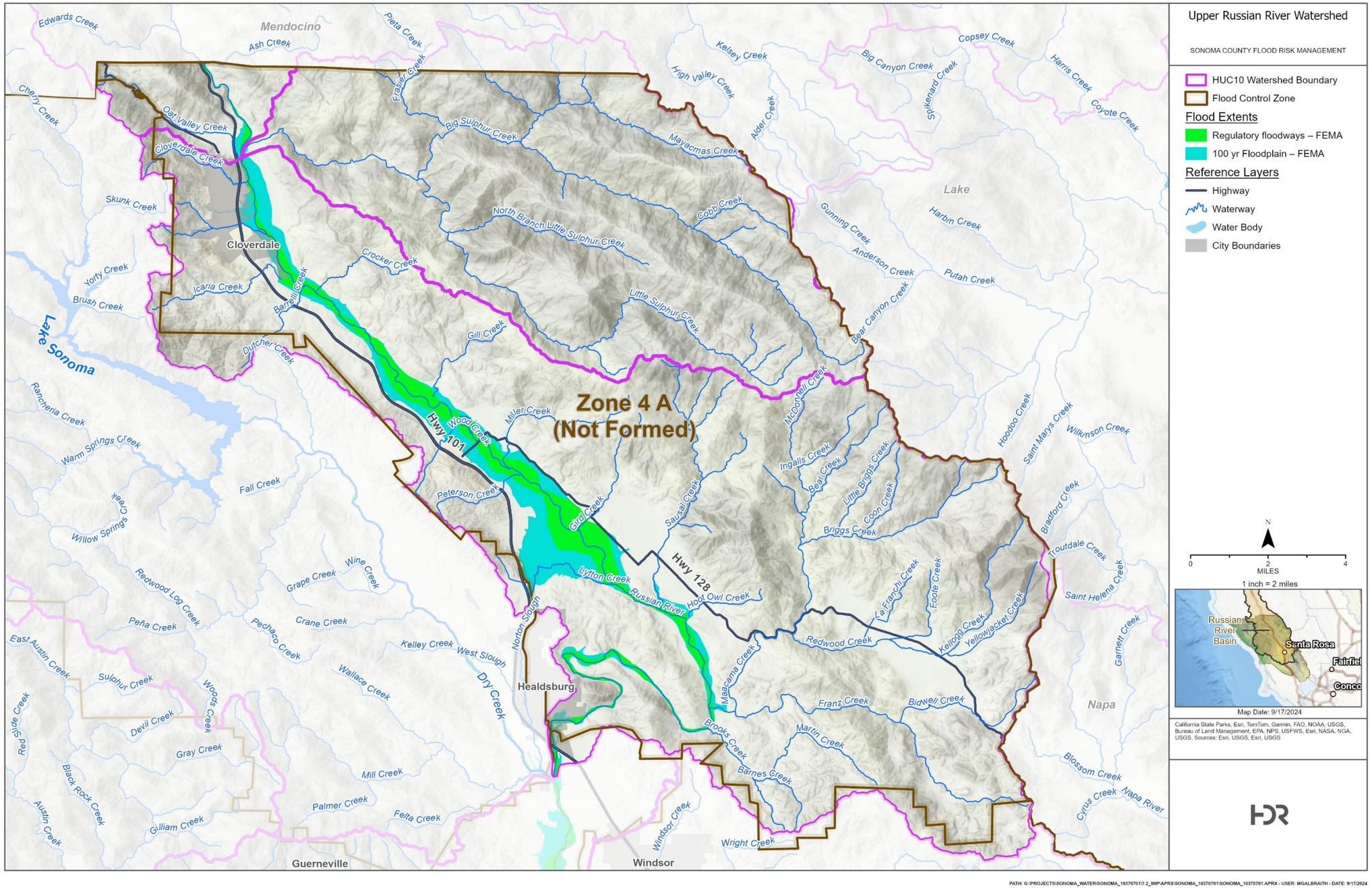

Figure 7. Hydrologic and Flood Control Zone Boundaries in the Upper Russian River Watershed (within Sonoma County)

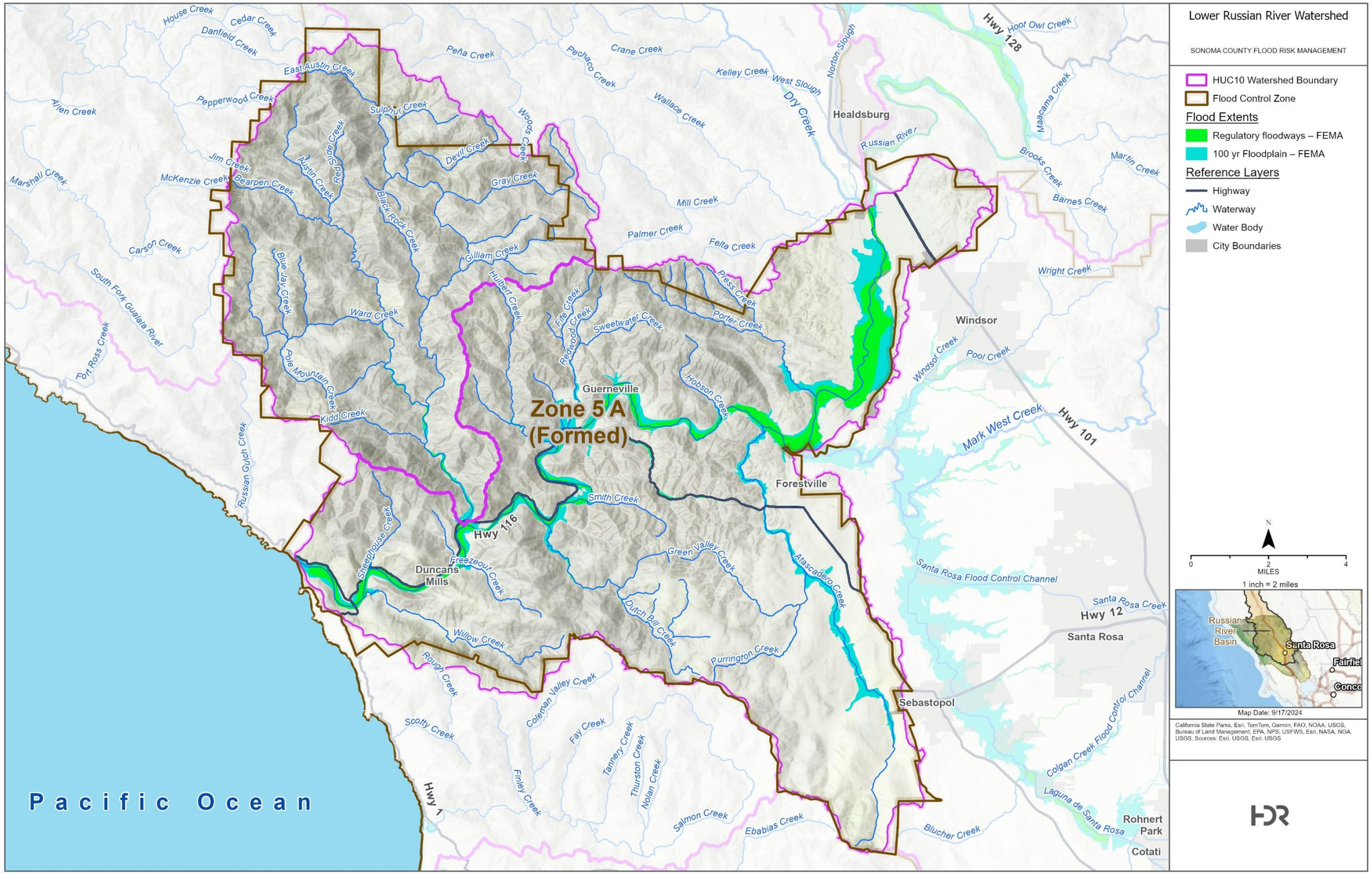

Figure 8. Hydrologic and Flood Control Zone Boundaries in the Lower Russian River Watershed

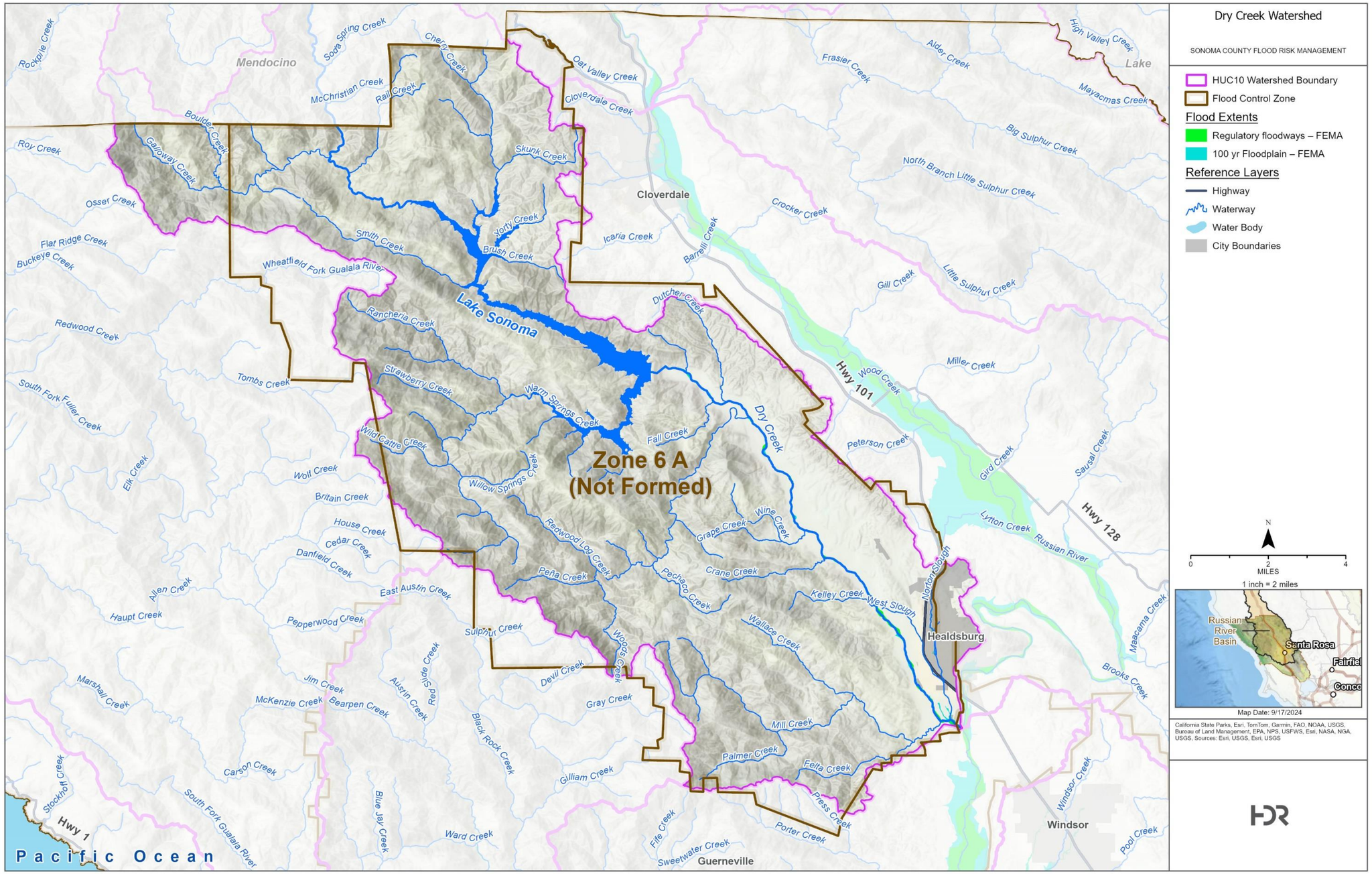

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Figure 9. Hydrologic and Flood Control Zone Boundaries in the Dry Creek Watershed

Figure 10. Hydrologic and Flood Control Zone Boundaries in the North Coast Watershed (within Sonoma County)

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Figure 11. Hydrologic and Flood Control Zone Boundaries in the South Coast Watershed (within Sonoma County)

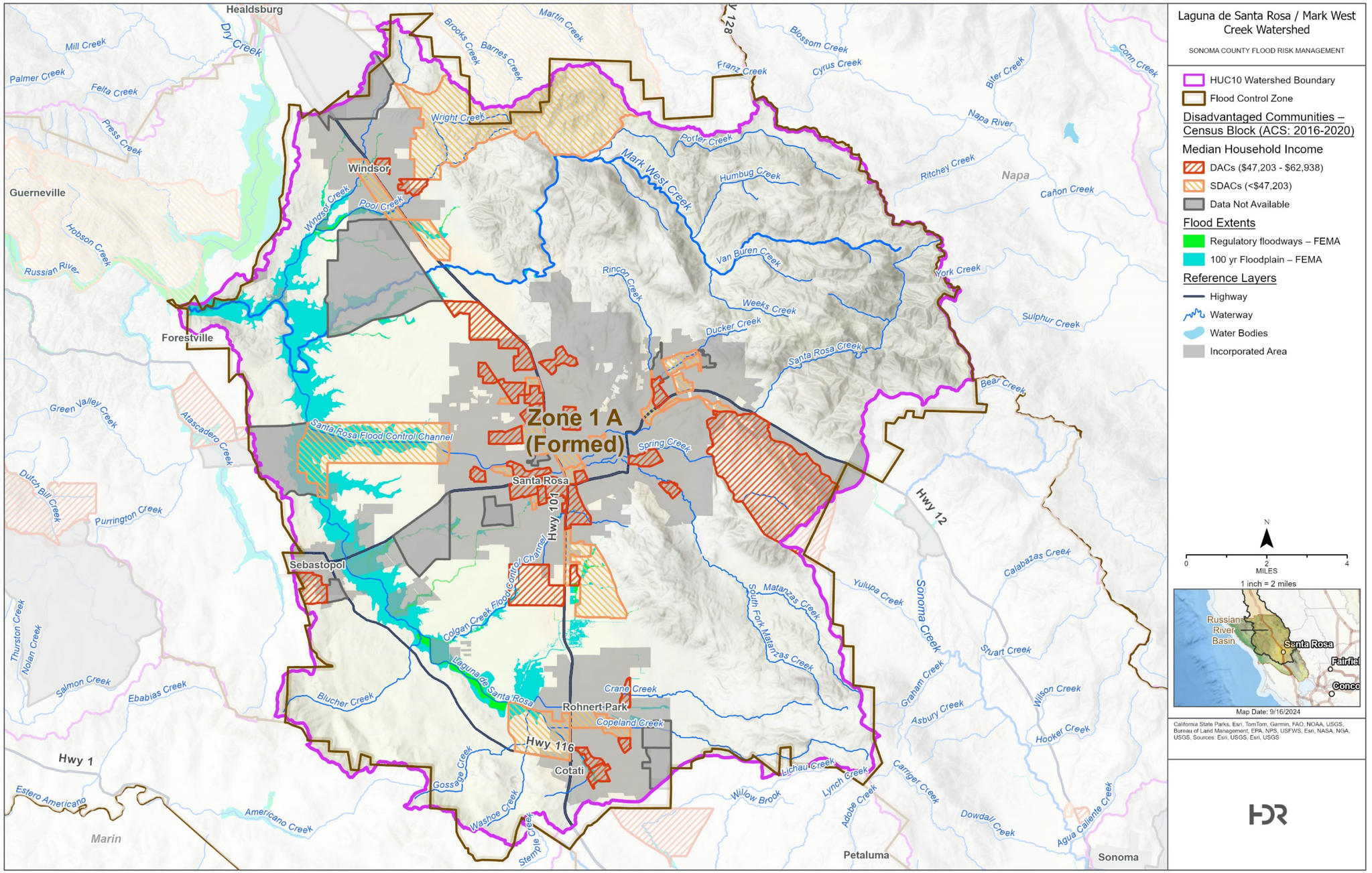

Figure 12. Disadvantaged and Severely Disadvantaged Census Block Groups in the Laguna de Santa Rosa / Mark West Creek Watershed

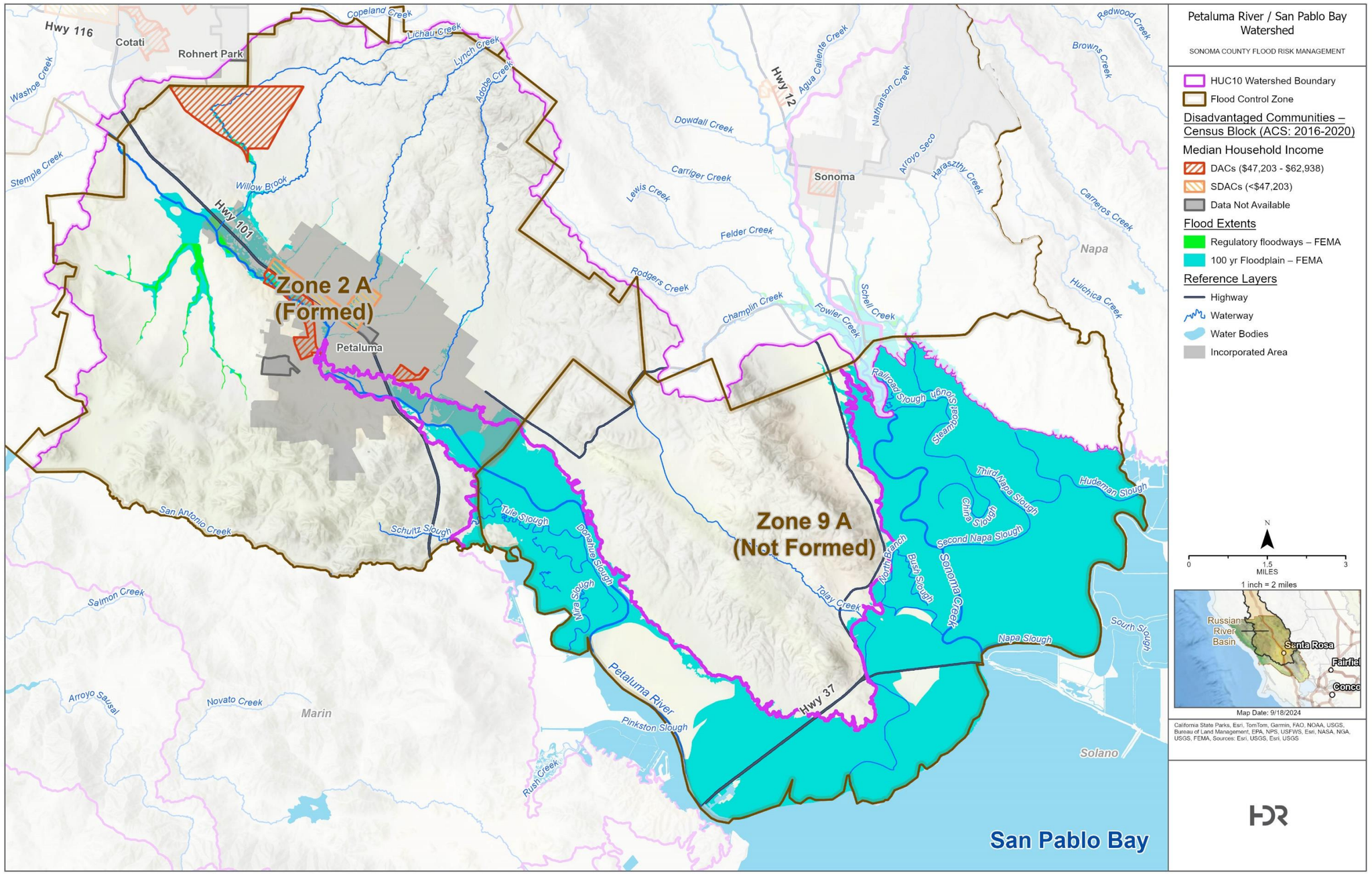

Figure 13. Disadvantaged and Severely Disadvantaged Census Block Groups in the Petaluma River Watershed

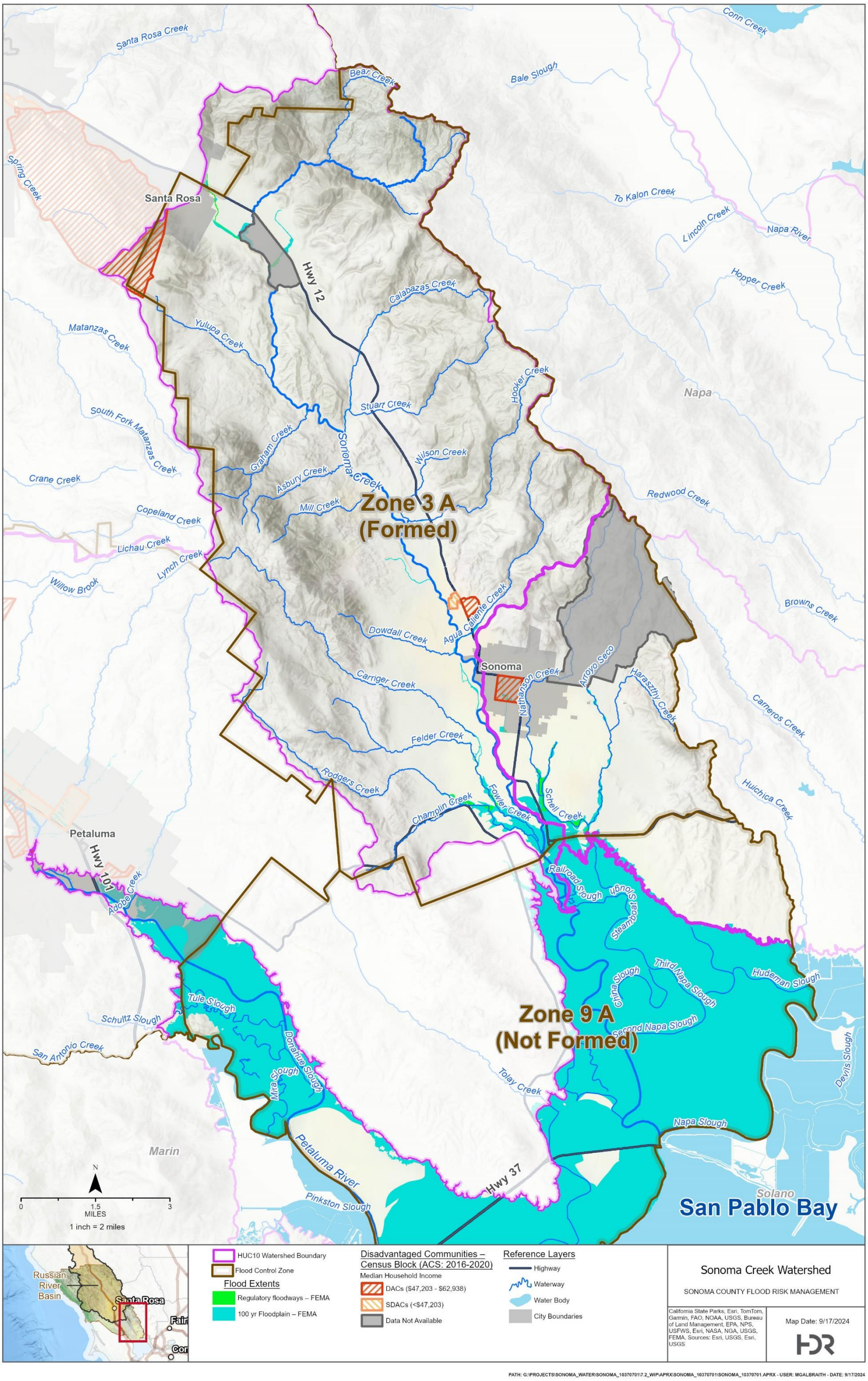

Figure 14. Disadvantaged and Severely Disadvantaged Census Block Groups in the Sonoma Creek Watershed

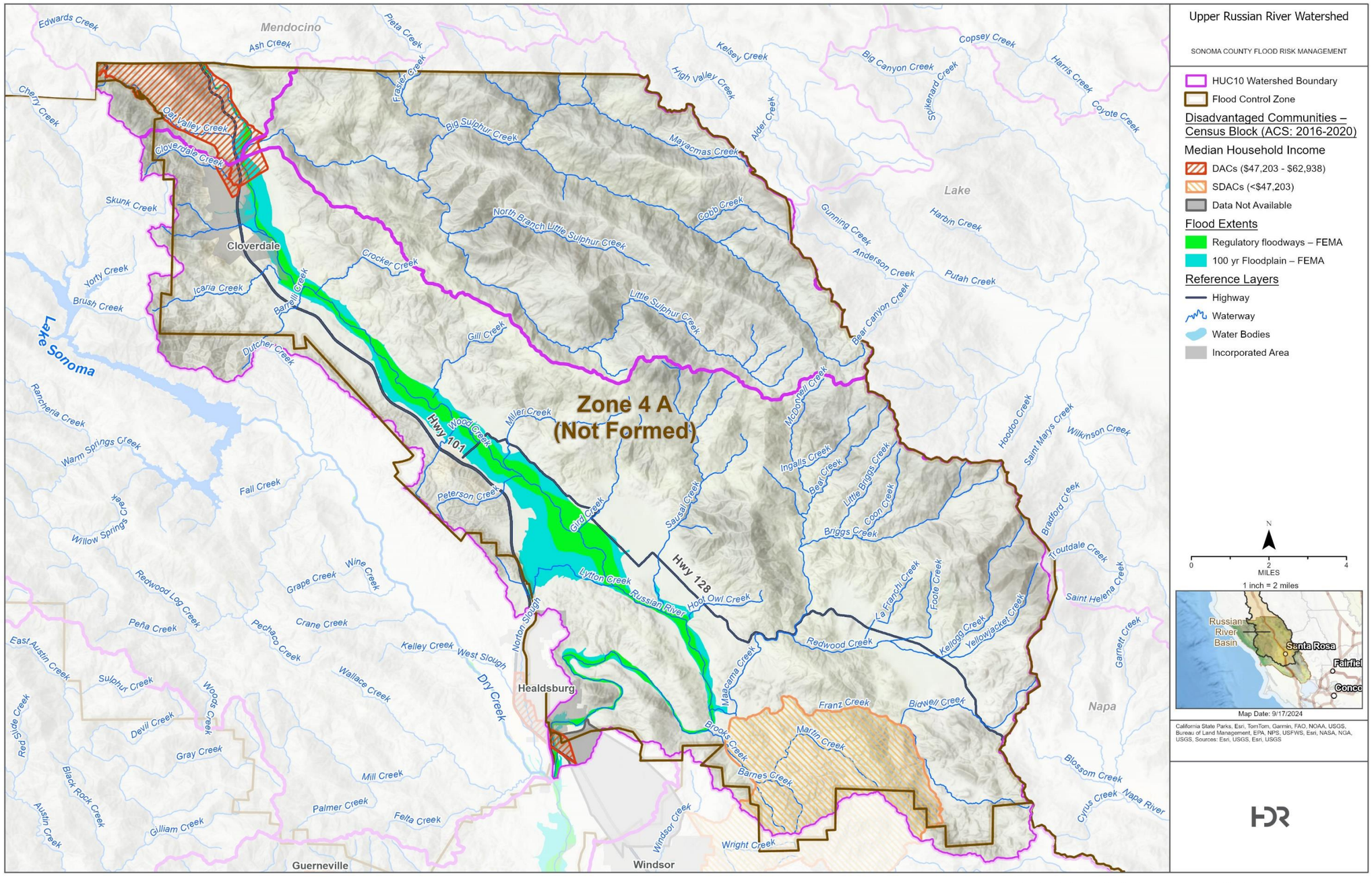

Figure 15. Disadvantaged and Severely Disadvantaged Census Block Groups in the Upper Russian River Watershed

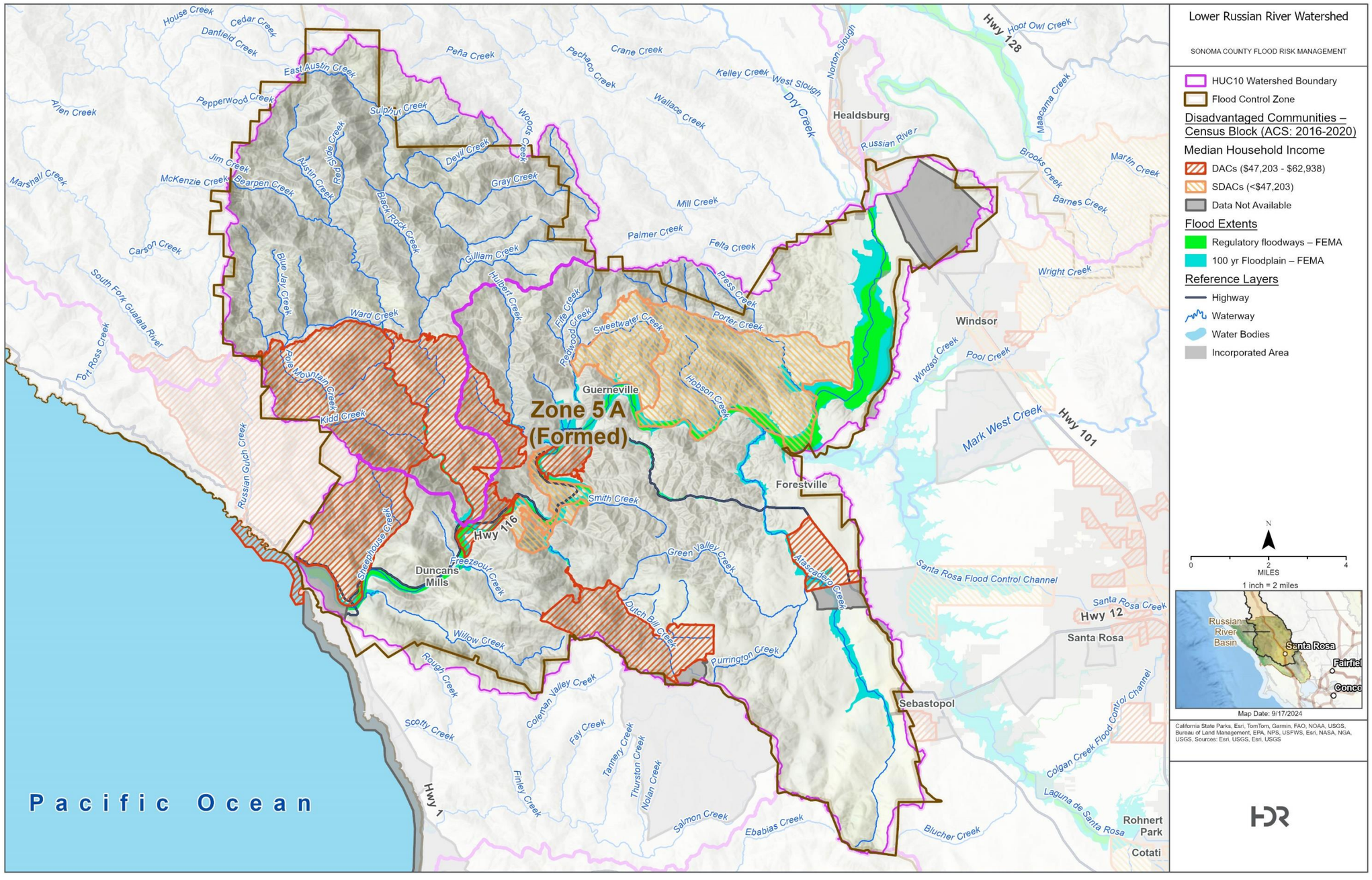

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Figure 16. Disadvantaged and Severely Disadvantaged Census Block Groups in the Lower Russian River Watershed

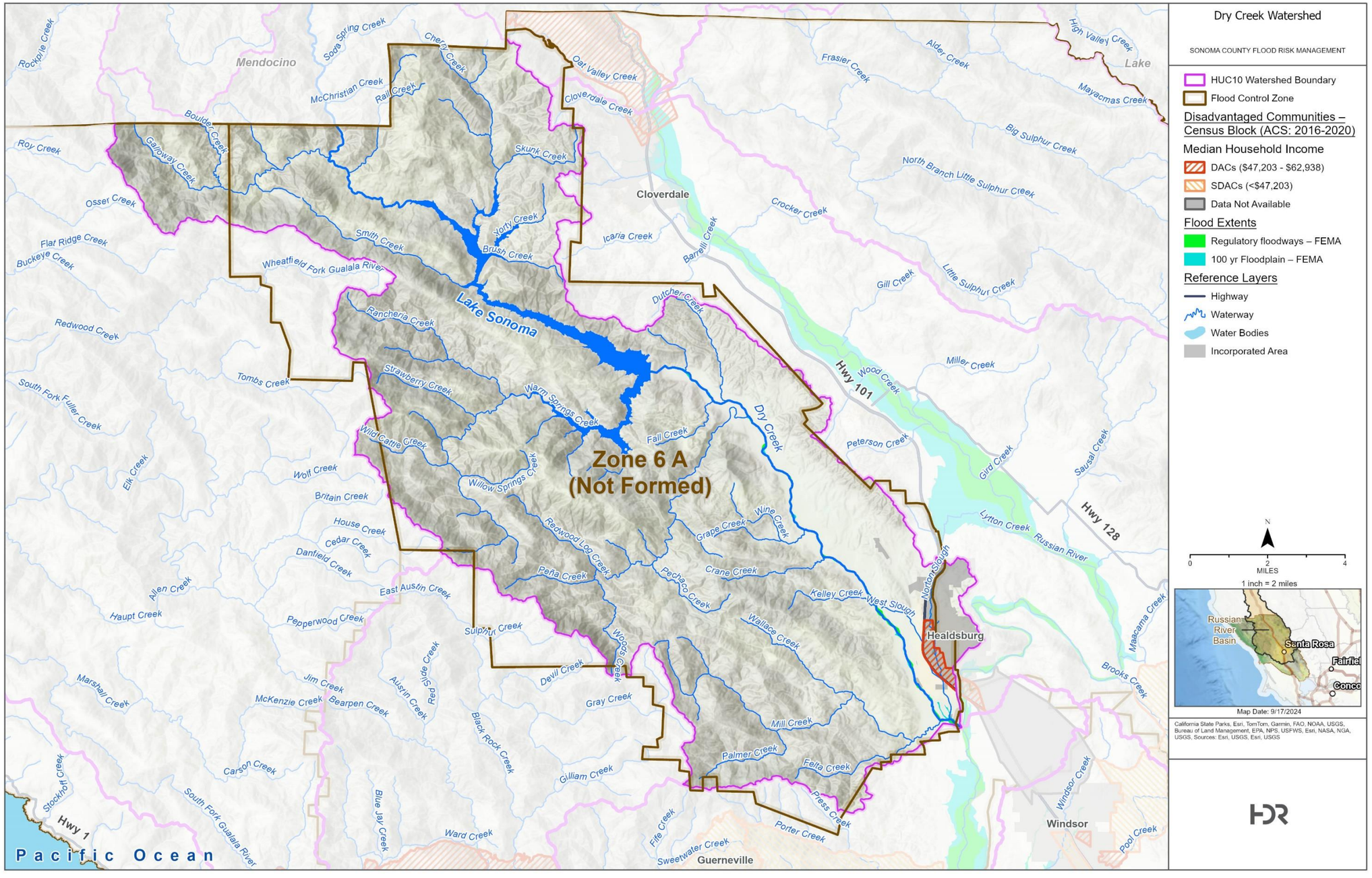

Figure 17. Disadvantaged Census Block Groups in the Dry Creek Watershed

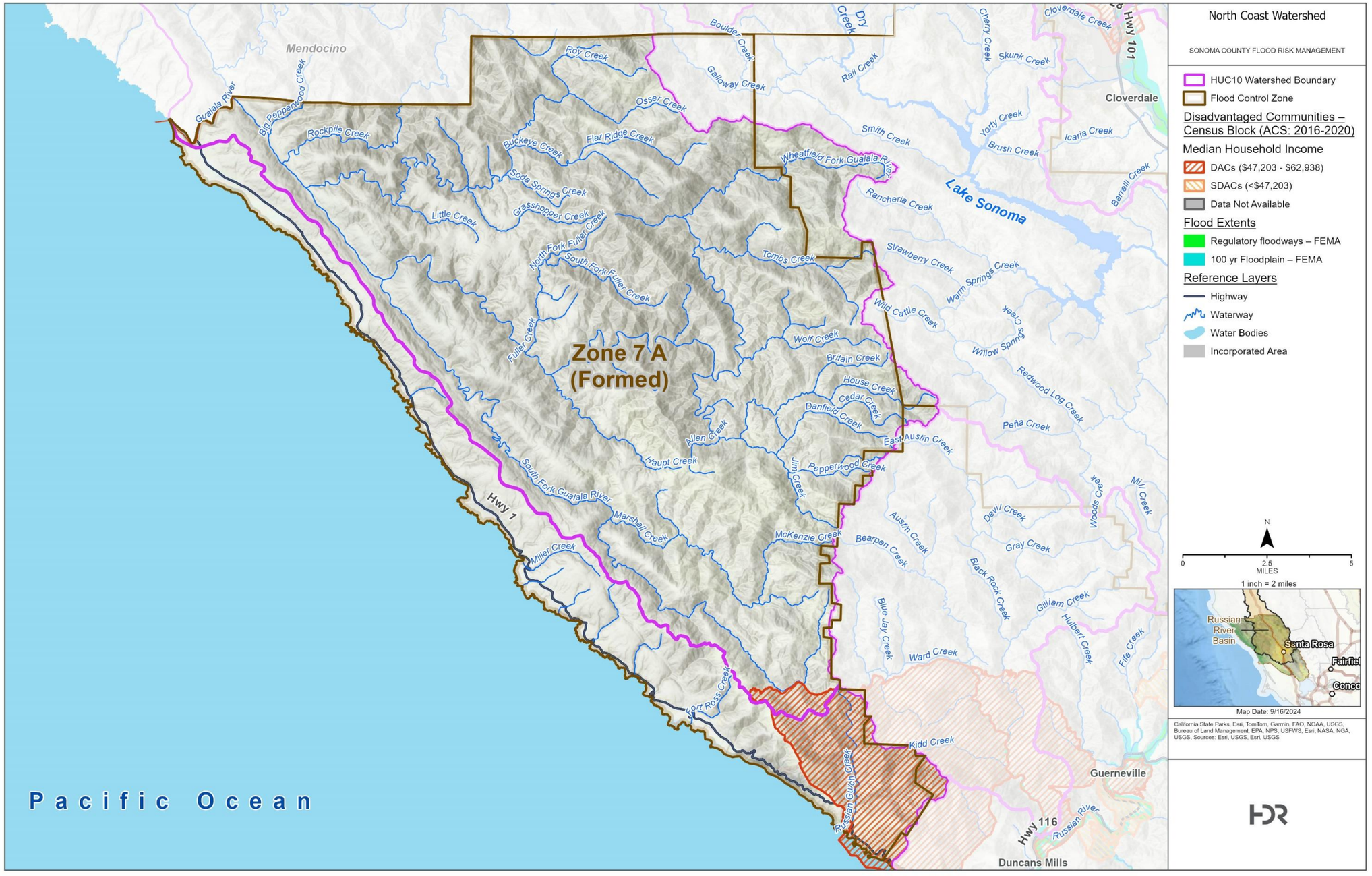

Figure 18. Disadvantaged Census Block Groups in the North Coast Watershed

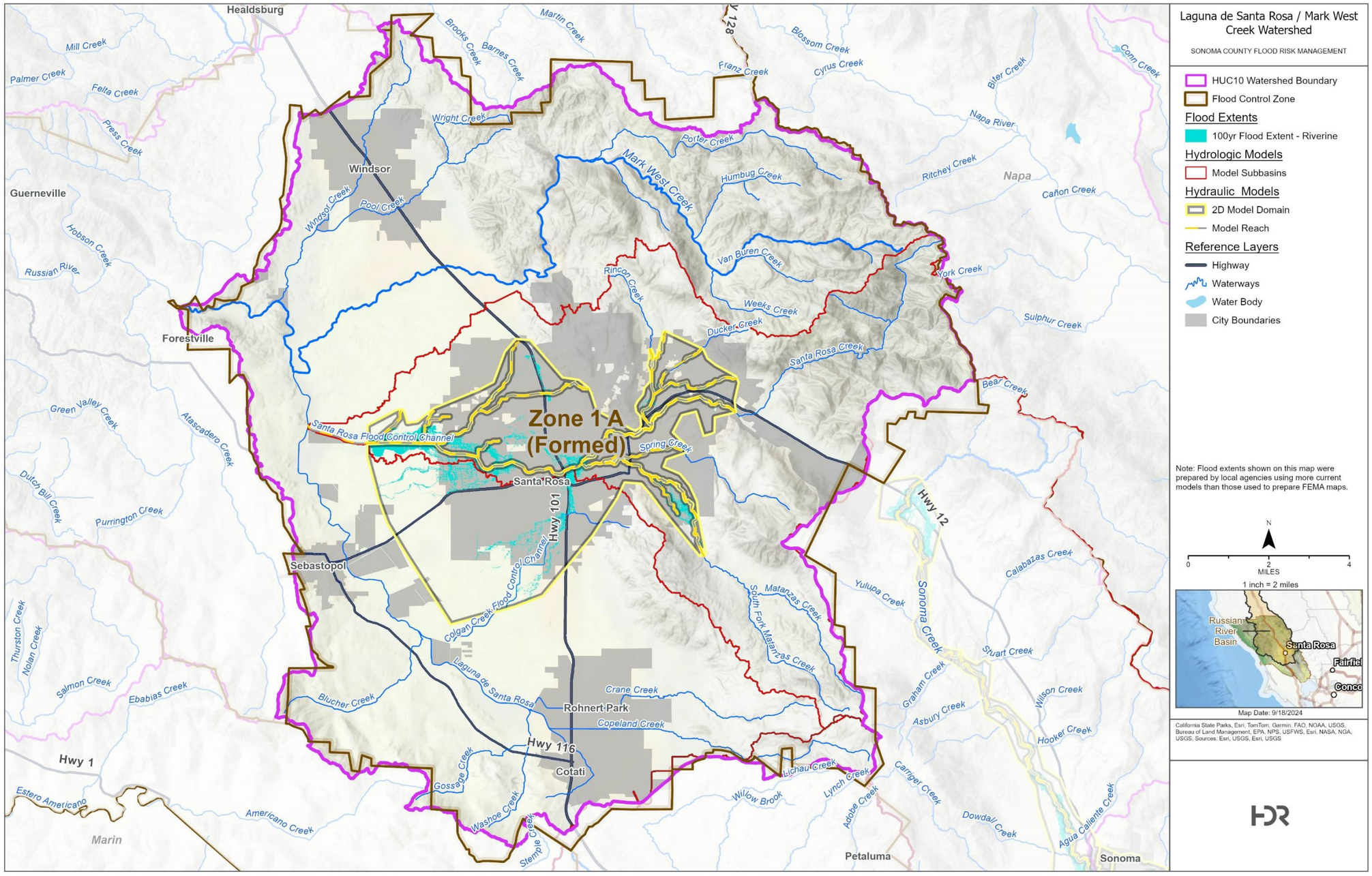

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Figure 19. Locally Prepared Flood and Model Extents in Laguna de Santa Rosa / Mark West Creek Watershed

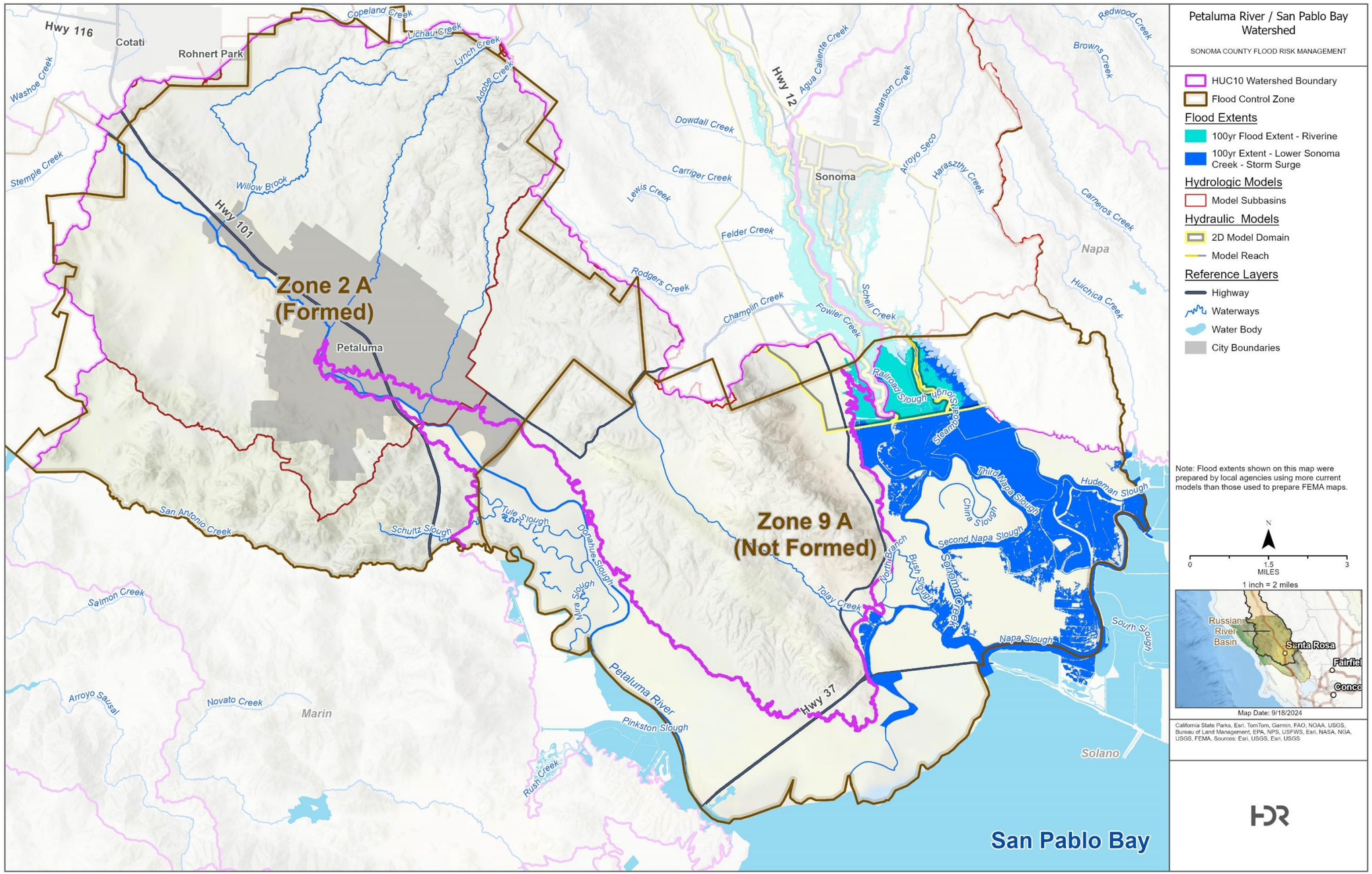

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Figure 20. Locally Prepared Flood and Model Extents in Petaluma River Watershed

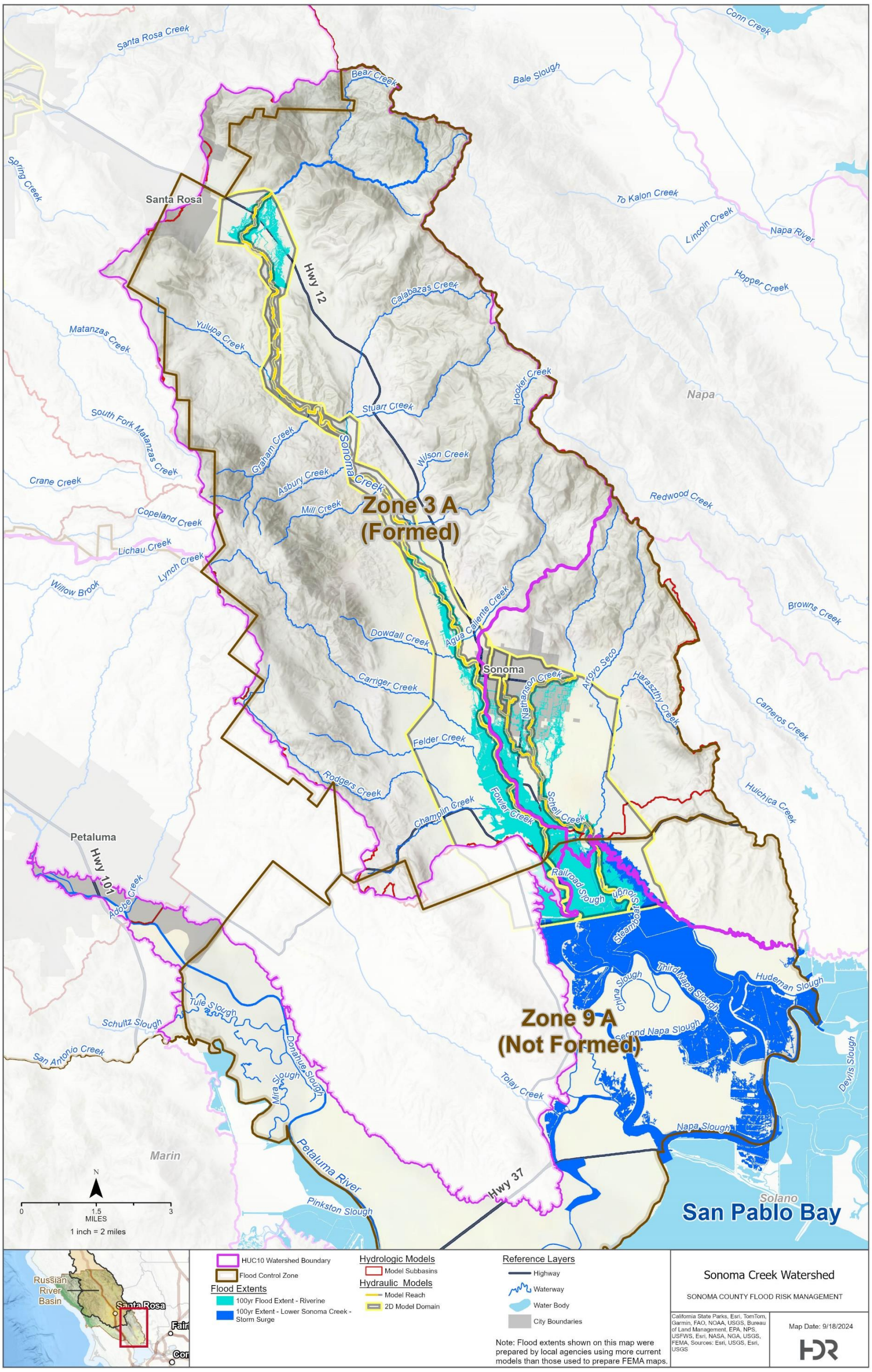

Figure 21. Locally Prepared Flood and Model Extents in Sonoma Creek Watershed

Appendix B. Funding Sources

Table 1. Federal Funding Sources

Program Name	Description	Eligible Applicants	Maximum Grant Award	Potential Projects	Federal Cost-Share	Funding Cycle	Eligible Activities			
							Planning	Env. & Final Design	Const.	O&M
FEMA Flood Mitigation Assistance (FMA)	The FMA grant program funds activities to prevent repeat flood damage in participating NFIP communities. It addresses increasing flood risks due to climate change and promotes mitigation efforts for climate adaptation, equity, and flood resilience.	States, District of Columbia, U.S. territories, and federally recognized tribal governments.	Varies based on project type.	**Individual Flood Mitigation Projects** **Localized Flood Risk Reduction Projects** **Capability and Capacity Building Activities:** Enhance workforce knowledge and skills in flood mitigation assistance administration.	75% - 100% depending on project type and other factors	Annual	✓	✓	✓	-
FEMA Building Resilient Infrastructure and Communities (BRIC)	The BRIC Program provides discretionary funding to states, cities, and counties to address risks associated with natural disasters, such as wildfire, drought, hurricanes, earthquakes, extreme heat, and flooding.	States, District of Columbia, U.S. territories, and federally recognized tribal governments.	Varies based on project type.	**Capability Building:** Enhancing workforce knowledge and skills in areas like hazard planning. **Hazard Mitigation Project**s: Projects to increase resilience and safety and reduce damage from natural hazards. **Management Costs:** Financial assistance for administrative expenses related to mitigation measures or projects.	Up to 75%	Annual	✓	-	✓	-

Program Name	Description	Eligible Applicants	Maximum Grant Award	Potential Projects	Federal Cost-Share	Funding Cycle	Eligible Activities			
							Planning	Env. & Final Design	Const.	O&M
USDA Emergency Watershed Protection (EWP) Program	EWP assists in post-disaster recovery to mitigate hazards like floods, fires, and storms. It covers up to 75% of eligible construction costs without a national emergency declaration. Projects aim to restore watershed functions and prevent further damage.	States, local government units, or tribal governments with legal responsibility for the affected watershed areas.	Not specified.	**Channel Clearing**: To restore flow and prevent flooding. **Stabilizing Streambanks**: To prevent erosion and protect land and infrastructure. **Implementing Erosion Control:** To safeguard public infrastructure. **Acquiring Floodplain Easements**: To enhance floodplain functions and protect against floods.	Up to 75%	Varies	✓	✓	✓	-

Program Name	Description	Eligible Applicants	Maximum Grant Award	Potential Projects	Federal Cost-Share	Funding Cycle	Eligible Activities			
							Planning	Env. & Final Design	Const.	O&M
EPA Environmental and Climate Justice Community Change Grants program (Community Change Grants)	Community Change Grants aim to transform disadvantaged communities in the U.S. into thriving, resilient areas. It supports projects addressing climate issues and pollution reduction while fostering community strength.	A partnership between two community-based nonprofit organizations (CBOs) or a partnership between a CBO and one of the following: a federally recognized Tribe, a local government, or an institution of higher education	Track 1: $20 million Track 2: $3 million	• Green infrastructure and nature-based solutions. • Energy-efficient, healthy, resilient housing. • Microgrid installation for community energy resilience. • Community resilience hubs. • Workforce development programs.	100%	Annual	✓	✓	✓	-

Program Name	Description	Eligible Applicants	Maximum Grant Award	Potential Projects	Federal Cost-Share	Funding Cycle	Eligible Activities			
							Planning	Env. & Final Design	Const.	O&M
FHWA Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation (PROTECT)	PROTECT provides funding for communities to address vulnerabilities to current and future weather events, natural disasters, and changing conditions, including sea level rise, and plan transportation improvements and emergency response strategies to address those vulnerabilities.	States, metropolitan planning organizations (e.g., MTC-ABAG), local governments, and Indian Tribes	No maximum.	Reducing transportation system impacts to floodplains while protecting infrastructure through nature-based solutions, infrastructure and system resilience projects.	80% - 90%	Annual	✓	✓	✓	-

Program Name	Description	Eligible Applicants	Maximum Grant Award	Potential Projects	Federal Cost-Share	Funding Cycle	Eligible Activities			
							Planning	Env. & Final Design	Const.	O&M
DOI WaterSMART – Environmental Water Resources Projects (EWRP)	The EWRP aims to fund projects that enhance ecological values and watershed health, particularly those that have a direct connection to water resources or water management. Projects should contribute to the sustainability and resilience of water resources in the face of changing conditions.	States, Indian Tribes, water districts, non-profit conservation organizations, and regional or local authorities with water or power delivery authority, located in specified states or territories.	$3 million	• Stream channel improvements • Floodplain connectivity enhancements • Erosion control • Water temperature regulation • Stream restoration, and backwater/ floodplain habitat restoration	75%	Annual	✓	✓	✓	✓

Program Name	Description	Eligible Applicants	Maximum Grant Award	Potential Projects	Federal Cost-Share	Funding Cycle	Eligible Activities			
							Planning	Env. & Final Design	Const.	O&M
DOI WaterSMART – Aquatic Ecosystem Restoration Project (AERP)	The AERP aims to fund projects that enhance and restore aquatic ecosystems, focusing on improving fish passage, habitat, and overall ecosystem health.	States, tribes, irrigation districts, water districts, regional authorities with water or power delivery authority, agencies with joint powers, organizations owning eligible dams, and nonprofit conservation organizations partnered with eligible entities.	Study and Design: $2 million Construction: $20 million	Projects aimed at the restoration and enhancements of aquatic ecosystems, such as barrier removal for fish passage, stream channel and floodplain connectivity improvements, and habitat restoration for aquatic species.	65%	Annual	✓	✓	✓	-

Table 2: State Funding Sources

Program Name	Description	Eligible Applicants	Maximum Grant Award	Potential Projects	State Cost-Share	Funding Cycle	Eligible Activities			
							Planning	Env. & Final Design	Const.	O&M
DWR Statewide Flood Emergency Response Grant Program	This program provides funding for local emergency responders to work with DWR to improve local flood emergency preparedness and response. The program focuses on planning, coordination, training, exercises, and providing facilities, equipment, and supplies for flood emergency response.	California public agencies responsible for flood response and coordination, excluding the legal Delta region, with multi-agency applications designating a lead agency.	Not specified.	Activities may include training for NIMS compliance, updating local flood safety plans, developing communication processes for flood emergencies, and establishing staging areas and flood emergency response facilities	100%	Ongoing	✓	-	-	-
DWR Riverine Stewardship Program	The RSP aims to implement riverine and riparian stewardship improvements through technical and financial assistance for projects that reduce flood risk, restore, and enhance fish populations and habitat, improve water quality, achieve climate change benefits, and ensure resilient ecological functions in various areas of the state.	Tribes, local public agencies, and certified nonprofits.	Not specified.	Projects that enhance native fish populations, reduce their vulnerability to water diversions, improve water quality, and restore natural ecosystem functions. Projects may involve habitat restoration, fish migration enhancements, green infrastructure designs, and solutions that improve water supply or quality.	80%	Ongoing	✓	✓	✓	✓

Program Name	Description	Eligible Applicants	Maximum Grant Award	Potential Projects	State Cost-Share	Funding Cycle	Eligible Activities			
							Planning	Env. & Final Design	Const.	O&M
DWR Floodplain Management, Protection, and Risk Awareness	The FMPRA Grant Program aims to reduce flood risks associated with stormwater flooding, mudslides, and flash flooding. The program gives priority to projects located in FEMA special flood hazard areas or equivalent flood hazard areas.	California public agencies, nonprofits, public utility agencies, federally recognized Indian Tribes, State Indian Tribe, and mutual water companies.	Not specified.	Eligible projects include those that reduce flood risk associated with stormwater flooding, mudslides, flash flooding, and promote the wise use of floodplains. Projects should include multiple benefit features, such as enhancing wildlife habitat, sustaining agricultural production, improving water quality, and groundwater recharge, among others.	75%	Annual	✓	✓	✓	-
DWR Integrated Regional Water Management	The IRWM Grant Program is designed to support integrated regional strategies for water resource management. The program aims to improve regional water self-reliance, adapt to climate change effects on water supply, and encourage collaboration across watersheds for managing regional water resources.	Public agencies, nonprofit organizations, public utilities, federally recognized Indian Tribes, state Indian tribes, and mutual water companies.	Not specified.	Eligible projects under this program include those that support integrated water management and address regional water security, climate, and drought preparedness. Projects may involve watershed protection, stormwater resource management, water quality improvement, and other IRWM activities.	50%	Annual	✓	✓	✓	-

Program Name	Description	Eligible Applicants	Maximum Grant Award	Potential Projects	State Cost-Share	Funding Cycle	Eligible Activities			
							Planning	Env. & Final Design	Const.	O&M
DWR Watershed Resilience Program (WRP)	The WRP responds to climate change by promoting collaborative efforts across various sectors, emphasizing a comprehensive approach to managing climate impacts at the watershed scale. The program supports projects that enhance coordination across water management sectors, integrate equity, and conduct quantitative assessments to address climate vulnerabilities.	Public agencies and water agencies	Not specified.	Projects focused on watershed network establishment, climate risk assessments, adaptation strategies, and resilience planning. It supports construction projects for drought relief, water system enhancements, well rehabilitation, fish and wildlife protection, and water conservation initiatives.	Not specified.	Annual	✓	-	✓	-
CDFW Fisheries Restoration Grant Program (FRGP)	The FRGP supports projects that restore, enhance, and protect anadromous salmonid habitat and anadromous watersheds of California.	State and local government agencies, public entities, California Native American Tribes, and nonprofit organizations.	Not specified.	**Four main criteria**: species criteria (focus on Coho Salmon, Steelhead, and Chinook Salmon), geographic criteria (projects must be within specified watersheds), project type criteria, and recovery or restoration criteria aimed at assisting salmonid population recovery.	Not specified.	Annual	✓	✓	✓	✓

Program Name	Description	Eligible Applicants	Maximum Grant Award	Potential Projects	State Cost-Share	Funding Cycle	Eligible Activities			
							Planning	Env. & Final Design	Const.	O&M
Wildlife Conservation Board Stream Flow Enhancement Program	The SFEP funds projects that enhance stream flows across California. The SFEP defines enhanced streamflow to mean: a change in the amount, timing, and/or quality of water flowing down a stream, or a portion of a stream, to benefit fish and wildlife.	Nonprofit organizations, local governmental agencies, federal agencies, state agencies, and California Native American tribes. Grants may also be awarded to private landowners, public utilities, federally recognized Indian tribes, state Indian tribes, and mutual water companies.	Not specified.	Potential projects include acquiring water rights for instream use, water conservation efforts to enhance stream flow, infrastructure modifications like changing diversion points or improving irrigation, habitat restoration to benefit ecosystems, land acquisition to improve stream conditions, and conducting research and monitoring to assess project impacts and inform future initiatives.	100%	Ongoing	✓	✓	✓	-

Program Name	Description	Eligible Applicants	Maximum Grant Award	Potential Projects	State Cost-Share	Funding Cycle	Eligible Activities			
							Planning	Env. & Final Design	Const.	O&M
California Natural Resources Agency Urban Greening Program	The program funds urban greening projects that reduce greenhouse gas emissions, mitigate extreme heat effects, and provide multiple additional benefits like improved air quality and more vibrant communities. The projects emphasize and prioritize benefits to disadvantaged communities and areas facing significant threats from extreme heat	Cities, counties, special districts, nonprofits, or agencies under the Joint Exercise of Powers Act, with at least one qualifying party. California Native American tribal governments must meet nonprofit criteria.	There are no maximum grant amounts.	The grant program includes multi-objective stormwater projects, which can encompass the creation or restoration of wetlands, recharge ponds, floodplains, or riparian corridors as eligible project elements	Not specified.	Annual	-	✓	✓	-
Governor's Office of Planning and Research Adaptation Planning Grant Program	The APGP funds climate adaptation planning addressing cross-sector issues intersecting with multiple climate risks. The program aims to strengthen statewide resilience by providing technical assistance, fostering collaborative learning, and promoting equitable decision-making, striving to address historical disparities and ensure broad community access to associated benefits.	Local public entities, California Native American Tribes, community-based organizations, and academic institutions.	$650,000	Eligible projects under APGP include climate adaptation planning activities that address cross-sector issues and intersect with multiple climate risks. Projects that focus on enhancing statewide resilience, providing technical assistance, fostering collaborative learning, and promoting equitable decision-making, especially for vulnerable communities.	100%	Annual; Three rounds.	✓	✓	-	-

Program Name	Description	Eligible Applicants	Maximum Grant Award	Potential Projects	State Cost-Share	Funding Cycle	Eligible Activities			
							Planning	Env. & Final Design	Const.	O&M
Governor's Office of Planning and Research Regional Resilience Grant Program (RRGP)	The RRGP supports projects through regional partnerships involving multiple jurisdictions to address significant climate risks. The program emphasizes strengthening climate resilience, with a focus on communities most affected by climate change.	Regional partnerships comprised of California Native American tribes, public entities, community-based organizations (CBOs), and academic institutions.	Planning: $650,000 Implementation: $3 million	Eligible projects must strengthen climate resilience on a regional scale and involve partnerships among eligible entities. Planning projects include floodplain management plans and flood resiliency plans.	100%	Annual	✓	✓	✓	-

State Coastal Conservancy Coastal Conservancy Grants	The State Coastal Conservancy funds projects aligned with its strategic plan and criteria, focusing on legal and environmental compliance, project management, and strategic goals such as community engagement, environmental justice, and resilience to climate change.	Public agencies, joint power authorities, federally recognized Indian tribes, nonprofit organizations, and other community-based organizations and non-federally recognized tribes with a 501(c)(3) fiscal sponsor	There are no maximum grant amounts. Grants anticipated to be between $200,000 and $5,000,000	• Land acquisition to prevent development, or for restoration, public access, or conservation. • Community-led planning, engagement, and capacity-building. • Technical analyses, resource studies, preliminary planning, and CEQA reviews. • Securing necessary permits, habitat area cleanup, levee breaches or barrier removal for water flow restoration.	Not specified.	Ongoing	✓	✓	✓	-

Table 3. Other Funding Sources

Program Name	Description	Eligible Applicants	Maximum Grant Award	Potential Projects	State Cost-Share	Funding Cycle	Eligible Activities			
							Planning	Env. & Final Design	Const.	O&M
San Francisco Bay Restoration Authority Community Grants Program	The Community Grants Program offers a more accessible route for CBOs in economically disadvantaged communities to obtain grants. It supports shoreline habitat projects, small projects with community benefits, trains leaders, and empowers communities in large restoration projects.	CBOs in economically disadvantaged communities.	$200,000	Habitat restoration, flood management projects that are part of habitat projects, and public access projects that improve access or recreational amenities linked to habitat projects.	100%	Ongoing	✓	✓	✓	✓