Final - Update 1

SOUTHERN SONOMA COUNTY STORM WATER RESOURCES PLAN

Prepared by
Sonoma Water

May 2019

Final - Update 1

SOUTHERN SONOMA COUNTY STORM WATER RESOURCES PLAN

Prepared by
Sonoma Water

May 2019

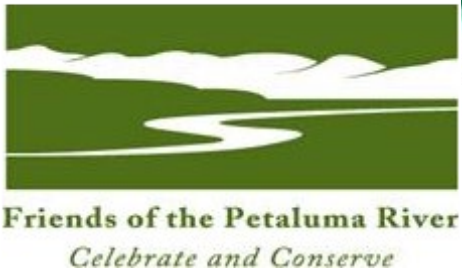
1425 N. McDowell Boulevard
Suite 200
Petaluma, CA 94954
707.795.0900
www.esassoc.com

ESA

Bend	Oakland	San Francisco
Camarillo	Orlando	Santa Monica
Delray Beach	Pasadena	Sarasota
Destin	Petaluma	Seattle
Irvine	Portland	Sunrise
Los Angeles	Sacramento	Tampa
Miami	San Diego	

D170210.01

PLAN COLLABORATORS



Sonoma Water

Funding has been provided in full or in part through an agreement with the State Water Resources Control Board using funds from Proposition 1. The contents of this document do not necessarily reflect the views and policies of the foregoing, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

OUR COMMITMENT TO SUSTAINABILITY | ESA helps a variety of public and private sector clients plan and prepare for climate change and emerging regulations that limit GHG emissions. ESA is a registered assessor with the California Climate Action Registry, a Climate Leader, and founding reporter for the Climate Registry. ESA is also a corporate member of the U.S. Green Building Council and the Business Council on Climate Change (BC3). Internally, ESA has adopted a Sustainability Vision and Policy Statement and a plan to reduce waste and energy within our operations. This document was produced using recycled paper.

TABLE OF CONTENTS

Southern Sonoma County Storm Water Resources Plan

Page

Page

Appendices

List of Figures

Page

List of Tables

EXECUTIVE SUMMARY

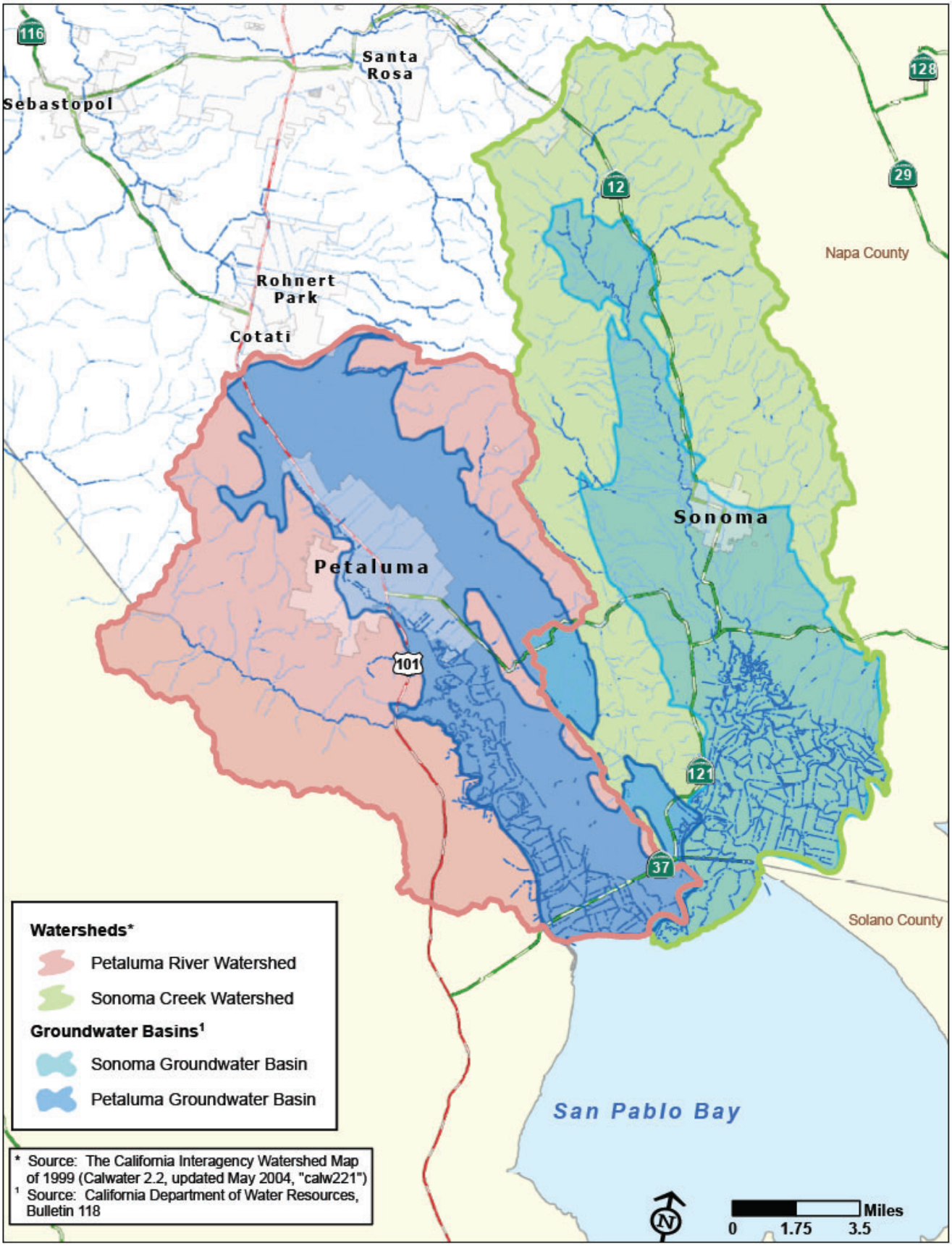
Background

In 2016 the Sonoma County Water Agency (Sonoma Water) was awarded a $484,627 storm water planning grant from the State Water Resources Control Board's Storm Water Grant Program. Senate Bill 985 (Pavley, 2014) requires an entity to develop a compliant Storm Water Resources Plan (SWRP) to be eligible to seek funding from any future state bond measures for storm water and dry weather capture projects. A SWRP is a non-regulatory, watershed-based and stakeholder-driven plan that builds on local storm water management objectives and identifies and prioritizes projects that capture, treat or reuse storm water and dry weather runoff. These projects must provide at least two benefits which may include environmental enhancement, flood protection, groundwater recharge, water quality improvement and/or recreational opportunities. Sonoma Water staff, their consultant, Environmental Science Associates (ESA), and a 13-member Technical Advisory Committee (TAC) worked expeditiously and collaboratively over a 17-month period to develop the Southern Sonoma County Storm Water Resources Plan covering the Petaluma River and the Sonoma Creek watersheds. Through the planning process, over 60 projects were identified and submitted by proponents for consideration and inclusion.

The resulting plan provides a framework for submitting, quantifying, scoring, and ranking future projects in an objective and data driven format. Continued adaptation of the SWRP will allow for productive stakeholder engagement and planning emphasizing a previously overlooked resource. This is an invaluable tool in the midst of changing climatic conditions that will continue to alter our local water supply resources and needs, contribute to water quality impairments, and exacerbate flood management challenges.

Southern Sonoma County Watersheds

The Southern Sonoma County SWRP planning boundary encompasses both the Sonoma Creek and Petaluma River watersheds, a total area of 316 square miles. Figure 1 portrays the planning area. The planning area includes three supervisorial districts, three counties, two cities, numerous unincorporated communities, major transportation arteries, and a diverse range of habitats, land uses, and storm water management challenges. Both watersheds are largely dominated by agricultural land uses and a majority of the land is held in private ownership or as public open space. The following natural resource challenges represent both the current status and anticipated evolution of watershed conditions, as well as the advantages provided by the SWRP planning process within this context moving forward.



SOURCE: SCWA

Southern Sonoma SWRP

Figure 1

Southern Sonoma County
Storm Water Resources Planning Area

ESA Sonoma Water SWGP STORM WATER GRANT PROGRAM

Water Quality Impairment: Both the Petaluma River and Sonoma Creek are listed on the Clean Water Act 303(d) list of impaired water bodies for nutrients, pathogens, and sediment. The Petaluma River is also listed for trash and nickel. Municipalities are actively complying with regulatory requirements related to receiving water bodies and treatment plant discharges. As amendments to the Basin Plan occur and additional regulations are placed on municipal, rural and agricultural activities in relation to runoff and land management, the SWRP can serve as a framework to guide implementing projects to meet water quality requirements and beneficial storm water management objectives.

Flood Management: Floods are the most frequent natural hazard impacting Sonoma County, causing the greatest property losses and accounting for the highest number of local, Gubernatorial, and Presidential disasters (Sonoma County, 2017). Notable recent flooding events on the Petaluma River include 1982, 1986, 1998, and 2006, causing approximately $91 million in damages. On Sonoma Creek, notable recent flooding events include 2005 and 2008, primarily flooding the lower watershed and baylands area. Both watersheds are tidally influenced, meaning storm surges exacerbate the effects of inundation upstream. Anticipated continued sea level rise will further aggravate these effects over time. The SWRP promotes flood management projects that can provide scalable and distributed capture facilities, easing the effects of flooding on communities, waterways and infrastructure.

Environmental Resource Concerns: Both watersheds support a wide variety of dedicated open space and native and special status species including California red-legged frog, California tiger salamander, California freshwater shrimp, steelhead, chinook salmon, as well as resident native and migratory species. With ongoing development pressure, stressors to environmental resources, including current and future special status species, are expected to increase in the future.

Water Supply Reliability: Water supply is provided primarily by water delivered via aqueducts from the Russian River; however, groundwater is a vital supplemental source of water for the city of Petaluma, city of Sonoma, Valley of the Moon Water District, and is the primary source of supply for domestic and agricultural use by rural property owners. Water managers face the challenge of meeting the increasing water demand with a combination of Russian River water, which has uncertainties in its future availability, and local groundwater resources (USGS, 2016).

With the passage of the Sustainable Groundwater Management Act in 2014, and subsequent updates since its passing, three basins within Sonoma County must be managed by Groundwater Sustainability Agencies (GSA) by 2018, and sustainability plans must be developed for each basin by 2022-23. Water managers need to determine the likely effects of future groundwater development in the Petaluma and Sonoma Valleys and identify efficient strategies for surface-water/groundwater management that will assure the long-term viability of water supply. The SWRP will likely aid in the planning process, supporting storm water capture and reuse initiatives by supplying data, potential funding opportunities, and a conduit for communication among watershed partners.

Stakeholder Engagement and Plan Implementation

The Southern Sonoma SWRP was developed through a collaborative process involving a 13-member technical advisory committee composed of the following organizations:

- Sonoma Water (Lead Agency)
- Sonoma County Ag + Open Space
- Sonoma Resource Conservation District
- Sonoma County Regional Parks
- Permit Sonoma, Sonoma County
- Sonoma Land Trust
- City of Petaluma
- Valley of the Moon Water District
- City of Sonoma
- Sonoma Ecology Center
- Lawrence Berkeley National Laboratories
- San Francisco Bay Regional Water Quality Control Board
- State Water Resources Control Board

Additional watershed stakeholders that were engaged in the planning process and submitted projects for consideration included Daily Acts, Equine Environmental Management, North Bay Agriculture Alliance, Friends of the Petaluma River and private landowners. The stakeholders involved in the planning process represent land managers, agricultural interests, residential, rural and disadvantaged communities, regulatory agencies and academic institutions. Many partners manage storm water-focused programs which have collectively elevated community awareness of storm water management at varying scales through education, volunteer mobilization, technical expertise, and targeted outreach.

During the Plan development process, four TAC meetings were held, as well as one public meeting, in addition to consistent project presentations and updates by members of the TAC and by Sonoma Water at various committees Sonoma Water manages and participates in. TAC meeting materials, the project submission form, completed grant deliverables and other relevant resources are available on the SWRP webpage at www.scwa.ca.gov/SWRP.

Successful implementation of the SWRP will be dependent on project proponent timelines, capacity and funding opportunities, and will be sustained by continued collaboration among watershed partners as the SWRP was intended to be developed as a “living document” that reflects changing conditions. A strategy for adaptive management and subsequent updates, as well as the existing monitoring programs and data management platforms that will enable the public and other stakeholders to track the progress of SWRP projects funded for implementation, have been developed and described within the plan. For subsequent Plan

update processes, notifications for project submission windows, public meetings, and public review will be distributed via the SWRP webpage and SCWA newsletter, as well as through local stakeholder meetings and newsletters.

Quantitative Methodologies and Identification and Prioritization of Projects

A multi-step project submission, project evaluation and prioritization process, as well as quantification methodologies, were developed and refined in collaboration with the TAC and local stakeholders. The four-step process involved the following components and scoring methods:

- *Step 1:* General project information including description, location and proponent and determination of eligibility for inclusion within the Plan. The eligibility criteria established were twofold: a project must be within the watershed planning boundary and must achieve at least two main benefits.

- *Step 2:* Initial quantification using a series of yes/no questions to evaluate project benefits. A project received two (2) points for each main benefit addressed and one (1) point for each additional benefit addressed.

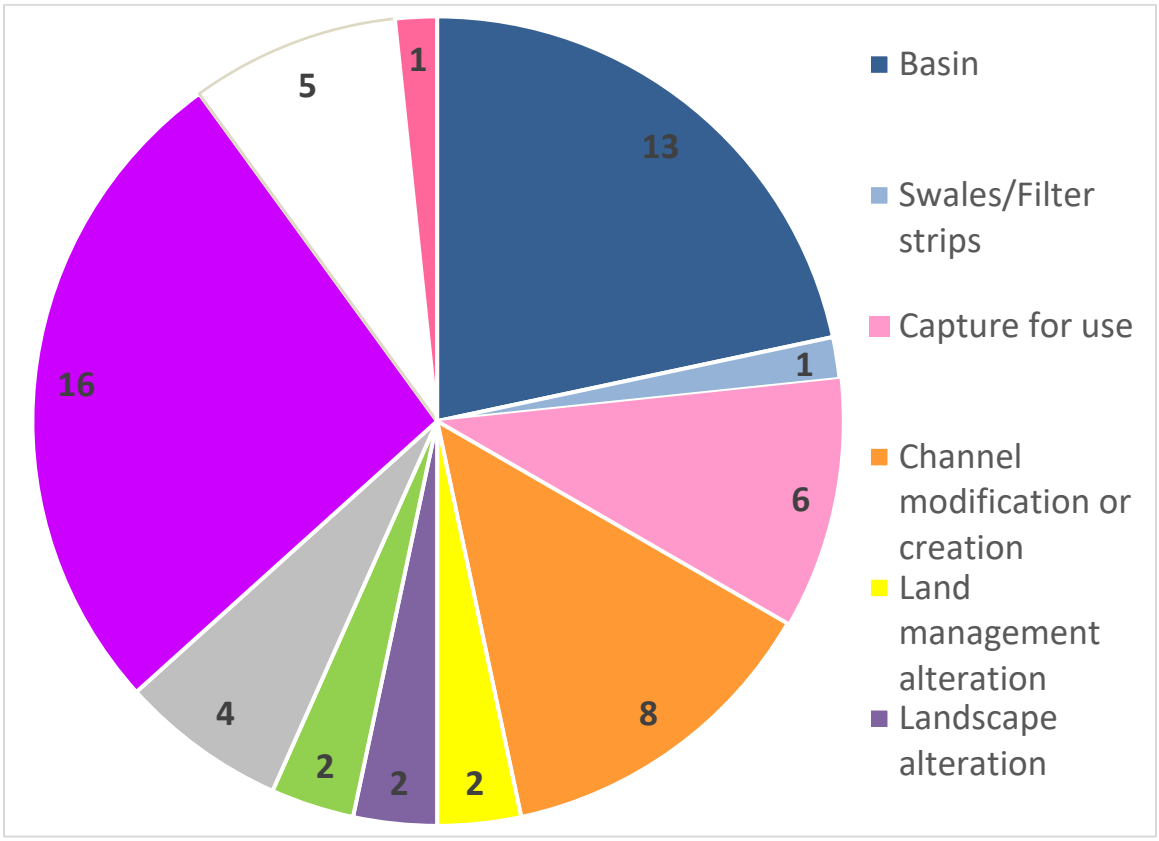
- *Step 3:* Detailed quantification completed using a combination of applicant-submitted information and results derived by analysis. A project received one to three (1-3) points depending on the quantified values, or zero (0) points if detailed quantification was not possible.

- *Step 4:* Bonus points were awarded if a project is located on public land, if the project is located on private land with a cooperating landowner, if the project provides synergistic benefits due to location relative to other existing or proposed projects, and/or if the project is supported by entities that have created permanent, local, or regional funding.

All 60 projects submitted met the eligibility criteria, and 25 of the 60 projects provided data to support detailed quantification. The overall detailed quantification approach for the Water Quality, Water Supply, and Flood Management benefit was to develop regional relationships and approaches that rely on modeling to establish curves that relate benefits to project scale or proposed BMP size. Applicant-supplied data was used to quantify benefits for Environmental and Community benefits.

Following the initial, detailed, and bonus scoring, projects were prioritized and separated into three tiers: A, B, and C. Tier A projects have the highest scores at 33 points and above, Tier B projects fell in the mid-range between 22 and 33 points, and Tier C was the lowest, including projects scoring 22 points and below.

Based on local experience and early input from the TAC, the main management action types were identified, and projects were distributed as shown in the graphic below.



1. INTRODUCTION

Sonoma Water, in partnership with collaborating entities, prepared this Storm Water Resource Plan (SWRP or Plan) in accordance with the State Water Resource Control Board's Storm Water Resource Plan Guidelines. The Guidelines were developed in accordance with the legislative directive found in SB 985, and were adopted by the State Water Board on December 15, 2015.The Plan covers the southern Sonoma County watersheds of Petaluma River and Sonoma Creek, tributaries to San Pablo Bay. The Plan is a comprehensive, living document that reflects the significant transformation in approach to watershed based resource planning and storm water and dry weather runoff management.

Preparation of the SWRP was led by Sonoma Water and its consultants, Environmental Science Associates (ESA), in partnership with the State Water Resources Control Board (SWRCB) and collaborating entities, including members of a Technical Advisory Committee (TAC) listed in section 7.1.1. The planning effort was conducted through a collaborative and iterative process involving stakeholders and the public with significant contributions from TAC members. The SWRP was tailored to address the specific storm water and dry weather runoff issues in the region. Development of the SWRP is funded through a Proposition 1 planning grant administered by the State Water Resources Control Board under its Storm Water Grant Program.

1.1 Purpose and Background

The purpose of the SWRP is to identify and prioritize storm water capture and dry weather runoff projects as key components to managing a safe, clean and resilient water supply. Projects are identified and prioritized through a detailed analysis of watershed processes and surface and groundwater resources, input from stakeholders and the public, and an analysis of multiple benefits that can be achieved. The collective objective of this plan is twofold: 1) to guide future planning from a watershed-based perspective by addressing major challenges and opportunities for managing storm water and dry weather runoff within the watershed and 2) to prioritize projects for implementation and illuminate multiple benefit projects to position the watershed to garner matching funds.

In the midst of increasing water supply uncertainty, extended drought, devastating fires, and historic flood events, the foresight of local leadership to prepare this voluntary Plan has afforded the stakeholders a unique opportunity to reinvest in natural systems. The SWRP provides the foundational framework and tools to tap into the potential for storm water capture, recharge and reuse across the watershed, while maintaining productive working lands and highly valued community open spaces. The SWRP is the result of thoughtful collaboration between municipalities, local agencies, non-profits, and stakeholders including private

landowners and the public to identify watershed-based management strategies and elevate multi-benefit projects with the greatest quantified potential.

This SWRP meets the requirements of California Water Code Section 10560 et seq., and per the plan guidelines establishes parameters for eligibility for local agencies and organizations to identify, prioritize and implement future multiple benefit storm water projects, pursuant to Senate Bill 985 (SB 985), Storm Water Resources Planning Act. The intent of SB 985 was to encourage the use of storm water and dry weather runoff as a resource to improve water quality, reduce localized flooding, and increase water supplies for beneficial uses and the environment. The Act helped to codify the transformation of storm water from a nuisance, captured and conveyed in concrete, to a resource for water supply and other multiple benefits. California Water Code requires a SWRP as a condition of receiving funds for storm water capture and runoff projects from any water bond measure approved by voters after January 1, 2014. Proposition 1 funding (Water Bond) and future bonds approved by voters will provide opportunities for eligible entities to apply for implementation when projects are identified in a SWRP according to the state SWRP guidelines.

Per the state's SWRP guidelines, SWRPs shall identify the following in the Plan:

1. Opportunities to augment local water supply through groundwater recharge or storage for beneficial use of storm water and dry weather runoff.
2. Opportunities for source control of pollutants due to storm water and dry weather runoff, onsite and local infiltration, and use of storm water and dry weather runoff.
3. Projects to reestablish natural water drainage treatment and infiltration systems, or mimic natural system functions to the maximum extent feasible.
4. Opportunities to develop, restore, or enhance habitat and open space through storm water and dry weather runoff management, including wetlands, [streams,] riverside habitats, parkways, and parks.
5. Opportunities to use existing publicly owned lands and easements, including, but not limited to, parks, public open space, community gardens, farm and agricultural preserves, school sites, and government office buildings and complexes, to capture, clean, store, and use storm water and dry weather runoff either onsite or offsite.
6. Design criteria and best management practices to prevent storm water and dry weather runoff pollution and increase effective storm water and dry weather runoff management for new and upgraded infrastructure and residential, commercial, industrial, and public development. These design criteria and best management practices shall accomplish all of the following:
    a. Reduce effective impermeability within a watershed by creating permeable surfaces, retention basins, cisterns, and other storage for beneficial use.
    b. Increase water storage for beneficial use through a variety of onsite storage techniques.
    c. Increase groundwater supplies through infiltration, where appropriate and feasible.

d. Support low-impact development for new and upgraded infrastructure and development using low-impact techniques.

7. Activities generating or contributing to the pollution of storm water or dry weather runoff, or that impair the effective beneficial use of storm water or dry weather runoff.

This page intentionally left blank

2. SOUTHERN SONOMA COUNTY WATERSHEDS

SWRP Checklist Guidelines

- ☒ Plan identifies watershed and subwatershed(s) for storm water resource planning
- ☒ Plan is developed on a watershed basis, using boundaries as delineated by USGS, CalWater, USGS Hydrologic Unit designations, or an applicable integrated regional water management group, and includes a description and boundary map of each watershed and sub-watershed.
- ☒ Plan includes an explanation of why the watershed(s) and sub-watershed(s) are appropriate for storm water management with a multiple-benefit watershed approach.
- ☒ Plan describes boundaries of municipalities; service areas of individual water, wastewater, and land use agencies, including those not involved in the Plan; and groundwater basins
- ☒ Plan describes the water quality priorities within the watershed based on, at a minimum, applicable TMDLs and consideration of water body-pollutant combinations listed on the State's Clean Water Act Section 303(d) list of water quality limited segments
- ☒ Plan describes the general quality and identification of surface and ground water resources within the watershed
- ☒ Plan describes the local entity or entities that provide potable water supplies and the estimated volume of potable water provided by the water suppliers.
- ☒ Plan includes map(s) showing location of native habitats, creeks, lakes, rivers, parks, and other natural or open space within the sub-watershed boundaries.
- ☒ Plan identifies the natural watershed processes that occur within the sub-watershed and a description of how those processes have been disrupted.

The Southern Sonoma County SWRP planning area includes both the Petaluma River and Sonoma Creek watersheds. These watersheds are ideal for coverage under a single comprehensive SWRP as they are substantially identical to the jurisdictional areas of Sonoma County which drain into San Pablo Bay and the larger San Francisco Bay, and they share water quality goals driven by similar impairments in shared receiving waters. The Petaluma River and Sonoma Creek watersheds also share similar and consistent land uses and flooding patterns that generate collaboration across watersheds.

The Southern Sonoma County SWRP uses the CalWater 2.2 Hydrologic Area delineation for both watersheds. Using the CalWater delineation allows the SWRP to utilize a vast amount of existing data available for each watershed to support the project prioritization and quantification process. In addition, concurrent planning efforts in Sonoma County utilize the same planning area boundary, allowing collaborators to maintain consistency between regional efforts to plan land uses, protect natural resources, and meet storm water management objectives. These efforts include the future Groundwater Sustainability Plans for the Petaluma and Sonoma Valley Groundwater Basins, pursuant to the Sustainable Groundwater Management Act (SGMA), and the Sonoma County Ag + Open Space's Vital Lands Initiative.

This section describes the jurisdictional boundaries, water quality priorities, surface and

groundwater resources, potable and recycled water supplies, native habitats, and watershed processes for each watershed. This section concludes with information on climate change vulnerabilities and challenges that will affect both watersheds in Southern Sonoma County.

2.1 Petaluma River Watershed

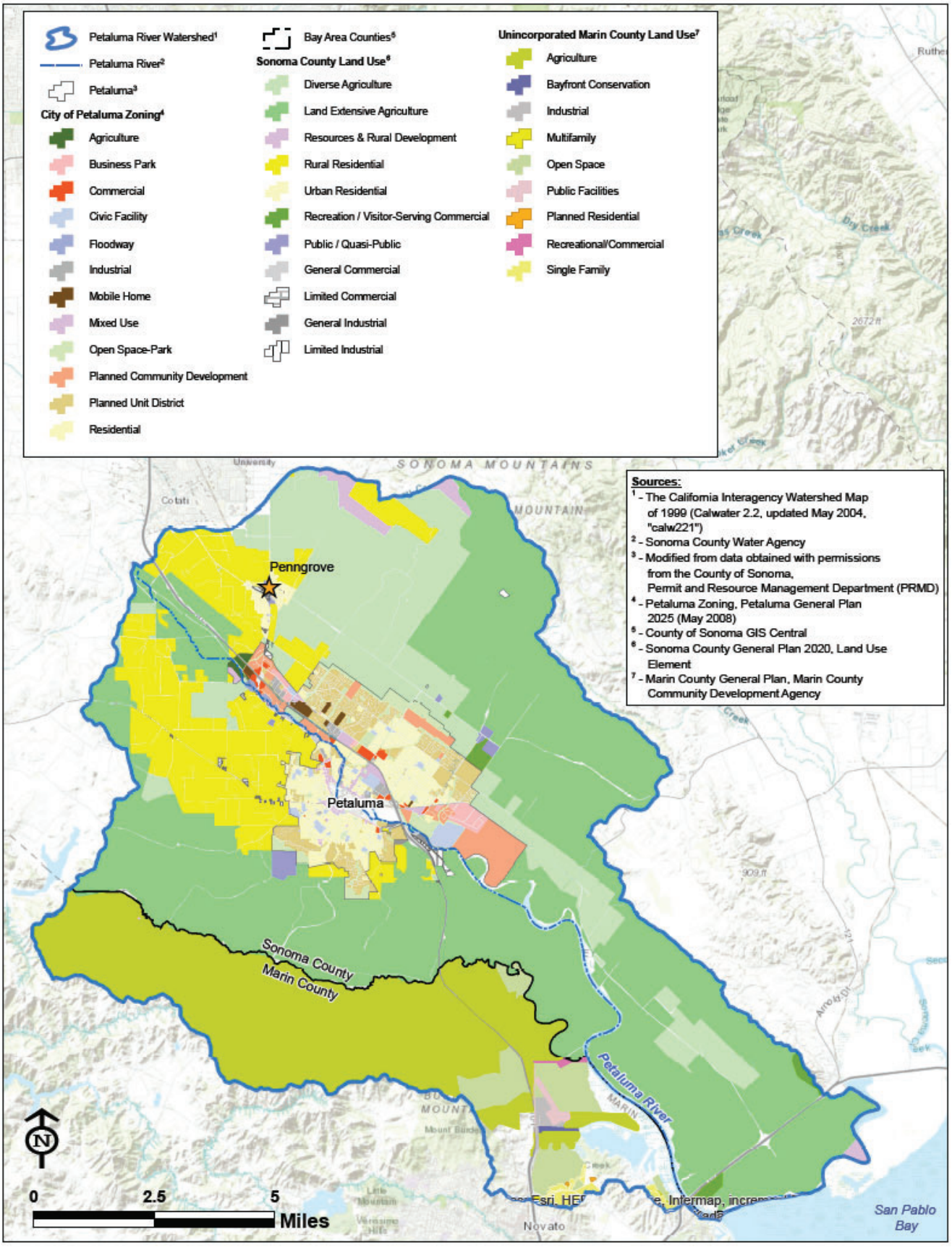
2.1.1 Watershed Area, Communities, and Land Use

The Petaluma River Watershed is located in southern Sonoma County and a portion of northeastern Marin County (Figure 2). The Petaluma River Watershed encompasses a 146-square mile, pear-shaped basin, of which 113 square miles (77%) are in Sonoma County and 33 square miles (23%) are in Marin County. The watershed is approximately 19 miles long and 13 miles wide. Average annual rainfall in the watershed ranges from approximately 20 inches near the valley floor to greater than 50 inches on the highest slopes.

Near the center of the watershed lies the City of Petaluma, incorporated in 1858, with a population of approximately 60,530 residents (2016). The unincorporated community of Penngrove, with a population of approximately 2,500 residents, is located in the northerly portion of the watershed, between Petaluma and the cities of Rohnert Park and Cotati. Primary languages spoken include English and Spanish. The City of Petaluma's economy includes telecommunications, research and development, manufacturing, retail trade, services, and tourism as well as agricultural products. Median household income is expected to grow around 12.3%, from a level of $77,149 in 2016 to $86,666 in 2021 (Sonoma County EDB, 2017).

The Petaluma River watershed is a largely agricultural landscape dominated by grassland and pasture for grazing cattle and sheep and has historically been the production center for poultry and dairy products. Although the poultry industry has declined, milk remains one of the county's leading agricultural commodities. In recent years, agricultural production has diversified to include vineyards, flowers, olive groves, and other specialty crops. The remainder of the land use in the watershed is rural and urban residential, salt marsh and wetlands along the river channel in the south, vineyards scattered around Penngrove and the Petaluma urban boundaries, and forested areas in the hills along the southwestern and northeastern borders of the watershed.

Radiocarbon tests indicate settlement in the Petaluma region by Native Americans as far back as 9,000 years. The Petaluma River watershed is located within the area identified as Coast Miwok territory. Native Americans are believed to have moved into the Petaluma area approximately 3,000 to 3,500 years ago and actively managed the land prior to European contact (Sonoma RCD, 2015).



SOURCE: SCWA

Southern Sonoma SWRP

Figure 2
Petaluma River Watershed
Communities and Land Use

2.1.2 Water Quality Priorities

The Petaluma River supports beneficial uses for cold and warm freshwater habitat, fish migration, preservation of rare and endangered species, fish spawning, estuarine habitat, navigation, wildlife habitat and contact and non-contact water recreation. Impacts from urban activities, construction, land development, atmospheric deposition, and agricultural runoff have resulted in the 2012 Clean Water Act's Section 303(d) listing of the river, stream and tidal portions of the Petaluma River for the medium priority pollutants of nutrients, pathogens, sediment (river and stream only) and low priority pollutant nickel (tidal only). The watershed was listed for trash (river and stream only) in 2010. The Petaluma River pathogen and nutrient TMDL is under development. Expected completion dates for all TMDLs are from 2019 to 2021. Water quality priorities for the Petaluma River Watershed are described in further detail in Section 3.

2.1.3 Surface Water and Groundwater Resources

Surface Water

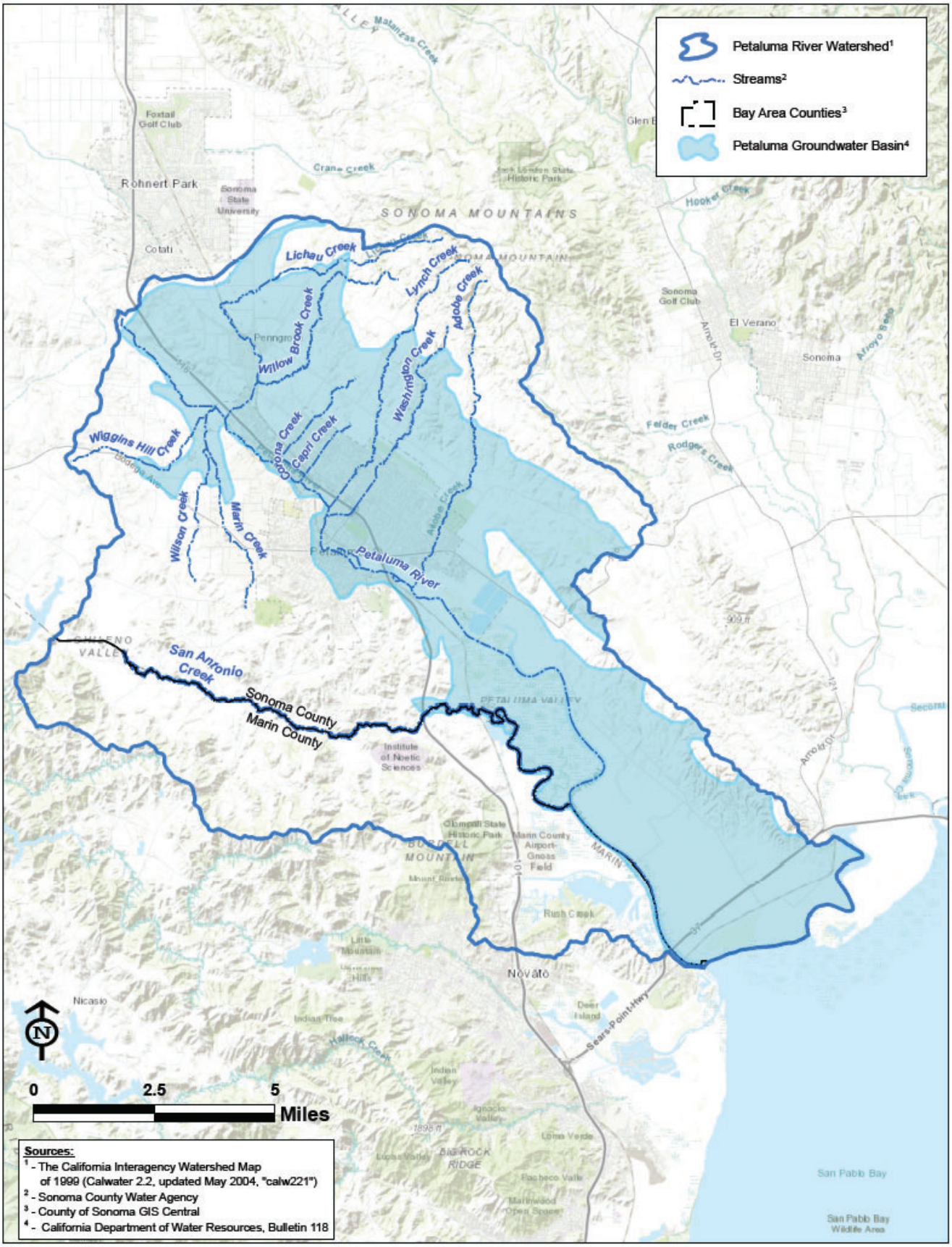
The headwaters and ephemeral tributaries of the Petaluma River begin on the steep southwest slopes of Sonoma Mountain, the southern slopes of Mecham Hill, and the eastern slopes of Weigand's Hill and Mount Burdell (Figure 3). While the river's source lies over 300 feet above sea level, it descends to 50 feet above sea level within about 0.4 miles in the Denman Flat area.

The confluence of Wilson Creek, Marin Creek, and Wiggins Creek form the headwaters of the Petaluma River watershed. Major tributaries in the eastern portion of the watershed include Lichau Creek, which flows into Willow Brook and feeds into Denman Flat area, Corona Creek, Capri Creek, Lynch Creek, Washington Creek, and Adobe Creek. These tributaries flow through both unincorporated land and lands within the City of Petaluma limits before joining the Petaluma River.

The lower 12 miles of the Petaluma River flow through the Petaluma Marsh, the largest remaining natural tidal brackish marsh in California, and is fed by the largest subwatershed, San Antonio Creek. The river is fully tidal 11 miles from its mouth, a product of its slight gradient through the marshes. Tidal influence extends upstream of the confluence with Lynch Creek.

Groundwater

The Petaluma Valley Groundwater Basin is faulted and discontinuous with relatively low well capacities. Moderate to high water yielding formations in the valley include alluvium, alluvial fan deposits, Tolay and Sonoma Volcanics and the Merced Formation. Water quality is inadequate for potable standards in some areas, showing high total dissolved solids, iron and manganese, and nitrate contamination in the northwestern area. The northwestern area also contains a large proportion of the total groundwater in storage and much of the total storage space available in the Petaluma Valley to accept recharge.



SOURCE: SCWA

Southern Sonoma SWRP

Figure 3

Petaluma River Watershed
Surface Water and Groundwater Resources

ESA Sonoma Water SWGP STORM WATER GRANT PROGRAM

Groundwater levels near the City of Petaluma dropped from the mid-1950s until the early 1960's allowing greater salt water intrusion into the aquifers along the lower Petaluma River. Delivery of Russian River Project water to the City of Petaluma began in 1962 with completion of Sonoma Water's Petaluma Aqueduct. This allowed reduction in the volume of municipal groundwater pumped and recovery of ground water levels. Only 6 of the City's existing 12 active wells are used for production. Many of the wells are inactive due to low yields, poor water quality, or deteriorating well conditions. In the rural portions of the watershed, wells are used for agricultural and residential purposes (City of Petaluma, 2015).

The Petaluma Valley Groundwater Basin was originally listed as medium priority by the Department of Water Resources and was proposed to be re-listed as high priority in 2018, but that action not yet been finalized. A Groundwater Sustainability Agency was formed in 2017 consistent with the implementation of the Sustainable Groundwater Management Act. Local stakeholders representing diverse groundwater users and interests continue to guide development and implementation of the Groundwater Sustainability Plan through a Board of Directors and an Advisory Committee. In 2014, the U.S. Geological Survey (USGS), City of Petaluma and Sonoma Water partnered to conduct a three-year long groundwater study of the Petaluma Valley, which is scheduled to be completed by the end of 2018.

2.1.4 Potable and Recycled Water Supplies

Potable and recycled water supplies in the Petaluma River watershed are provided by Sonoma Water, the City of Petaluma, the North Marin Water District, the Penngrove Water Company, and a limited number of smaller water systems (Figure 4). A summary of the potable and recycled water supplies for the Petaluma River watershed is included in Table 1 below and additional details are provided in the following sections.

TABLE 1
POTABLE AND RECYCLED WATER SUPPLIED IN THE PETALUMA RIVER WATERSHED

Supplier	Volume of Potable Water Supplied (AFY)	Volume of Recycled Water Supplied (AFY)
City of Petaluma	7678[1]	846[4]
North Marin Water District	7829[2]	
Penngrove Water Company	169[3]	

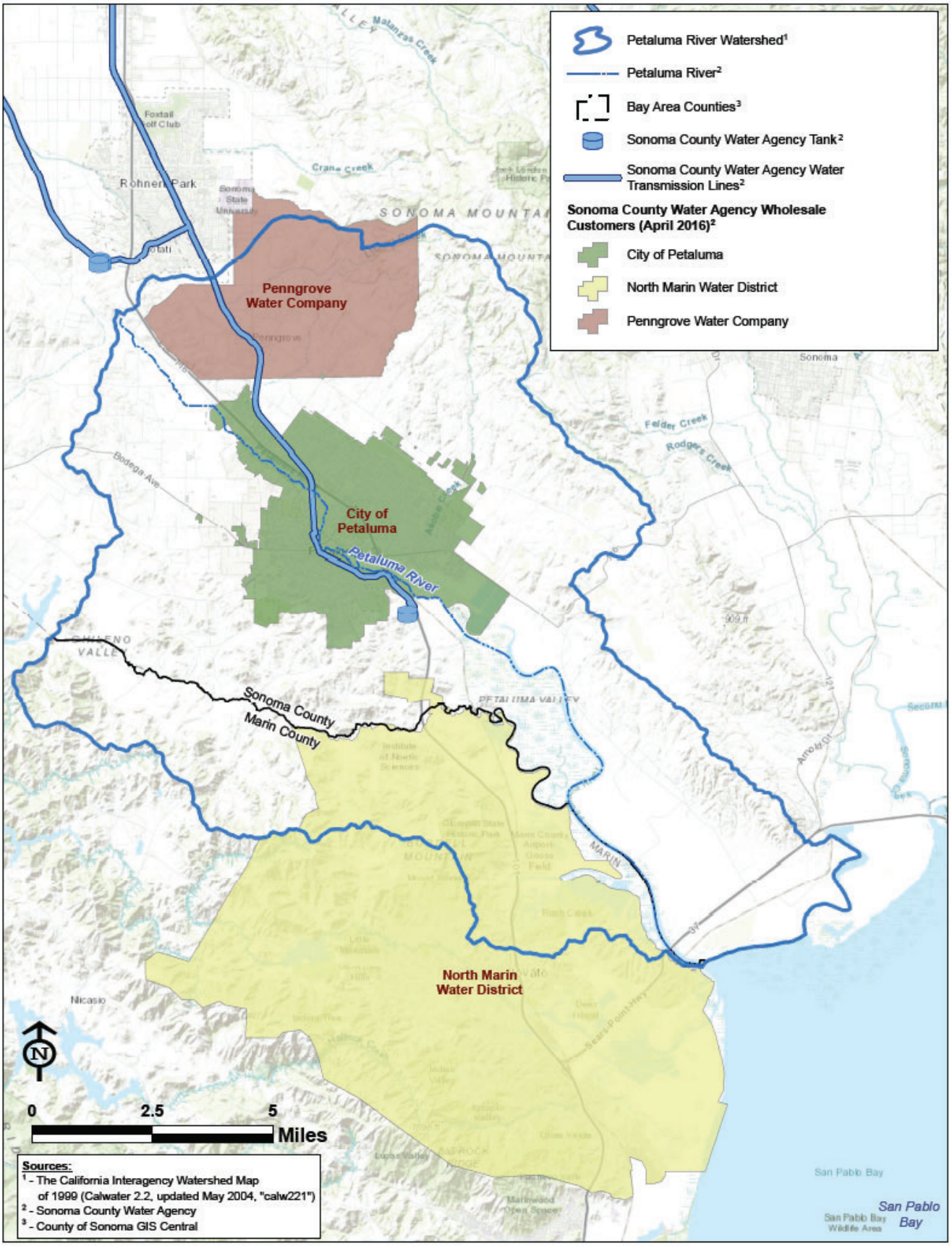
NOTES:

1 Volume provided by the 2015 City of Petaluma Urban Water Management Plan (Water supplies include wholesale water provided by SCWA and local water supplies. Does not include recycled water)

2 Volume provided by the 2015 North Marin Water District Urban Water Management Plan (Does not include recycled water and accounts for the entire NMWD service area)

3 Volume provided by the 2015 SCWA Urban Water Management Plan

4 Volume provided by the 2015 City of Petaluma Urban Water Management Plan. The City's Water Recycling Facility uses an additional 470 AFY of recycled water



SOURCE: SCWA

Southern Sonoma SWRP

Figure 4

Petaluma River Watershed
Potable and Recycled Water Supplies

ESA Sonoma Water SWGP STORM WATER GRANT PROGRAM

Sonoma County Water Agency

The Sonoma County Water Agency (Sonoma Water) is a special district providing wholesale water supply to several cities and water districts (nine primary water contractors) in Sonoma and Marin counties. The 1949 state law that created Sonoma Water gives it the authority to produce and furnish surface water and groundwater for beneficial uses, control floodwater, generate electricity, and provide recreation in connection with its facilities. Legislation enacted in 1994 added the treatment, disposal, and reuse of wastewater to Sonoma Water's powers and duties.

The primary source of Sonoma Water's water supply is naturally-filtered water from the Russian River, the watershed to the north of Petaluma watershed. Water is conveyed via a transmission system of aqueducts and piping. Sonoma Water supplements Russian River supplies by operating three groundwater supply wells in the Santa Rosa Plain. Sonoma Water delivers over 40,356 acre feet (2016-2017) of drinking water to retail customers who serve more than 600,000 residents in portions of Sonoma and Marin counties.

Within the Petaluma River Watershed, Sonoma Water provides the majority of the urban potable water supplies to the City of Petaluma and the unincorporated community of Penngrove. Sonoma Water's transmission system brings potable water to the Petaluma River watershed via the Petaluma aqueduct.

City of Petaluma

In 1961, the City of Petaluma entered into an agreement with Sonoma Water to begin potable supply through the 16.5 mile Petaluma Aqueduct, a booster pumping plant, and a six million gallon reservoir near Lake Ralphine. The City of Petaluma's Department of Public Works and Utilities (PW&U) serves water to customers both within and outside the city's boundary, supplying approximately 61,798 customers and 19,739 municipal connections (City of Petaluma, 2015). The City of Petaluma also provides potable water service to Two Rock U.S. Coast Guard base.

The City of Petaluma does not rely on groundwater as a significant portion of supply due to specific yield and water quality limitations. The City intends to only use groundwater in the future as emergency backup. The City had consistent groundwater use from 2010-2015, with an increase in usage in 2015. In 2015, the City supplied approximately 5% of its annual demand using groundwater. This increase was the product of rehabilitated well sites and studies to determine actual production capabilities in the event of emergency use. In 2015, the City purchased approximately 7,303 AF from Sonoma Water, and obtained 375 AF from groundwater (City of Petaluma, 2015).

North Marin Water District

The North Marin Water District (NMWD) serves a small portion of the lower Petaluma River watershed, in addition to the Marin County community of Novato. NMWD receives the majority (~80%) of its water from Sonoma Water through the North Marin Aqueduct that transports water from Sonoma Water's Petaluma Aqueduct near the Kastania Tank in south Petaluma to Novato. The remainder of NMWD's water supply is from its local water supply from Stafford

Lake and a modest amount of recycled water developed in cooperation with Novato and Las Gallinas Valley Sanitary Districts (North Marin Water District, 2015).

Small Water Systems

In the upper watershed, the Penngrove Water Company serves the unincorporated community of Penngrove with surface water from Sonoma Water. Other small water systems in the Petaluma River watershed rely on groundwater to serve schools, agriculture, churches, parks and recreational facilities.

Recycled Water

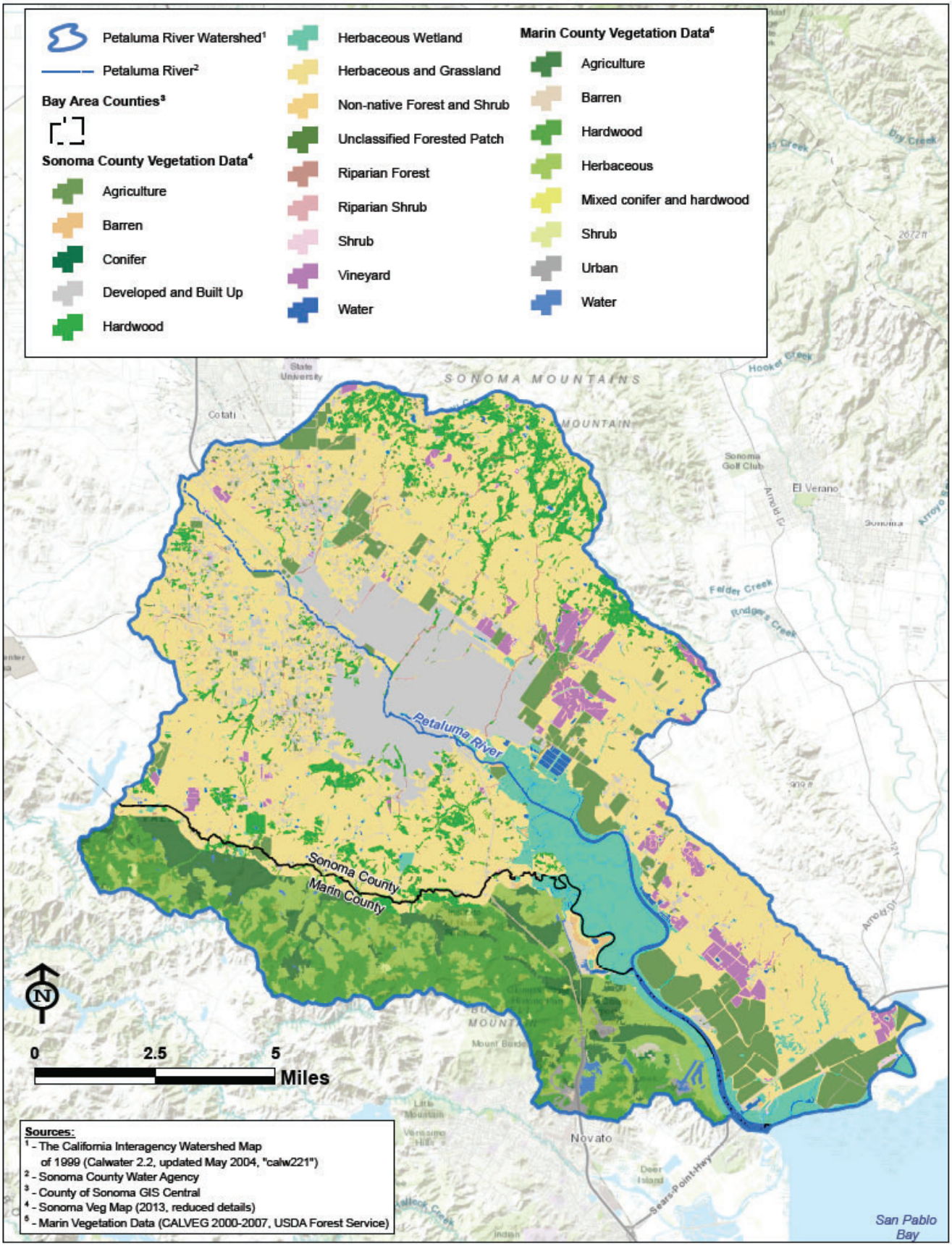
In 2009, the City of Petaluma opened the Ellis Creek Water Recycling Facility, a new facility to recycle wastewater, which can treat up to 6.7 million gallons per day (MGD). This plant replaced the old wastewater treatment plant, which had reached capacity. The Ellis Creek Water Recycling Facility currently treats about five million gallons of wastewater each day. The plant treats wastewater from parcels within the City of Petaluma and the community of Penngrove to a secondary and tertiary level. In the winter, highly treated wastewater is introduced back into the Petaluma River. During the summer, 100% of tertiary treated recycled water is introduced into the City of Petaluma's recycled water system and used for irrigation of agricultural lands, schools, parks, golf courses, and a vineyard.

2.1.5 Native Habitats

Habitats and Species

The Petaluma River watershed includes a diversity of native habitats, characterized by mixed evergreen forests, oak woodlands and savanna, grasslands, chaparral, brackish marsh, perennial and seasonal wetlands, and riparian scrub and woodland (Figure 5). The majority of native habitat and undeveloped land exists on private property. Urban development occupies the valley floor along US 101 and Highway 116, with cities separated and generally surrounded by grazing lands and agricultural uses—primarily vineyards, dryland crops and irrigated pasture. Major vegetation communities in the watershed include herbaceous wetland, herbaceous grassland and hardwood.

Numerous special status invertebrate, fish, amphibian, reptile, bird, mammal and plant species are known to occur within the Petaluma River watershed. Among those are the California red-legged frog, California freshwater shrimp, steelhead trout, chinook salmon, Ridgway's rail, and salt marsh harvest mouse (Figure 6). In addition to special status species, the watershed supports an array of resident native and migratory species. Sonoma County lies within the Pacific Coast flyway and the Petaluma River watershed includes stopover habitat for migratory birds. Resident species include the San Pablo Song Sparrow and California Black Rail. Exceptionally large numbers of migrant and wintering waterfowl occur here, particularly Canvasback. Other waterfowl that occur in exceptional numbers include Northern Shoveler, Ruddy Duck, Bufflehead, and Greater Scaup.

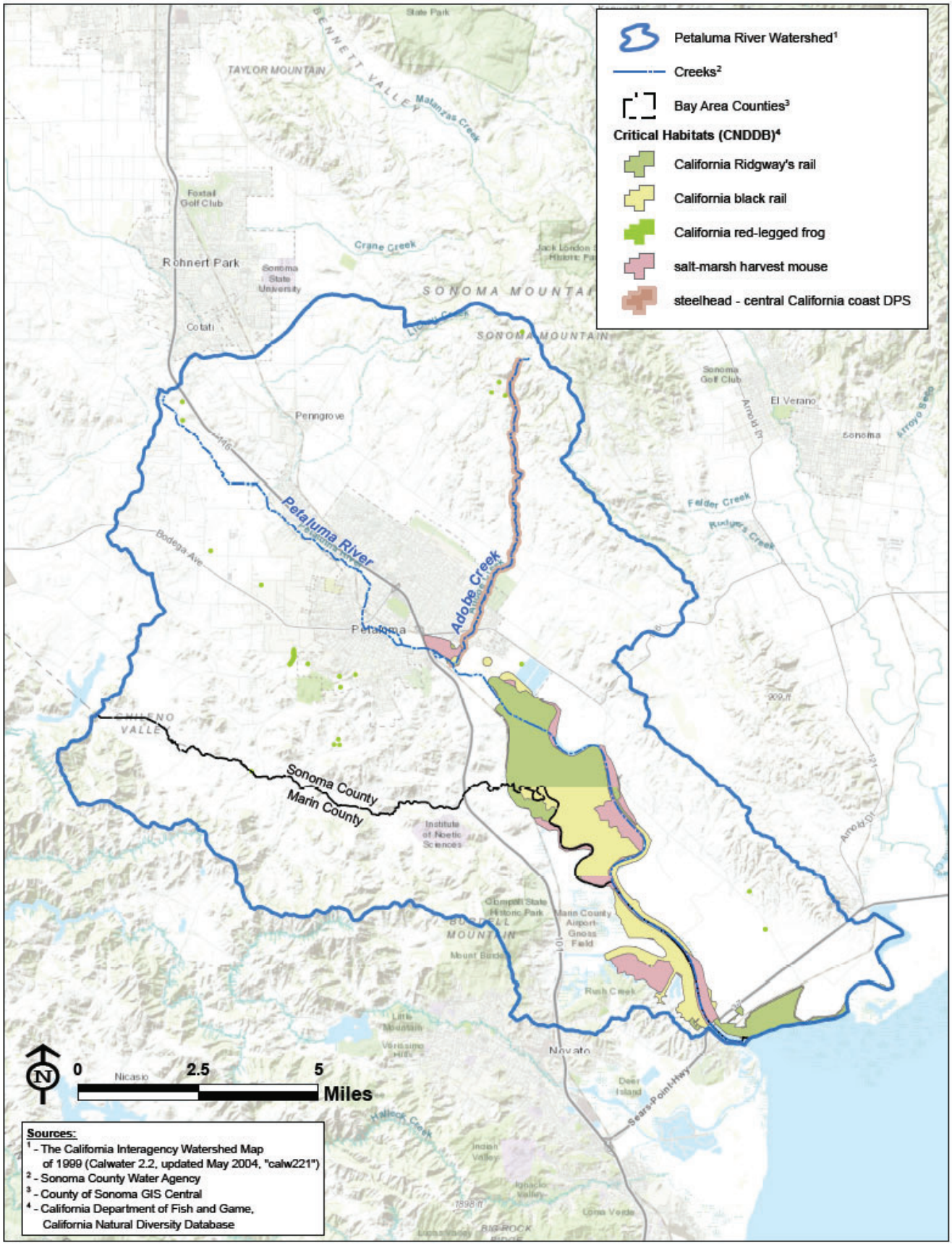


SOURCE: SCWA

Southern Sonoma SWRP

Figure 5

Petaluma River Watershed Vegetation



SOURCE: SCWA

Southern Sonoma SWRP

Figure 6

Petaluma River Watershed
Critical Habitats

ESA Sonoma Water SWGP STORM WATER GRANT PROGRAM

Managed Habitat and Protected Open Space

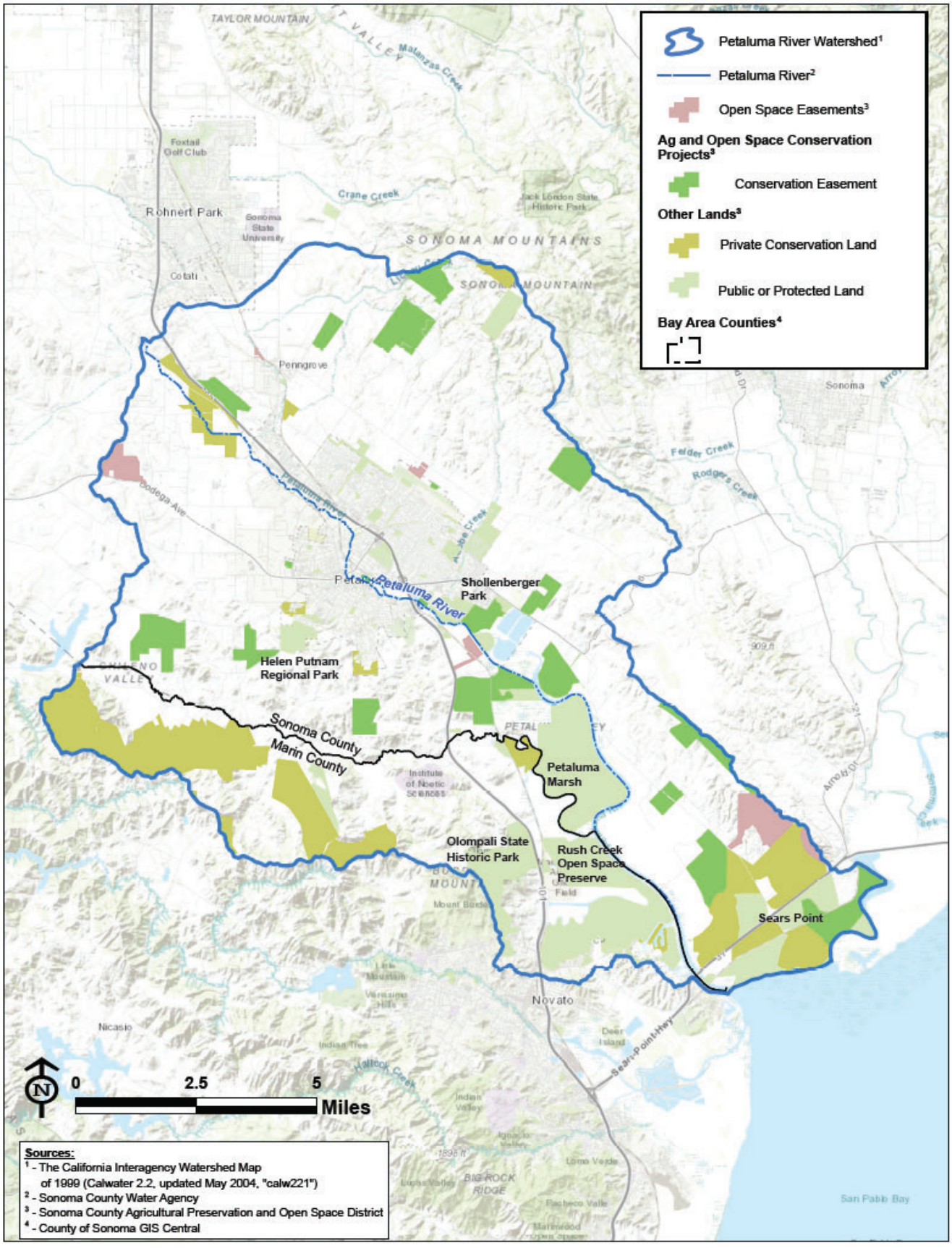
The California Department of Fish and Wildlife (CDFW) manages the approximately 4,200-acre Petaluma Marsh Wildlife Area, which is comprised of multiple units and includes tidal salt marsh, mudflats, coastal oak woodlands, and coastal scrub habitat. The Petaluma River unit is the largest remaining natural tidal brackish marsh in California. The Wildlife Area is located approximately six miles southeast of the City of Petaluma and is situated between the Petaluma River to the east, Highway 37 to the south, and US 101 to the west.

The 522-acre Rush Creek Open Space Preserve, located north of Novato, is managed by Marin County Parks and CDFW. The Preserve is noted as one of the best birding locations in the North Bay and offers unimpeded views of large expanse of tidal wetland and abundant wildlife in ridge and wetland areas.

The San Pablo Bay National Wildlife Refuge, managed by the US Fish and Wildlife Service, lies along the north shore of San Pablo Bay in Sonoma, Solano, and Napa Counties. The Refuge includes open bay/tidal marsh, mud flats, and seasonal and managed wetland habitats. The Sonoma Land Trust owns and manages nearly 1,400 acres adjacent to San Pablo Bay which includes grassland, seasonal wetland and riparian habitats. Most of this acreage is also in agriculture, primarily ranching, with some 200 acres farmed. Sonoma Land Trust also holds an agricultural easement over an additional 528 acres in this region. The easement is farmed.

Sonoma County Ag + Open Space has numerous conservation easements on agricultural properties in the watershed as well as multiple easements over public land within the City of Petaluma, including the McNear Peninsula and Paula Lane Open Space Preserve. Protected lands provide habitat to numerous endangered species, oak woodlands, headlands to tributary watersheds, and tidal marshland.

Other important open space land in the watershed includes: Helen Putnam Regional Park and Tolay Lake Regional Park, the Burdell Ranch (CDFW), Petaluma Adobe State Historic Park and Olompali State Historic Park (both owned by California Department of Parks and Recreation), Schollenberger Park, Lafferty Ranch, Alman Marsh, the Bay Area Ridge Trail, and the Petaluma River Marina (City of Petaluma). Protected lands and open spaces in the Petaluma watershed can be seen in Figure 7.



SOURCE: SCWA

Southern Sonoma SWRP

Figure 7

Petaluma River Watershed
Managed Habitat and Open Space

2.1.6 Watershed Processes

Historic land use within the Petaluma River watershed has altered much of the landscape, including the plant communities and wildlife dependent upon them. Beginning in the mid-nineteenth century and continuing into the present, activities such as livestock grazing, clearing and diking for agricultural production, road building, and urban and suburban development have markedly altered the natural communities. Native perennial grasslands have been largely replaced by non-native annual grasslands, and a number of highly invasive species now threaten the remaining grasslands. Fire suppression, livestock grazing, vineyard conversion, and, more recently, the effects of Sudden Oak Death have altered the extent of woodland and forest cover. Grazing and clearing for firewood and agricultural production have reduced the extent of oak woodland and savanna, and continue to affect oak regeneration. This is particularly prevalent on the valley floors and lower foothills, where croplands continue to be converted to urban and suburban uses today. Historic land uses continue to influence the aquatic habitat of the rivers and streams, and limit the viability of the anadromous fisheries. Urban and suburban development, freeway and highway widening projects, vineyard expansion and use of exclusionary fencing to protect crops have all contributed to fragmentation of the remaining natural areas.

Petaluma River watershed processes have been significantly impacted by land use changes that occurred with modern (past 200 years) European settlement, including alterations to the Petaluma River to increase flood conveyance and improve navigation, conversion of wetland to farmland, loss of seasonal wetlands and modifications to tributary streams.

Dredging and straightening of the Petaluma River: The Petaluma River, formerly known as Petaluma Creek, was first reshaped by the U.S. Army Corps of Engineers (USACE) in 1880 to a channel 50 feet wide and three feet deep at high tide. Sediment accumulation within the channel prompted reshaping by the USACE in 1931 to 100 feet wide and eight feet deep. In 1959, Petaluma Creek was designated as a river by H.R. 2191, an Act of Congress. Sediment accretion has also resulted in the conversion of hundreds of acres of intertidal channel and mudflat to vegetated marsh at the mouth of the Petaluma River and at False Bay. The USACE continues to dredge sections of the river to keep it navigable by gravel barges and pleasure craft. The most recent maintenance dredging of the channel occurred in 2003.

Conversion of tidal marsh land: Beginning in the late 19th century, thousands of acres of tidal marsh were diked and drained in an effort to reclaim lands for agricultural use. Construction of transportation corridors and industrial infrastructure further contributed to tidal wetland loss. Despite this substantial loss of tidal wetland habitats, the Petaluma Marsh remains the largest contiguous expanse of historical tidal marsh in San Pablo Bay. Restoration efforts in recent decades have begun to reverse the decline in tidal wetland extent.

Loss of seasonal wetlands: The large wet meadow that occupied much of the valley floor east of the Petaluma River has been almost completely eliminated, as have the vast majority of vernal pool complexes throughout the watershed. The Laguna de San Antonio wetland complex was ditched and drained in the late 19th century, though highly modified wetlands still occupy several hundred acres at the head of San Antonio Creek.

Alteration of tributary stream alignments: Many stream segments have been channelized and straightened to increase drainage efficiency and control flooding. Streams that were historically disconnected from the estuary or mainstem channel downstream have been lengthened, and today artificial channels convey flows and sediment further downstream than they did in the past. Portions of many tributaries – most notably lower San Antonio Creek – have also been realigned. In addition, thousands of feet of artificial channels have been constructed through diked baylands to facilitate drainage. These modifications have resulted in a 50% increase in channel length among higher order channels within alluvial areas (SFEI, 2018).

Although past influences have greatly altered the natural landscape, the Petaluma River watershed contains considerable undeveloped land and continues to provide important habitat for native plants and animals. These remaining undeveloped lands serve as core areas for habitat biodiversity, and maintaining connections between these areas is essential for their sustainability.

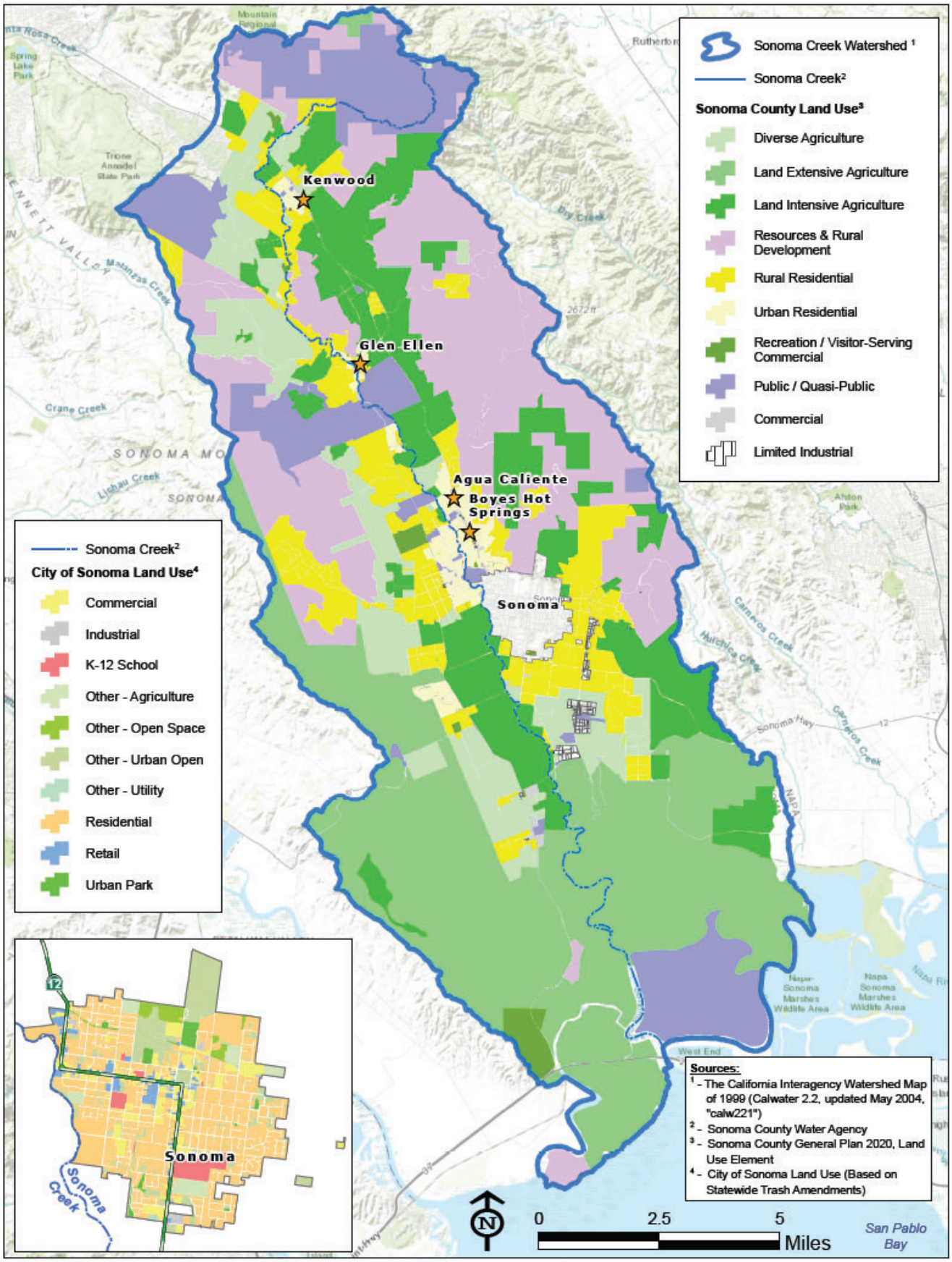
2.2 Sonoma Creek Watershed

2.2.1 Watershed Area, Communities, and Land Use

The Sonoma Creek watershed encompasses a 170-square mile, oval-shaped basin (Figure 8). The headwaters of Sonoma Creek lie in Sugarloaf Ridge State Park, 31 stream miles inland from San Pablo Bay. It is bounded on the east by the Mayacamas Mountains, on the west and north by the Sonoma Mountains. On the north, near Kenwood, a subtle divide separates the Sonoma Creek watershed from the Laguna de Santa Rosa watershed. Average annual rainfall in the watershed ranges from approximately 23 inches in the lower portions of the Sonoma Creek watershed to greater than 50 inches in the highest slopes of the Sonoma Mountains to the west and Mayacamas Mountains to the east. The watershed drains southward and discharges into San Pablo Bay.

Sonoma Creek flows past and through three populated areas supporting a total population of approximately 42,000 residents, including the unincorporated communities of Kenwood and Glen Ellen. Further downstream, Sonoma Creek flows through a more densely urbanized area, including Agua Caliente, Boyes Hot Springs and the City of Sonoma, which spans approximately 2.2 square miles. The City of Sonoma's population grew to 11,405 in 2017, and is projected to reach 11,916 in 2022 (Sonoma County EDB, 2018). The primary languages spoken include English and Spanish. With a combined population of 42,000, this area includes medium and high density residential land uses and significant commercial, urban park, and institutional land uses. 51% of the watershed is designated as agricultural land use, and 20% as resources and rural development. Tourism and agriculture are the major economic drivers for Sonoma Valley.

Archeological records indicate that the Sonoma Creek Watershed has been inhabited for at least 8,000 to 10,000 years and perhaps longer by ancestors of the Pomo, Miwok, and Wappo tribes. It is believed that the Sonoma Valley was occupied by the Coast Miwok people who actively managed the landscape. Two hundred years ago it was estimated that anywhere from 3,000 to 5,000 Native Americans were living in Sonoma Valley; however by 1823, General Vallejo had arrived and by 1840 most had died of the small pox epidemic or were taken to reservations in Mendocino (Sonoma RCD, 2013).



SOURCE: SCWA

Southern Sonoma SWRP

Figure 8

Sonoma Creek Watershed Communities and Land Use

ESA Sonoma Water SWGP STORM WATER GRANT PROGRAM

2.2.2 Water Quality Priorities

Sonoma Creek supports beneficial uses for cold freshwater habitat, warm freshwater habitat, contact and noncontact water recreation, fish migration, preservation of rare and endangered species, fish spawning, and wildlife habitat. Sonoma Creek is currently listed on the Clean Water Act 303(d) list of impaired water bodies for excess nutrients, sediment and pathogens. However, the SFBRWQCB approved at its 2014 meeting a proposal to delist Sonoma Creek for nutrients and to remove this water body from the EPA 303(d) list. The de-listing will be included in the Integrated Report submitted to the U.S. EPA for the 2018 listing cycle. TMDLs for sediment and pathogens have been established with compliance activities underway. Water quality priorities for the Sonoma Creek Watershed are described in further detail in Section 3.

2.2.3 Surface Water and Groundwater Resources

Surface Water

Sonoma Creek and its tributaries drain an area of about 170 square miles in southeast Sonoma County between the Mayacamas Mountains to the east and the Sonoma Mountains to the west (Figure 9). Sonoma Creek has its headwaters in Sugarloaf Ridge State Park north of Kenwood and flows through the valley through the City of Sonoma to an extensive tidal marsh before discharging into San Pablo Bay. This tidal marsh reach of Sonoma Creek provides substantial fish and wildlife habitat and is contiguous with other similar habitats in the northern part of the San Pablo Bay.

Upstream of the town of Glen Ellen, the mainstem of Sonoma Creek supports spawning and rearing habitat for steelhead trout. The upstream extent of this habitat is restricted by a waterfall in Sugarloaf Ridge State Park. Downstream of Glen Ellen, the creek serves as a migration corridor for steelhead, but is generally too warm in the summer for successful rearing; fish in this area are primarily native warmwater species. From the upper extent of tidal influence near Highway 121 upstream to near Kenwood, Sonoma Creek supports a population of the endangered California freshwater shrimp. Major tributaries to Sonoma Creek include Calabazas Creek, Carriger Creek, Nathanson Creek, Fryer Creek and Rodgers Creek.

The lower portion of the watershed flows through a large alluvial fan formed from the very large amounts of sediment that flow from Sonoma Mountain to the west. In the southeastern portion of the lower watershed, Schell Creek empties 19 square miles of land and joins Sonoma Creek within the zone of tidal influence.

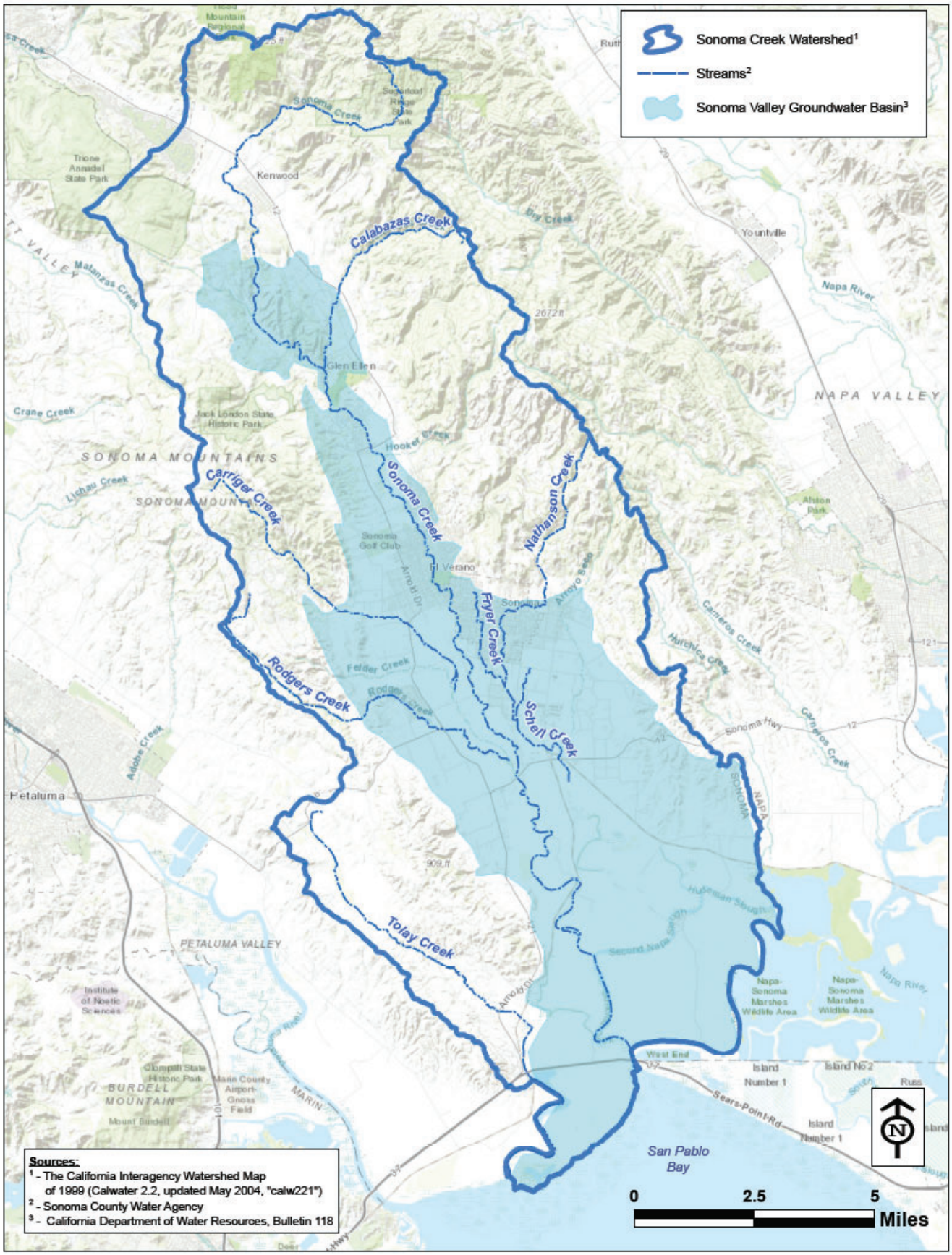
Tolay Creek is a third-order channel that flows for 12.5 miles to Sonoma Creek and is connected to numerous tributaries from both the west and east ridges of the Tolay Valley. The banks and historic floodplains of the creek support intermittent riparian woodland and herbaceous riparian species. Tolay Creek is connected to Tolay Lake, once the largest freshwater lake in Sonoma County (Sonoma County Regional Parks, 2017).

Groundwater Resources

Within the watershed, groundwater in the mountains flows towards lower elevations, following the dips of geologic units toward the valley's center (Figure 9). The Eastside Fault serves as a conduit for the upward circulation of deeper thermal waters in the area and may restrict groundwater flow. According to the Sonoma Valley Groundwater Management Plan, all of the Sonoma Valley geologic formations contain groundwater, but the water-bearing properties vary among the formations (SCWA, 2007). The most important water bearing formations overlay the Franciscan Complex basement rocks acting as a barrier to flow (USGS, 2006).

Declining groundwater levels (primarily observed in the deeper aquifers in the El Verano area and an area southeast of the City of Sonoma) indicate groundwater withdrawals in excess of recharge in the southern portion of the Sonoma Valley. The net loss of groundwater is due to a combination of increasing groundwater demands and declining levels of precipitation over the last few decades. These declining groundwater levels, which have fallen below sea level in areas, could exacerbate the intrusion of poor quality water (either from brackish water or geothermal fluids) into the deeper aquifers in these areas. Reversing the declining trends and recovering groundwater levels in the deeper aquifers is necessary to protect and preserve groundwater uses in these areas and will require a number of management actions over the coming years (SCWA, 2016).

The Sonoma Creek Watershed contains two DWR listed groundwater basins. The Kenwood Valley Groundwater Basin is located in the northern portion of the watershed and the Sonoma Valley Groundwater Subbasin in the central to southern portion. The Sonoma Valley Groundwater Basin was originally listed as medium priority by DWR, and was elevated to high priority in 2018. The Sonoma Valley Groundwater Sustainability Agency was formed in 2017 consistent with the implementation of the Sustainable Groundwater Management Act. Local stakeholders representing diverse groundwater users and interests continue to guide development and implementation of the Sonoma Valley Groundwater Sustainability Plan through a Board of Directors and an Advisory Committee.



SOURCE: SCWA

Southern Sonoma SWRP

Figure 9

Sonoma Creek Watershed
Surface Water and Groundwater Resources

ESA Sonoma Water SWGP STORM WATER GRANT PROGRAM

2.2.4 Potable and Recycled Water Supplies

Approximately 59% of water demands in the Sonoma Valley are met by local groundwater, 7% by recycled water, 8% by local surface water, and 26% by imported water (from the Russian River). The general types of water demands by use in Sonoma Valley consist of: agricultural irrigation (an estimated 7,800 AF); rural domestic users, including rural private and mutual water systems (an estimated 3,500 AF); municipal and commercial users including residences and businesses served by the City of Sonoma and Valley of the Moon Water District and private water systems (an estimated 5,900 AF); and irrigated golf courses and parks (an estimated 700 AF) (SCWA, 2014). A summary of the potable and recycled water supplies for the Sonoma Creek watershed is included in Table 2 below and additional details are provided in the following sections. Figure 10 shows the services areas of the Sonoma Creek providers.

TABLE 2
SONOMA CREEK WATERSHED POTABLE AND RECYCLED WATER SUPPLIES

Supplier	Volume of Potable Water Supplied (AFY)	Volume of Recycled Water Supplied (AFY)
Valley of the Moon Water District	2529[1]	
City of Sonoma	1762[2]	
Kenwood Mutual Water Company	4[3]	
Lawndale Mutual Water Company	62[3]	
Sonoma Valley County Sanitation District		2024

NOTES:

1 Volume provided by the 2015 Valley of the Moon Urban Water Management Plan

2 Volume provided by the 2015 City of Sonoma Urban Water Management Plan (Does not include recycled water)

3 Volume provided by the 2015 SCWA Urban Water Management Plan

Sonoma County Water Agency

As presented in the Petaluma River watershed sections, Sonoma Water (Sonoma Water) is a special district providing wholesale water supply to several cities and water districts (nine primary water contractors) in Sonoma and Marin counties. Within the Sonoma Creek watershed, Sonoma Water provides the majority of the urban potable water supplies to the City of Sonoma and Valley of the Moon Water District. Sonoma Water's transmission system brings potable water to the Sonoma Creek watershed via the Sonoma aqueduct.

Valley of the Moon Water District

The Valley of the Moon Water District (VOMWD) service area extends from the Trinity Oaks Subdivision, located just north of the town of Glen Ellen, to the Temple Subdivision located at the southern end of the Sonoma Valley, which is a span of over nine miles and encompasses a total area of approximately 7,545 acres. As of 2015, VOMWD provided potable water to approximately 23,782 residents with 6,884 service connections. VOMWD receives most of its water supply from Sonoma Water's Sonoma aqueduct. VOMWD also maintains a local source of supply, consisting of seven municipal production wells, five of which are active. In 2015,

VOMWD purchased approximately 1,947 acre-feet (AF) of water from Sonoma Water, and obtained 581 AF from groundwater (VOMWD, 2015).

City of Sonoma

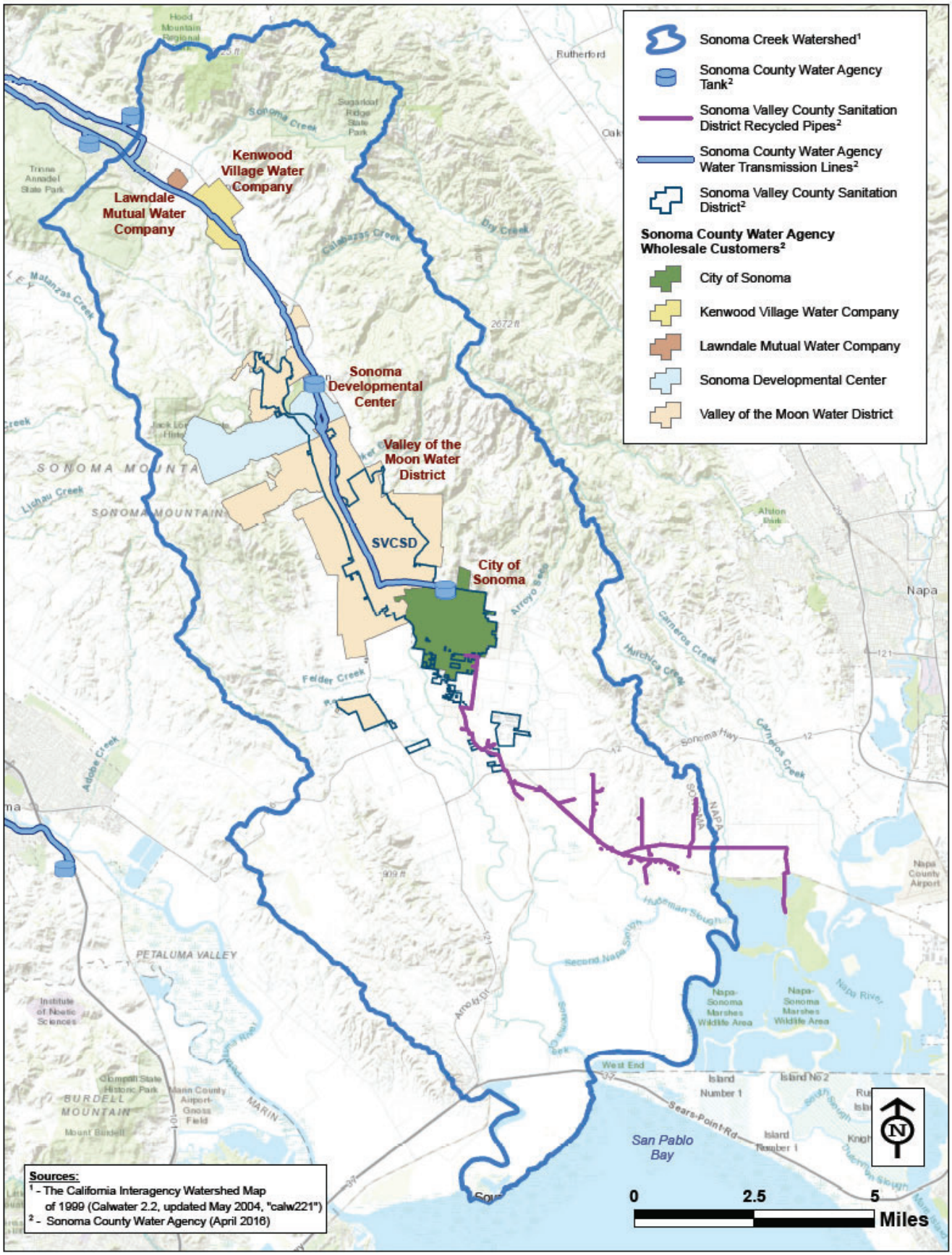
The City of Sonoma provides potable water to a population of approximately 11,150 residents (2015), with 4,358 service connections. Distribution facilities owned by the City of Sonoma include four storage tanks, two booster pump stations, and water mains and appurtenances for delivering water to residents within the City's service area. The City receives most of its potable water supply from Sonoma Water's Sonoma aqueduct, and pulls from two storage tanks near First Street West where the aqueduct terminates. As a supplement to Sonoma Water supply, the City has six deep wells connected to its distribution system. In a normal water year, approximately 10% of the City's supply is from local groundwater. In 2015, the City purchased approximately 1,588 AF of water from Sonoma Water, and obtained 174 AF from groundwater (City of Sonoma, 2015).

Small Water Systems

The majority of the mutual water companies rely solely on groundwater, although some, including Kenwood Village Water Company and Lawndale Mutual Water Company in the upper watershed, also receive surface water supplies from urban providers. In case of emergencies, Sonoma Developmental Center maintains connections to the Valley of the Moon Water District and Sonoma Water's Sonoma Aqueduct. Small water supply systems throughout the Sonoma Creek watershed rely on groundwater for supply to apartments and mobile homes, wineries and vineyards, wine tasting rooms, hotels, restaurants, schools, churches, camps, parks and recreational facilities, warehouses and factories.

Recycled Water

Sonoma Water manages and operates the wastewater collection system, wastewater treatment facility, and treated effluent storage and disposal facilities owned by the Sonoma Valley County Sanitation District (SVCSD). The SVCSD service area covers approximately 4,500 acres and includes the City of Sonoma and the unincorporated areas of Agua Caliente, Boyes Hot Springs, Eldridge, Fetters Hot Springs, Glen Ellen, Schellville, Temelec, and Vineburg. The wastewater collection system conveys water south to the wastewater treatment facility in Schellville. The SVCSD plant treats wastewater from approximately 17,027 equivalent single-family dwellings to a tertiary level. In 2015, the SVCSD treatment plant effluent totaled 2,378 AF, of which 2,024 acre-feet (85%) was reused. Vineyard irrigation accounted for approximately 61% and pasture irrigation approximately 26% of the total recycled water used in 2015. The remaining 13% was used in the SVCSD Hudeman Slough and restoration activities in the Napa Sonoma Salt Marshes (SCWA, 2015).



SOURCE: SCWA

Southern Sonoma SWRP

Figure 10

Sonoma Creek Watershed
Potable and Recycled Water Supplies

ESA Sonoma Water SWGP STORM WATER GRANT PROGRAM

2.2.5 Native Habitats

Habitats and Species

The Sonoma Creek watershed includes a diversity of native habitats, including mixed evergreen forests, oak woodlands and savanna, grasslands, chaparral, brackish marsh, perennial and seasonal wetlands, and riparian scrub and woodland (Figure 11). The majority of native habitat and undeveloped land exists on private property. Urban development occupies the valley floors along Highways 121 and 12, with cities separated and generally surrounded by grazing lands and agricultural uses—primarily vineyards, dryland crops, and irrigated pasture. Major land cover types in the watershed include herbaceous wetland, hardwood and conifer forest, herbaceous grassland and vineyard agriculture. Developed land (residential, industrial, agricultural or commercial) accounts for approximately 15% of the watershed.

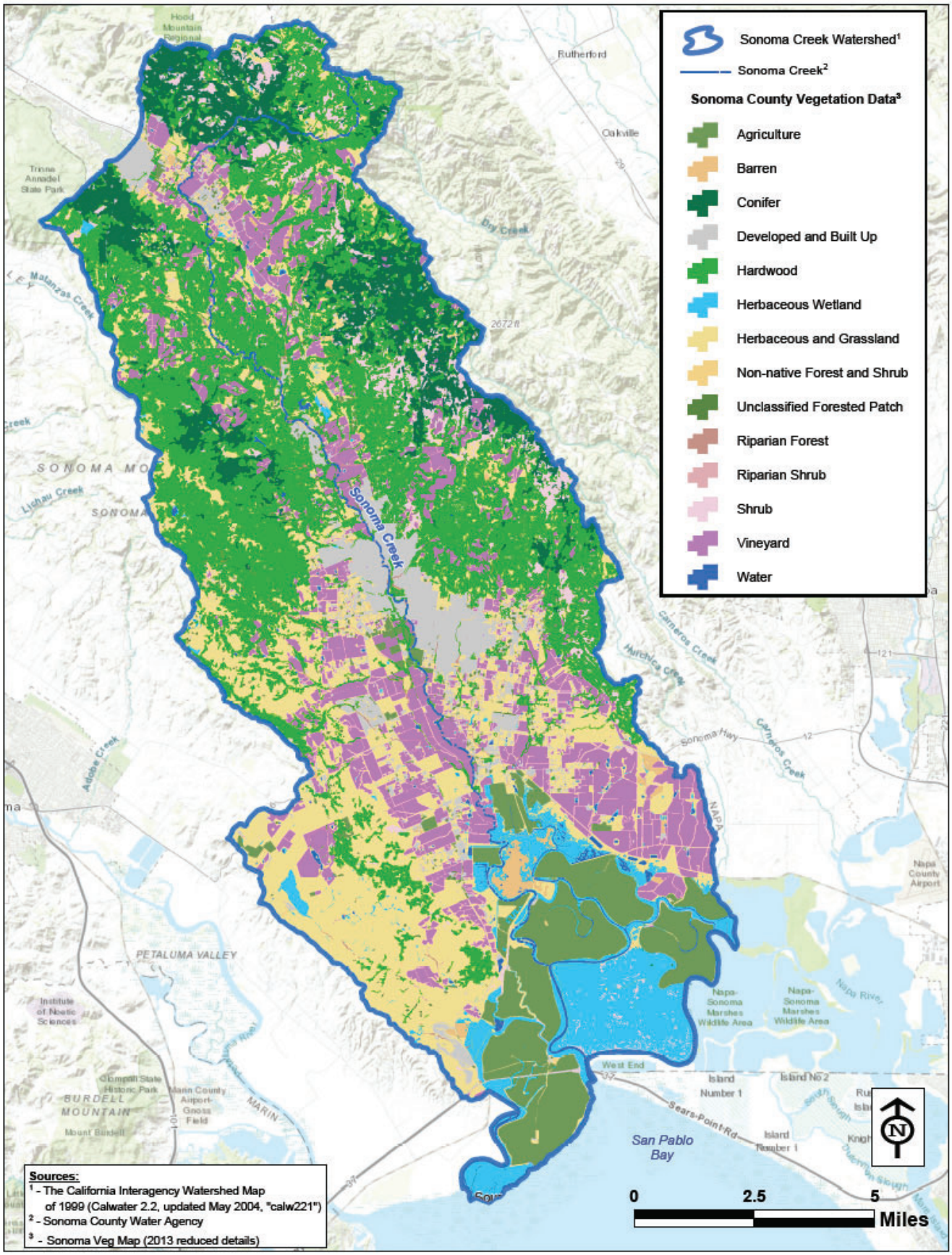
Diked baylands, south of Schellville, are primarily farmed for hay with some acreage in vineyard. These lands are non-irrigated with some lands providing pasture for grazing dairy livestock as well as hay for livestock feed.

Numerous special status invertebrate, fish, amphibian/reptile, bird mammal and plant species are known to occur within the Sonoma Creek watersheds, such as California red-legged frog, California freshwater shrimp, steelhead trout, chinook salmon, Ridgeway's Rail, and salt marsh harvest mouse (Figure 12). In addition to special status species, both watersheds support an array of resident native and migratory species. Sonoma County lies within the Pacific Coast flyway, and the Sonoma Creek watershed includes stopover habitat for migratory birds. Resident species include the San Pablo Song Sparrow and California Black Rail. Exceptionally large numbers of migrant and wintering waterfowl occur here, particularly Canvasback. Other waterfowl that occur in exceptional numbers include Northern Shoveler, Ruddy Duck, Bufflehead, and Greater Scaup.

Managed Habitat and Protected Open Space

Sonoma Creek Watershed is predominantly rural and has significant acreage in working and natural lands. Figure 13 depicts lands protected for open space and natural resource values as well as for parks and recreation. The City of Sonoma owns over 95 acres of public parks and preserves that comprise roughly 10% of the acreage within the City's Urban Growth Boundary. In the unincorporated communities of Kenwood and Glen Ellen, small community parks and the larger Sonoma Valley Regional Park provide public access to recreation and open space maintained by the County.

Sonoma County Ag + Open Space's largest publicly-accessible parcels include the 1,290 acre Calabazas Creek Open Space Preserve and the 162-acre Van Hoosear Wildflower Preserve. The Johnson and Lawson properties in the upper watershed provide a 547-acre expansion to the nearly 2,000 acre Hood Mountain Regional Park. Additional open space within City limits include the Nathanson Preserve, the Sonoma Garden Park and the Maxwell Farm Regional Park. The City manages the 98 acre Montini Open Space Preserve.



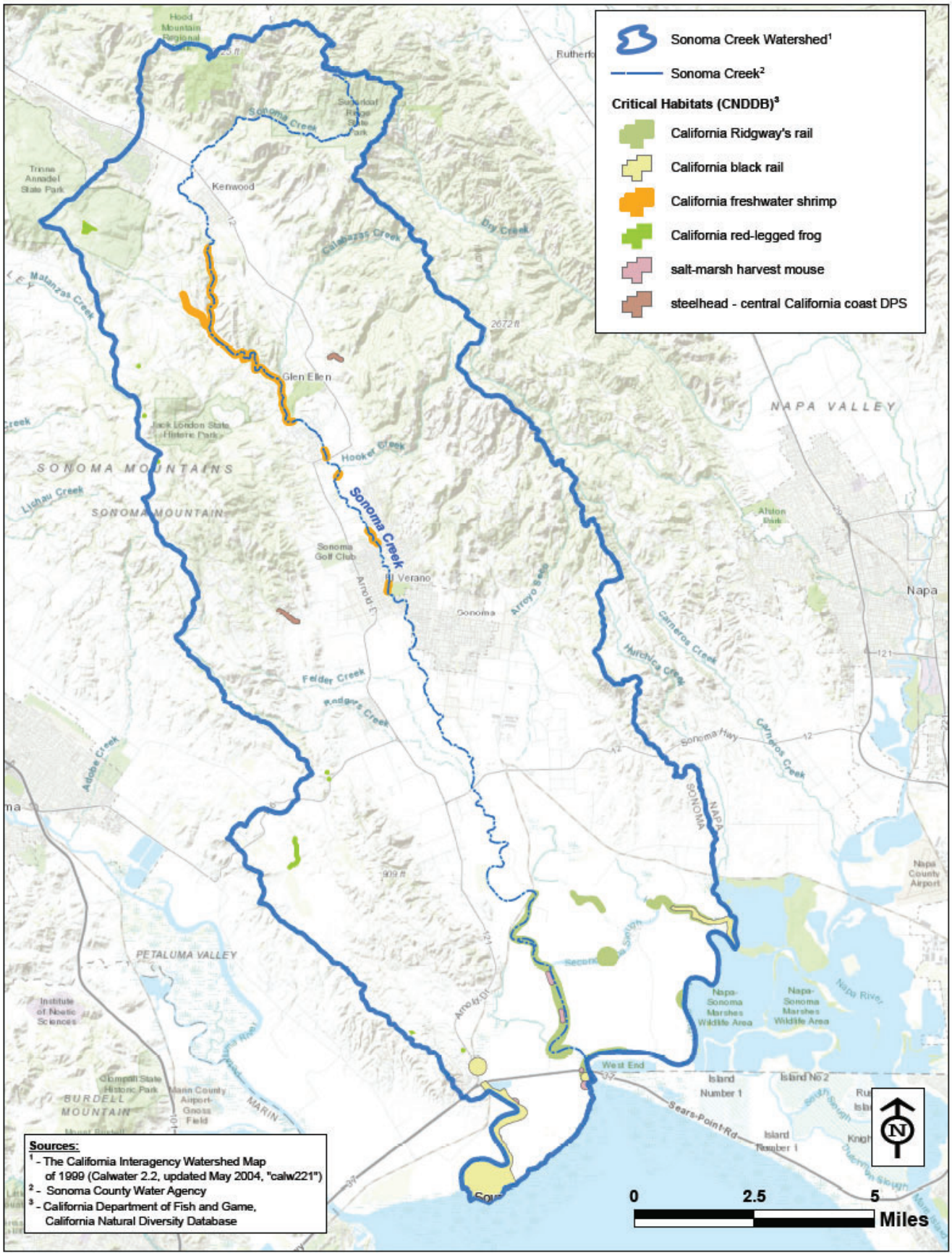
SOURCE: SCWA

Southern Sonoma SWRP

Figure 11

Sonoma Creek Watershed Vegetation

ESA Sonoma Water SWGP STORM WATER GRANT PROGRAM



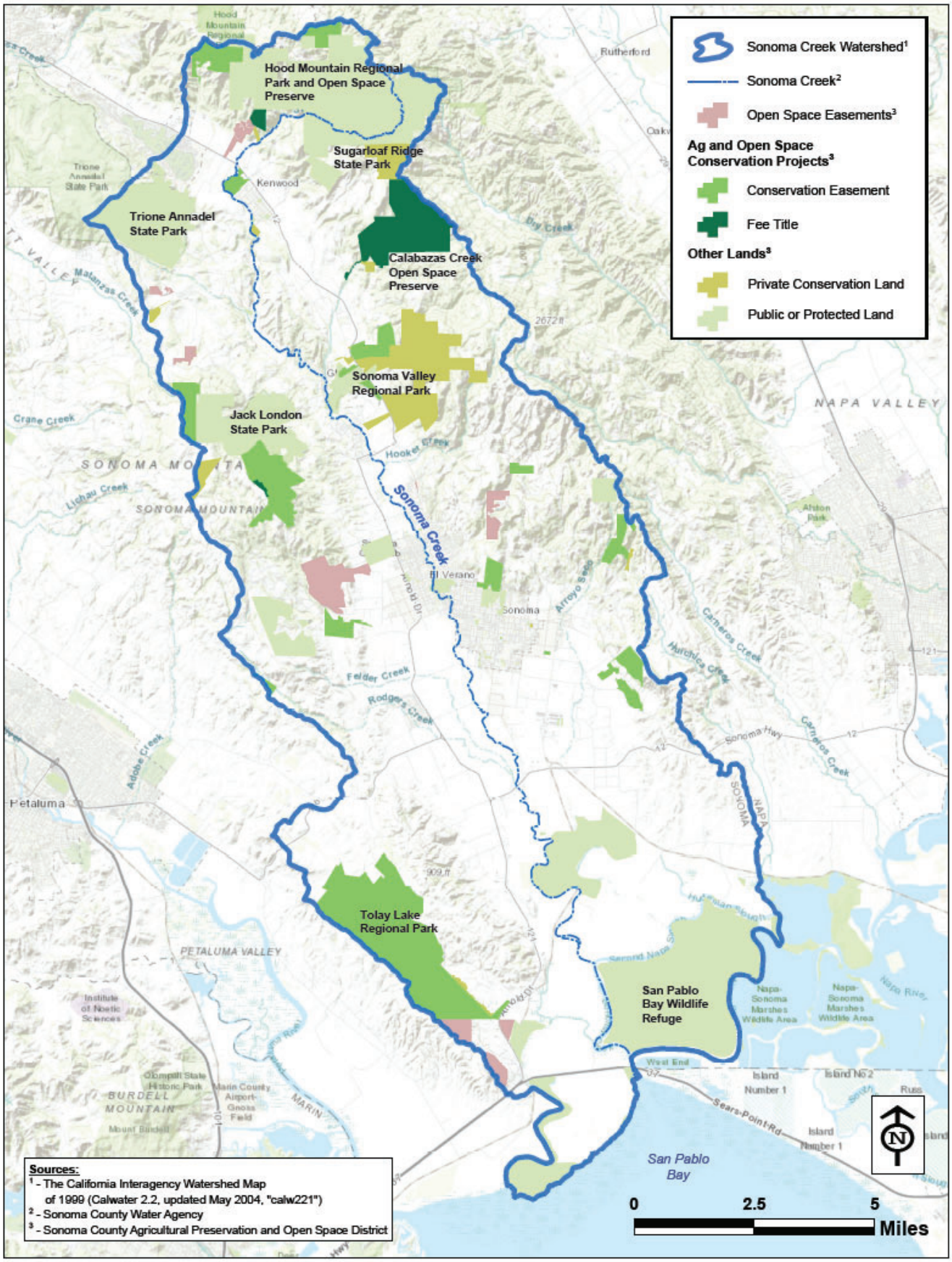
SOURCE: SCWA

Southern Sonoma SWRP

Figure 12

Sonoma Creek Watershed
Critical Habitats

ESA Sonoma Water SWGP STORM WATER GRANT PROGRAM



SOURCE: SCWA

Southern Sonoma SWRP

Figure 13

Sonoma Creek Watershed
Protected Lands and Open Space

ESA Sonoma Water SWGP STORM WATER GRANT PROGRAM

Sonoma Land Trust owns and manages the Glen Oaks Ranch, a 234-acre anchor preserve located in the Valley of the Moon, near Glen Ellen. The valley oaks are among the finest stands in the Sonoma Valley. The Land Trust was integral in 2013 in protecting the 1,092-acre Haire Ranch on Skaggs Island along Highway 37, which was transferred to the US Fish & Wildlife Service for marsh habitat restoration. The Land Trust holds numerous conservation easements on key properties in the watershed protecting viewsheds and open space for community and natural resource values. These conservation easements protect biodiversity and critical wildlife corridors and restore historic steelhead fish runs.

One of the largest State parks within the watershed is the 3,900-acre Sugarloaf Ridge State Park, which also contains the headwaters of Sonoma Creek in the Mayacamas Mountains near Kenwood. California State Parks also own and maintain Sonoma State Historic Park within the City limits, as well as the Jack London Ranch State Park. In the upper watershed just outside of Glen Ellen, the California Department of Developmental Services owns the 860-acre property that is home to the Sonoma Development Center (SDC). The property includes two reservoirs and a vitally-important five-mile riparian habitat corridor that links to an 85-mile wildlife corridor stretching from Lake County to Marin County.

Sonoma County Regional Parks within the watershed include Sonoma Valley Regional Park, Maxwell Farms, Hood Mountain Regional Park and Open Space Preserve, and Tolay Lake Regional Park. The Tolay Lake Regional Park illustrates a long presence of Native American cultural history throughout the landscape that includes 1,769 acres of ecologically and historically rich lands. The preservation of such areas has been vital to the community, cultural histories, and natural resources that support a number of threatened species. The land has been identified as a historic spiritual center for Native Americans across California and is considered by the Federated Indians of Graton Rancheria as an area of spiritual significance (Sonoma RCD, 2015).

In the southernmost portion of the watershed, the 19,000- acre San Pablo Bay National Wildlife Refuge hosts millions of migratory shorebirds, provides wintering habitat for the largest population of canvasbacks on the west coast, and protects the largest remaining contiguous patch of pickleweed-dominated tidal marsh found in the northern San Francisco Bay. The Refuge extends from the mouth of the Petaluma River, to Tolay Creek, Sonoma Creek, and ending at Mare Island.

2.2.6 Watershed Processes

Similar to the Petaluma River watershed processes, Sonoma Valley watershed processes have been altered significantly by modern land use changes, including straightening of channels to increase flood conveyance and improve navigation, loss of seasonal wetlands, conversion of wetland to farmland, and modifications to tributary streams.

Straightening of Channels: Historical evidence shows a straightening of Sonoma Creek where it previously meandered, resulting in a decrease in channel length and thus a consequent increase in slope. Similarly, several tributaries show a decrease in length of their lower reaches (possibly due to ditching) that changed their confluences with Sonoma Creek from nearly parallel to

perpendicular. Channel straightening increases the speed of water in the channel, resulting in less infiltration, greater quantities of flow and sediment being delivered downstream, and increased channel incision and erosion contributing to the sediment load.

Draining of Freshwater Marshes: Historically-significant areas of perennial freshwater marsh existed at several sites, particularly the Kenwood Marsh complex, covering approximately 400 acres, as well as of smaller marshes and ponds throughout the valley. Historical evidence for seasonal wetlands strongly suggests that these covered 20% or more of the valley floor. About 95% of these wetlands were drained for agriculture and development in the late 19th and early 20th centuries. Some marshes were converted to freshwater farm ponds. The conversion has had the effect of speeding up delivery of water and sediment to Sonoma Creek and decreasing the recharge of groundwater.

Baylands Conversion: The lower end of the watershed originally supported 15,000 acres of tidal marsh connected by an intricate network of sloughs. Beginning with hand labor, which was soon replaced by steam dredges, 90% of the baylands were converted to agricultural lands through a series of massive levee building projects that were completed about 1935. Reclamation has effectively decreased flood storage capacity in the lower watershed and increased sedimentation in the lower reaches of Sonoma Creek.

Alteration of Tributary Stream Connectivity: Prior to U.S. colonization, roughly 20% of the tributaries throughout the watershed did not appear, on maps, to have a direct connection to the main stem of Sonoma Creek. During the dry season, their waters descended to the valley floor and sank into their alluvial fans. Under winter flood conditions, these streams probably spread out in sheet flows, at times covering large areas of the valley floor. By 1875, due to a variety of factors associated with settlement and the introduction of European-style agriculture, all tributaries had direct connections from their headwaters to the confluence with Sonoma Creek. These direct connections increased the speed and quantity of storm water and sediment delivered to the Sonoma Creek main stem and decreased groundwater recharge on the valley floor.

2.3 Climate Change Hazards and Management Challenges for Southern Sonoma

The material in this section is summarized from *Climate Ready Sonoma County: Climate Hazards and Vulnerabilities* report prepared by North Bay Climate Adaptation Initiative (NBCAI) for RCPA (Cornwall et al. 2014), and from the various reports of the *Climate Ready North Bay* project (Micheli et al. 2016).

More Frequent and Intense Droughts: Whether Sonoma County experiences more or less rainfall in the future, it will likely be drier overall because warmer temperatures increase evapotranspiration (the loss of water from plants and soil into the air) even under wetter scenarios. Climatic water deficit (CWD) is a measure of drought stress, or the extent to which plants' need for water exceeds the moisture available in the soil. The Plan area CWDs are projected to increase an average of 7% by mid-century and an average of 12% by the end of the

century. An increased CWD may make vegetation more susceptible to fire and disease issues, while causing some forest plant communities to transition to scrub and chaparral. Fog could potentially offset these CWD rises, but because future fog patterns are so uncertain, its influence on future climatic water deficit is also uncertain." (Micheli et al., 2016b) Even greater increases in CWD are projected in the warmer south and southeastern portions of the county.

Management Challenges: Integrate the management of water for sustainability, on a watershed basis, to assure plentiful water for all uses, reduce water waste, support the natural water system's many benefits, and protect sensitive species and habitats. "One Water" (a phrase used by some water utilities) sums up the intent: it's all the same water. "Slow it, spread it, sink it, save it" is a phrase coined by Brock Dolman at OAEC. It means to capture and store excess storm water and flood water in the ground by increasing the capacity of watersheds, stream corridors, floodplains, and wetlands to catch and infiltrate rain and runoff. This approach is also called "green infrastructure." Generally, it involves efforts to protect, expand, and enhance the natural water supply system, including wetlands, upper watersheds, groundwater recharge areas, streamside areas, and flood-prone areas, with the result of spending less on "hard" engineering approaches for water supply and treatment, and flood control.

Safeguard groundwater as the water source that is least variable under future climate scenarios, and with proper management, highly reliable year-to-year. Invest in empirical data collection to map areas of more-rapid groundwater recharge. Protect these areas from compaction, construction, and paving. Protect the ability of riparian and floodplain areas to infiltrate rain and runoff. Control excessive groundwater pumping. Manage groundwater as a shared resource. Stable levels of groundwater are a protection against saline intrusion.

Increased Risk of Extreme Floods: The climate scenarios project increased seasonal variability of precipitation, runoff, and stream flows for Sonoma County, along with increased likelihood of "extreme" precipitation and drought events that were rare or unprecedented in the historic past. However, the precise risk of flood events is difficult to predict. Much of Sonoma County's wintertime precipitation comes in the form of "atmospheric rivers" from the Pacific Ocean. An atmospheric river is a relatively narrow ribbon of moisture in the atmosphere with ample moisture and strong winds. These atmospheric phenomena can produce very high precipitation in relatively focused areas. The amount and intensity of precipitation therefore depends greatly on where these atmospheric rivers make landfall. Under climate change projections for California, the average intensity of a typical atmospheric river does not increase, but there may be more years with more frequent storm events and occasional events that are much stronger than historical ones. Moreover, the length of the season over which storm events may occur is predicted to increase. These changes to the patterns of storm events may result in more frequent and more severe floods in Sonoma County.

Management Challenge: Maintain room for water and wildlife in wide buffers alongside streams and wetlands, allowing natural and floodable features to fully function. Building new structures in these areas should be avoided, and over time existing structures should be removed wherever possible. Locate and install detention basins where appropriate to detain storm water and recharge groundwater.

More Frequent Coastal Flooding, Increased Erosion, and Saline Intrusion: Sea levels are projected to rise between 16.5 and 65.8 inches by the end of this century. Rising sea levels, combined with increased storm surge, will lead to more frequent inundation of low-lying areas, and flooding of homes, infrastructure, agricultural lands, and natural areas on the shores of San Pablo Bay and the ocean coast, with the greatest impact anticipated during winter storms. Additionally, saltwater intrusion underground will raise salinity levels to unacceptable levels for crop, animal and human uses. Many existing wells and uses will be impacted.

Management Challenges: Protect and expand large areas of connected tidal wetlands around the Bay, particularly near the mouths of major streams. This will be important to providing habitat for diverse species that rely on tidal marshes for critical periods in their life cycle, and maintaining a buffer for upland communities from sea level rise. Maintaining or increasing sediment delivery to marshes will be important for accretion to keep up with sea level rise. Sediment sources include the tidally-borne sediment as well as that derived from adjacent watersheds. Protecting connected upland watersheds to tidal wetlands now will allow for tidal marshes to move and migrate with sea level rise and for natural sediment delivery. (Goals Project, 2015).

Ensure adequate freshwater recharge in the aquifers to prevent saltwater intrusion from migrating further up from the bay, where it can negatively impact water supplies.

Elevate Highway 37 on a causeway, and remove or modify other barriers to tidal action.

3. WATER QUALITY COMPLIANCE

This section discusses the compliance of the SWRP with other water quality regulations for the Southern Sonoma SWRP planning area. Regulatory authorities exist on the federal, state, and regional levels for the protection of water quality in California. With regard to water quality management responsibilities, the USEPA is the federal agency pursuant to the Clean Water Act, and the SWRCB is the state agency pursuant to the Porter-Cologne Act. The SWRCB has also assumed delegated responsibility for many programs under the Clean Water Act, with oversight by EPA. The San Francisco Bay Regional Water Quality Control Board (SFRWQCB) implements water quality regulations throughout the planning area including the Sonoma Creek and Petaluma River watersheds.

SWRP Checklist Guidelines

- ☒ Plan identifies activities that generate or contribute to the pollution of storm water or dry weather runoff, or that impair the effective beneficial use of storm water or dry weather runoff.
- ☒ Plan describes how it is consistent with and assists in, compliance with total maximum daily load implementation plans and applicable national pollutant discharge elimination system permits.
- ☒ Plan identifies applicable permits and describes how it meets all applicable waste discharge permit requirements.

3.1 Applicable Permits and Plans

The purpose of the Clean Water Act is to protect and maintain the quality and integrity of the nation's waters by requiring states to develop and implement state water plans and policies. California implemented the Porter-Cologne Water Quality Control Act (Water Code Section 13000 et seq.) in 1969. The Porter-Cologne Act established the SWRCB and divided California into nine regions, each overseen by a RWQCB, such as the SFRWQCB. The Clean Water Act and the Porter-Cologne Act established several permits and plans, including the Water Quality Control Plans (Basin Plans) and the NPDES program, as discussed below.

3.1.1 Basin Plans and Impaired Water Bodies

The nine regional water quality control boards within the state are responsible for adoption and implementation of Basin Plans, issuance of waste discharge requirements, and performing other functions concerning water quality control within their respective regions, subject to SWRCB review or approval. According to State Water Code Section 13050, Basin Plans establish the beneficial uses of waters within a specified area, water quality objectives to protect those uses, and an implementation program for achieving the objectives. The Southern Sonoma SWRP incorporates the water quality objectives listed in the SFRWQCB Basin Plan.

Under Section 303(d) of the Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters. Impaired waters are waters that do not meet water quality standards identified in the Basin Plan for that region, even after point sources of

pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions establish a priority ranking for listed waters and develop TMDL action plans to improve water quality. TMDLs are generally described in Section 3.1.2 below.

3.1.2 Total Maximum Daily Loads

The Clean Water Act Section 303(d) requires states to identify water bodies – bays, rivers, streams, creeks, and coastal areas – that do not meet certain water quality standards and the pollutants that impair them. Where water quality standards are not being met, TMDLs are required to ensure the attainment of water quality standards. In California, TMDLs are established in the Regional Basin Plan subject to the requirements of the state Water Code Section 13242.

A TMDL is a quantitative assessment that examines pollutant-specific water quality problems, identifies sources of pollutants, defines how much of a pollutant a water body can receive and still meet water quality standards established to protect beneficial uses, and specifies actions to be implemented to achieve the load reductions needed to restore and protect receiving waters and their beneficial uses (Clean Estuary Partnership, 2004). The TMDL approach provides a framework for evaluating pollution control efforts and for coordination between federal, state, and local efforts to meet water quality standards. Following development of final TMDL project reports, RWQCB staff develop amendments to be considered for adoption into the region's basin plan (SFRWQCB, 2017a).

A TMDL project may consist of a single water body and pollutant, or a combination of multiple water bodies and pollutant listings to restore impaired water bodies. Within the San Francisco Bay Region, the 2010 303(d) list included more than 270 listings in 88 water bodies. Water Board staff are currently developing more than 30 TMDLs to address more than 160 of these listings for water bodies impaired by specific pollutants (SFRWQCB, 2017b).

Table 3 below lists the TMDLs that have been adopted, are pending, or are under development by the SFRWQCB within the Southern Sonoma SWRP planning area, along with their adoption date. These TMDLs are described in Section 3.2.

TABLE 3
TMDLS ADOPTED AND IN DEVELOPMENT FOR THE SOUTHERN SONOMA SWRP PLANNING AREA

Adopted TMDLs	Adoption Date
Sonoma Creek Pathogens	June 14, 2006
Sonoma Creek Sediment [a]	December 12, 2008
San Francisco Bay Diazinon and Pesticide-Related Toxicity in Urban Creeks	December 12, 2008
San Francisco Bay Mercury	November 7, 2007
San Francisco Bay PCBs	October 20, 2009
Pending Delisting	**Anticipated Date**
Sonoma Creek Nutrients	2020

TABLE 3 (CONTINUED)
TMDLS ADOPTED AND IN DEVELOPMENT FOR THE SOUTHERN SONOMA SWRP PLANNING AREA

In Development	Anticipated Release
Petaluma River Bacteria	Fall 2018
Petaluma River Sediment (non-tidal)	2019
Petaluma River Nickel (tidal)	2019

NOTES:

[a] Sonoma Creek was segmented into sub-waterbodies during 2016, including a tidal and non-tidal reach. The sediment TMDL now only applies to the non-tidal segment of Sonoma Creek.

SOURCE: SFRWQCB, 2017a

3.1.3 National Pollutant Discharge Elimination System Permits

In 1972, the Clean Water Act was amended to state that discharge of pollutants to waters of the United States from any point source is unlawful unless the discharge is in compliance with a NPDES permit. General permits establish essential regulatory requirements for a broad range of activities related to storm water and wastewater management. NPDES permits pertaining to storm water within the Southern Sonoma SWRP planning area include the Construction General Permit, the Industrial General Permit, and the MS4 Permit. These permits are described in more detail below.

Construction General Permit

The Construction General Permit regulates storm water discharges associated with construction projects that disturb one or more acres of soil, or construction projects that disturb less than one acre but are part of a larger common plan of development that in total disturbs more than one acre. Construction projects that meet these criteria are required to obtain coverage under the Construction General Permit (2009-0009-DWQ as amended by 2010-0014-DWQ and 2012-0006-DWQ). Compliance with the Construction General Permit requires the preparation and implementation of a project-specific Storm Water Pollution Prevention Plan (SWPPP) by a Qualified SWPPP Developer.

The SWPPP is intended to prevent storm water pollution from construction sites. It generally includes an assessment of conditions at the construction site, identification of potential pollution sources, description of BMPs that will be used to reduce pollutants within storm water leaving the construction site, and recording of site inspections and follow up maintenance to be performed (EPA, 2007). Categories of BMPs include erosion control, sediment control, waste management, good housekeeping, and post-construction. The SWPPP must also detail any pertinent monitoring and sampling requirements to be performed throughout the construction period, which are identified in the Construction General Permit and are dependent on the sediment and receiving water risk level of the site. Within the SFRWQCB region, there are added special provisions for mercury to be included in the assessment of potential pollutant sources,

due to historical mercury mining in the region and its neurotoxicity to humans and wildlife (SFRWQCB, 2017c).

Compliance with the Construction General Permit is implemented and enforced by the SWRCB, which runs the Stormwater Multiple Application and Report Tracking System (SMARTS) database, where applicants electronically file their storm water permit documents. Submittals are required to include a complete Notice of Intent, Risk Assessment, Post-Construction Calculations, a Site Map, the SWPPP, and a signed certification statement by a legally responsible person. Local municipalities are also required to enforce compliance with the Construction General Permit.

Projects evaluated and prioritized by this SWRP disturbing more than an acre of ground surface would be required to comply with the Construction General Permit requirements.

Industrial General Permit

The SWRCB adopted the most recent version of the Industrial General Permit in July of 2015 (Order 2014-0057-DWQ). The purpose of this permit is to implement the federally-required storm water regulations in California for storm water associated with industrial activities discharging to receiving waters. A total of ten broad categories of industrial activities are covered by the Permit, including:

1. Facilities subject to storm water effluent limitations guidelines, new source performance standards, or toxic pollutant effluent standards.
2. Manufacturing facilities.
3. Oil and gas/mining facilities.
4. Hazardous waste treatment, storage or disposal facilities.
5. Landfills, land application sites and open dumps.
6. Recycling facilities.
7. Steam electric power generating facilities.
8. Transportation facilities.
9. Sewage or wastewater treatment works.
10. Manufacturing facilities where industrial materials, equipment or activities are exposed to storm water.

The General Industrial Permit also requires the development of a SWPPP, through which sources of pollutants are identified and BMPS are identified to reduce storm water pollution at the site. BMPs must include all minimum BMPs identified in the Industrial General Permit that are required for all facilities, along with any applicable advanced BMPs. The SWPPP also requires monitoring. Minimum BMP types include good housekeeping, preventative maintenance, spill and leak prevention and response, material handling and waste management, erosion and

sediment control, quality assurance, and record keeping. Operation of industrial facilities must comply with discharge prohibitions, effluent limitations, receiving water limitations, and TMDLs for receiving waters. Monitoring and receiving water sampling requirements for the facility must also be detailed in the SWPPP. The Industrial General Permit requires each facility to have a Pollution Prevention Team established and responsible for assisting with the implementation of the requirements in the Permit (SWRCB, 2014).

Projects evaluated and prioritized by this SWRP would be required to comply with the Industrial General Permit if they involve industrial operations as identified by the permit. No projects involving industrial operations are currently included as part of this SWRP.

Phase II General Municipal Separate Storm Sewer System (MS4) Permit

The Southern Sonoma SWRP planning area is covered by a Phase II Small MS4 Permit (Order No. 2013-0001-DWQ) designed to regulate discharges from municipal separate storm sewer systems. This MS4 Permit covers all small MS4s within California, including municipalities having a population less than 100,000 people and also known as “traditional MS4s,” but also systems similar to separate storm sewer systems in municipalities such as systems at military bases, large hospital or prison complexes, water districts, highways and other thoroughfares. The latter are known as “non-traditional MS4s.” Within the planning area, the Phase II MS4 Permit regulates storm water (wet weather) runoff and dry weather runoff to surface waters, and includes the Cities of Sonoma and Petaluma, the surrounding unincorporated areas under the jurisdiction of the County of Sonoma, and non-traditional permittees including Sonoma Water, Sonoma Development Center and Sonoma-Marin Fair (SWRCB, 2017a). Sonoma Water's role is unique in that it is a flood control district, not a regulator nor a land use authority, and thus does not have the legal authority to enact ordinances, issue permits, regulate or inspect industrial or commercial facilities, impose controls on new development, or initiate enforcement actions.

The MS4 Permit includes specific BMP and management measure requirements required for commercial, industrial, municipal, and residential land uses to reduce or eliminate the discharge of pollutants to receiving waters. The Permit also requires inspection and post-construction assessment of BMPs. Additionally, the Permit incorporates requirements for new development and re-development projects aimed at reducing surface water impacts caused by urbanization and restoring dominant watershed processes. Where applicable and feasible, low impact development (LID) requirements are mandated to mimic natural hydrology functions by retaining and/or treating pollutants in storm water runoff prior to discharging to and from the MS4. All MS4 Permittees in the SWRP planning area use the BASMAA Post-Construction Manual (BASMAA, 2014) as guidance for designing LID BMPs. Complementary to LID requirements and the desire to protect dominants watershed processes affected by urban storm water, hydromodification control requirements are also included within the Permit. Preliminary data suggest that BASMAA rainfall depth design criteria when applied to new development are sufficient to meet hydromodification control requirements.

The MS4 Permit also incorporates TMDL implementation requirements and water quality monitoring requirements for TMDLs and 303(d) listed waterbodies. TMDL-specific permit requirements developed by the SFRWQCB are incorporated into the Permit for compliance with TMDLs in which storm water or urban runoff is listed as a source. These TMDL-specific permit requirements are included in Appendix G of the Permit, and include all adopted TMDLs within the planning area (see Table 3). Amendments to the Phase II Small MS4 Permit were recently proposed on July 5, 2017 clarifying that Permittees must comply with all applicable TMDL-based requirements.

3.1.4 General Waste Discharge Requirements (WDRs) for Vineyard Discharges

The SFRWQCB adopted General Waste Discharge Requirements (WDRs) for vineyard discharges within the Sonoma Creek and Napa River watersheds on July 12, 2017. The purpose of the general WDRs is to reduce the discharge of sediment, runoff, and other pollutants within these watersheds from vineyard properties. Vineyard properties are defined as a parcel or contiguous parcels under the same ownership where more than five acres are planted in grapes.

The general WDRs require actions to control pollutant discharges including sediment and storm water runoff from vineyards and unpaved roads, and pesticides and nutrients from vineyards. Vineyard property owners are required to enroll in the General Permit or seek individual permit coverage. The General Permit requires development of a farm plan, verified by a third party of RWQCB staff, that documents a vineyard property's natural features and developed areas, and outlines BMPs being implemented on the vineyard property. The farm plans will be required to achieve discharge performance standards as summarized in Table 4 below.

TABLE 4
PERFORMANCE STANDARDS FOR DISCHARGE INCLUDED IN THE GENERAL WDRS FOR VINEYARDS

Performance Standard	Date for Compliance
Vineyard soil erosion, pesticides, and nutrients	Within 3 years of adoption
Storm runoff/channel erosion (at hillslope vineyards)	Within 6 years of adoption
Road-related sediment delivery	Within 10 years of adoption

SOURCE: SFRWQCB, 2017d

The General Permit also established a three-tier system for enrollment based on the vineyard's relative risk to water quality determined by verification of the farm plan and achievement of performance standards as demonstrated through annual monitoring and reporting. Vineyards will be required to enroll under Tier 1, 2, or 3, as applicable. New vineyard properties developed on a ridgetop, on slopes >30%, and/or that involve a timber conversion plan will not be covered by the General Permit and will instead be required to obtain an individual permit (SFRWQCB, 2017d).

3.1.5 Conditional Waiver Program for Grazing Operations

The SFRWQCB adopted the conditional waiver of WDR's for grazing operations within the Sonoma Creek and Napa River watersheds on September 14, 2011 and renewed the waiver on November 8, 2017 for a second, five-year term. The purpose of the waiver program is to reduce the discharge of sediment, nutrients, and pathogens from grazing lands (SFRWQCB, 2017l). The program applies to landowners or operators of grazing operations encompassing 100 acres or more and areas smaller than 100 acres identified by Water Board staff as posing a threat to water quality. The program also specifies measures to address erosion and to protect riparian areas.

3.1.6 Statewide Trash Water Quality Objectives

The SWRCB amended the Water Quality Control Plan for Ocean Waters of California (Ocean Plan) and the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries in California (ISWEBE) to control trash on April 7, 2015. These amendments are referred to as the Trash Amendments.

The goal of the Trash Amendments is "to address the impacts of trash to the surface waters of California through the establishment of a statewide narrative water quality objective and implementation requirements to control trash, including a prohibition against the discharge of trash" (SWRCB, 2015a).

The Trash Amendments supersede the San Francisco Bay Basin Plan to the extent that any conflict exists; however, the SWRCB has not identified any such conflict (SWRCB, 2015a). The Trash Amendments also require the permitting authority (the SWRCB) for the three NPDES Permits discussed herein (the Construction General Permit, the Industrial General Permit, and the Small MS4 General Permit) to modify or re-issue those permits to be consistent with the prohibition against the discharge of trash.

The Trash Amendments require that, by June 2, 2017, the SWRCB either modify or re-issue the Small MS4 General Permit to include provisions implementing the Trash Amendments or issue a Water Code §13383 Order requiring permittees to begin taking implementation steps prior to re-issuance of the Small MS4 General Permit. The SWRCB issued Water Code §13383 Orders to traditional and non-traditional Small MS4 permittees on June 1, 2017. In summary, the Water Code §13383 Orders require permittees to:

1. By September 1, 2017, select one of two compliance methods (Track 1 or Track 2), and submit a jurisdictional map identifying priority land use areas and the corresponding storm drain network, and;
2. By December 1, 2018, submit the following based upon the previously selected compliance method:
    a. Permittees selecting the Track 1 compliance method must submit updated jurisdictional map as specified in the Trash Amendments, or
    b. Permittees selecting the Track 2 compliance method must submit updated jurisdictional map and provide implementation plan as specified in the Trash Amendments.

The Track 1 and Track 2 Compliance methods are as follows:

- Track 1: Install, operate, and maintain Full Capture Systems for all storm drains that capture runoff from priority land uses.

- Track 2: Install, operate, and maintain any combination of full capture systems, multi-benefit projects, other treatment controls, and/or institutional controls, and; the MS4 permittee shall demonstrate that such combination achieves full capture system equivalency.

Projects evaluated and prioritized by this SWRP would be required to comply with the Small MS4 General Permit requirements.

3.2 Pollutant Sources and Pollutant Generating Activities

This section discusses pollutant sources and pollutant-generating activities within the Southern Sonoma SWRP planning area for which high priority water quality conditions have been identified either through a TMDL or 303(d) listing. The following sub-sections identify the highest priority water quality conditions and the pollutant-generating facilities, areas, and activities by watershed. The information in each of these sub-sections was adapted from respective TMDLs that have been adopted or from available data and information for TMDLs under development. TMDLs specific to each watershed are presented first followed by TMDLs for San Francisco Bay that also apply within both watersheds of the planning area.

3.2.1 Sonoma Creek

As previously described, Sonoma Creek has adopted TMDLs for both Sediment and Pathogens, as well as being subject to the strategies included within the Diazinon and Pesticide-Related Toxicity in Urban Creeks TMDL. Its Nutrients TMDL has been approved for Delisting. Each Sonoma Creek-specific TMDL is briefly described below, while the Urban Creeks Pesticide Toxicity TMDL is described at the end of Section 3.2.3.

Sediment

The Sonoma Creek Watershed Sediment TMDL and Habitat Enhancement Plan was developed due to exceedances of water quality standards for sediment, and was prompted due to declines in native fish populations (SFRWQCB, 2008). The SFRWQCB's website for the Sediment TMDL states:

> The U.S. Environmental Protection Agency has approved the Basin Plan amendment adopted by the Regional Water Board in December 2008, incorporating the TMDL and an implementation plan to achieve the sediment TMDL and related habitat enhancement goals. The TMDL was approved by the State Office of Administrative Law and became effective on July 12, 2010. It is now fully approved and part of the Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan), the master planning document for water quality in the Bay Area. Water Board staff is now focusing on

implementing the TMDL and habitat enhancement. Current work includes developing a conditional waiver program for vineyard facilities and facilitating stream restoration projects through our grant programs (SFRWQCB, 2017e).

The Basin Plan Amendment incorporating the TMDL includes a summary of goals and specific actions needed to achieve those goals, summarized in Table 5 below.

TABLE 5
GOALS AND SPECIFIC ACTIONS LISTED IN THE SONOMA CREEK WATERSHED SEDIMENT TMDL AND HABITAT ENHANCEMENT PLAN

TMDL Goals
1) Conserve the steelhead trout population
2) Restore water quality to meet water quality standards, including attaining beneficial uses
3) Enhance the overall health of the native fish community
4) Protect and enhance habitat for native aquatic species
5) Enhance the aesthetic and recreational values of the creek and its tributaries
TMDL Specific Actions
1) Reduce sediment loads, and fine sediment in particular, to Sonoma Creek and its tributaries
2) Attain and maintain suitable gravel quality in freshwater reaches of Sonoma Creek and its tributaries
3) Reduce and prevent channel incision
4) Reduce erosion and sedimentation
5) Repair large sources of sediment supply (e.g., landslides)
6) Enhance channel complexity (e.g., by adding and encouraging retention of large woody debris and restoring riparian vegetation)

SOURCE: SFRWQCB, 2017e

The TMDL established the following numeric targets and desired conditions to achieve Basin Plan's narrative water quality objectives for sediment, settleable material, and population and community ecology (see Table 6).

TABLE 6
TMDL SEDIMENT TARGETS FOR SONOMA CREEK AND ITS TRIBUTARIES

Objective	Target/Desired Condition
Spawning gravel permeability	Median value ≥ 7000 cm/hr[a]
Pool filling	Decreasing trend in the volume of fine sediment deposited in pools
Substrate composition – percent fines	Percent of fine sediment less than 0.85 mm in diameter is less than or equal to 14 percent of the total bulk core sample (< 0.85 mm) [b]
	Percent of fine sediment less than 6.40 mm in diameter is less than or equal to 30 percent of the total bulk core sample (< 6.40 mm) [b]

NOTES:
[a] Target applies to all potential spawning sites for steelhead and salmon in Sonoma Creek and its tributaries.
[b] Target applies to wadeable streams and rivers with gradient less than 3 percent. A wadeable stream is one which an average human can safely cross on foot during the summer, low flow season while wearing chest waders.

SOURCE: SFRWQCB, 2017e

Table 7 below summarizes identified sources and estimated sediment delivery rates to Sonoma Creek based on field assessment and sediment load modeling during TMDL development. The current sediment delivery rate (117,000 tons/year) is estimated to be 225% of the natural background rate (52,000 tons/year).

TABLE 7
TMDL SEDIMENT SOURCE CATEGORIES AND ESTIMATED RATES OF DELIVERY TO SONOMA CREEK

Source Categories		Estimated Rate (tons/year) [a, c]
Natural Processes	Channel Erosion, Incision [b]	25,400
	Colluvial Bank Erosion (Soil Creep)	16,600
	Surface Erosion [b]	6,200
	Landslides [b]	4,100
	Total – Natural Processes	**52,300**
Human Actions	Channel Incision and Gully Erosion [b]	43,300
	Roads and Stream Crossings	11,200
	Surface Erosion [b] from vineyards, other row crops, and rangelands	8,600
	Urban Storm Water Runoff	1,100
	Landslides [b]	900
	Total – Human Actions	**65,100**
GRAND TOTAL		**117,400**

NOTES:
[a] Sediment delivery rates are rounded to the nearest hundred.
[b] Channel erosion and incision, surface erosion, and landslides are occurring due to both Natural Processes and Human Actions. For these sources, each component (natural processes vs. human actions) is displayed separately.
[c] The timeframe associated with the average annual rate varies from long-term average rates which were estimated for landslides, channel incision, and gully erosion to those for urban storm water, surface erosion, and road-related erosion, which are estimated based on current/contemporary conditions.

SOURCE: SFRWQCB, 2017e

The Sonoma Creek sediment TMDL was established at 65,400 tons/year, which is approximately 125% of natural background load. In order to achieve this TMDL, controllable sediment delivery resulting from human actions need to be reduced by approximately 80% from current delivery rates. The TMDL allocations are shown below in Table 8.

TABLE 8
TMDL SEDIMENT LOAD AND WASTELOAD ALLOCATIONS

Source Category		2005 Load	Estimated Reductions Needed (%)	TMDL Allocation	
				Tons/year	Percent of Natural Background
Load Allocations	**Natural Processes**				
	Channel Erosion, Incision [b]	25,400	0	25,400	49
	Colluvial Bank Erosion (Soil Creep)	16,600	0	16,600	32
	Surface Erosion [b]	6,200	0	6,200	12
	Landslides [b]	4,100	0	4,100	8
	Human Actions				
	Channel Incision and Gully Erosion [b]	43,300	81	8,100	15
	Roads and Stream Crossings	11,200	81	2,100	4
	Surface Erosion [b] from vineyards, other row crops, and rangelands	8,600	81	1,600	3
	Landslides [b]	900	81	200	0.4
	TOTAL	**116,300**		**64,300**	
Wasteload Allocations [c]	Municipal Storm Water	600	0	600	1
	Construction Storm Water	300	0	300	0.6
	Industrial Storm Water	100	0	100	0.2
	Caltrans Storm Water	100	0	100	0.2
	TOTAL	**1,100**		**1,100**	**2**
TOTAL ALLOCATIONS = TMDL = 125% OF Natural Background				**65,400**	**125**

NOTES:
[a] Sediment delivery rates are rounded to the nearest hundred. Some totals may not appear to add up due to rounding.
[b] Total current (2005) estimated load = 117,400 tons/year
[c] Source categories included in the wasteload allocations (e.g., municipal storm water) are described as "urban storm water" in Table 5. The term "urban storm water" in Table 5 incorporates municipal, construction, industrial, and Caltrans storm water.

SOURCE: SFRWQCB, 2017e

Pathogens

The Sonoma Creek Pathogen TMDL was developed due to exceedances of water quality standards for pathogens within Sonoma Creek and its tributaries. The SFRWQCB's website for the Pathogen TMDL states:

> On February 29, 2008, the U.S. Environmental Protection Agency approved the Basin Plan amendment adopted by the regional Water Board in June 2006, incorporating a TMDL and implementation plan for pathogens in the Sonoma Creek watershed. The TMDL was approved by the State Office of Administrative Law and became effective on December 7, 2007. The amendment is now part of the Water Control Plan for the San Francisco Bay Basin, the master planning document for water quality in the Bay Area. (SFRWQCB, 2017f).

The Basin Plan Amendment incorporating the TMDL states the overall goal of the TMDL is to minimize human exposure to waterborne disease-causing pathogens and to protect beneficial uses of water for recreational activities such as wading, swimming, fishing, and rafting. The most common sources of pathogens are wastes from humans and animals, which also contain nutrients that in excess pose threats to aquatic ecosystem beneficial uses. Therefore, by reducing or eliminating the source of pathogens, this TMDL will also protect beneficial uses of Sonoma Creek watershed's aquatic ecosystem, including cold and warm freshwater habitat, and wildlife habitat.

The TMDL established the following numeric targets and desired conditions to achieve Basin Plan's narrative water quality objectives for coliform bacteria in contact recreational waters, and from U.S. EPA's bacteriological criteria (see Table 9).

TABLE 9
TMDL PATHOGEN WATER QUALITY TARGETS[a] FOR SONOMA CREEK

Objective	Target/Desired Condition
E. coli density	Geometric mean < 126 CFU/100 mL [b]; 90th percentile < 409 CFU/100 mL [c]
Fecal coliform density [d]	Geometric mean < 200 CFU/100 mL [b]; 90th percentile < 400 CFU/100 mL [c]
Total coliform density [d]	Median < 240 CFU/100 mL [b]; no sample to exceed 10,000 CFU/100 mL [c]
Zero discharge of untreated or inadequately treated human waste	

NOTES:
[a] These targets are applicable year-round.
[b] Based on a minimum of five consecutive samples collected at approximately equal intervals over a 30-day period.
[c] No more than 10 percent of total samples during any 30-day period may exceed this number.
[d] The water quality targets for total and fecal coliform shall sunset and shall no longer be effective upon the replacement of the total and fecal water quality objectives in the Basin Plan with *E. coli* based water quality objectives for contract recreation.

SOURCE: SFRWQCB, 2017f

The following source categories were identified as having the potential to discharge pathogens to surface waters within the Sonoma Creek watershed.

- On-site sewage disposal systems (septic systems)
- Sanitary sewer systems
- Municipal runoff[1]
- Grazing lands
- Dairies
- Municipal wastewater treatment facility
- Wildlife

The Sonoma Creek pathogen TMDL established density-based pollutant load allocations for identified pathogen source categories, and wasteload allocations for the single municipal

1 Pet waste is recognized as a source of pathogen pollution within municipal runoff.

wastewater discharger in the watershed, the Sonoma Valley County Sanitation District, and for municipal runoff. Due to inherent uncertainties associated with estimating pathogen loading from nonpoint sources and municipal runoff, allocations for these source categories incorporate a 10% margin of safety.

The TMDL load allocations and wasteload allocations are shown below in Table 10.

TABLE 10
TMDL SEDIMENT LOAD AND WASTELOAD ALLOCATIONS

	Source Category	*E. coli*		Fecal coliform [b]		Total coliform [b]	
		Geometric mean [c]	90th percentile [d]	Geometric mean [c]	90th percentile [d]	Median [c]	Single sample maximum
Load Allocations [a]	On-site sewage disposal systems	0	0	0	0	0	0
	Sanitary sewer systems	0	0	0	0	0	0
	Grazing lands	< 113	< 368	< 180	< 360	< 216	9,000
	Dairies	< 113	< 368	< 180	< 360	< 216	9,000
	Wildlife [e]	< 113	< 368	< 180	< 360	< 216	9,000
Wasteload Allocations [a]	Sonoma Valley County Sanitation District (NPDES Permit No. CA0037800)	< 126	< 409	< 200	< 400	< 240	10,000
	Municipal Runoff (NPDES Permit No. CAs00004) [f]	< 113	< 368	< 180	< 360	< 216	9,000

NOTES:
[a] These allocations are applicable year-round. Wasteload allocations apply to any sources (existing or future) subject to regulation by a NPDES permit. Load allocations and the wasteload allocation for municipal runoff reflect a 10% margin of safety.
[b] The allocations for total and fecal coliform shall sunset and shall no longer be effective upon the replacement of the total and fecal water quality objectives in the Basin Plan with *E. coli* based water quality objectives for contract recreation.
[c] Based on a minimum of five consecutive samples collected at approximately equal intervals over a 30-day period.
[d] No more than 10 percent of total samples during any 30-day period may exceed this number.
[e] Wildlife are not believed to be a significant source of pathogens and their contribution is considered natural background; therefore, no management measures are required.
[f] Municipal runoff permittees are: Sonoma County Water Agency, County of Sonoma, City of Sonoma, Sonoma Development Center, and any other designated entities.

SOURCE: SFRWQCB, 2017f

Nutrients

Sonoma Creek was included on the U.S. EPA's 303(d) list of impaired water bodies due to nuisance algae growth caused by excessive concentrations of nutrients. Nuisance algae can impair recreational beneficial uses by creating unaesthetic conditions, and can also lead to depletion of dissolved oxygen, which is essential to aquatic life. While many water quality objectives are numeric, the Basin Plan includes narrative objectives for nutrients, essentially stating that nutrients shall not cause algal growth to the extent that it harms the beneficial uses of a water body.

Since its original listing, RWQCB staff has undertaken extensive monitoring of nutrient levels (nitrogen and phosphorus), dissolved oxygen levels, quality of physical habitat (shading,

temperature, streamflow) and algae levels (chlorophyll concentrations in samples scraped from stream bed) within the Sonoma Creek watershed. Data collected during the 2011 and 2012 dry seasons showed that nutrient concentration, physical habitat quality, and algae biomass were meeting water quality objectives and relevant benchmarks. The water quality data collection effort and results of the monitoring supported a proposal to delist Sonoma Creek for nutrients (SFRWQCB, 2017g).

The SFRWQCB's website for the Nutrient TMDL states:

> The San Francisco Bay Regional Water Quality Control Board approved at its February 12, 2014 meeting a proposal to delist Sonoma Creek for nutrients resulting in excessive algae growth and to remove this water body from the EPA 303(d) list. The staff report detailing recent water quality assessments, lines of evidence, and interpretation of data are provided below. This de-listing will be included in the Integrated Report submitted to U.S. EPA for the 2018 listing cycle. We estimate the State Board hearing on the 2018 list will occur in summer 2020. State Board and U.S. EPA must still review this delisting action before the non-tidal portion of the Napa River may be removed from the 303(d) list. (SFRWQCB, 2017g).

While nutrients are no longer considered to be a pollutant of concern within the Sonoma Creek watershed, implementation of the pathogens TMDL within the watershed is anticipated to further decrease nutrient levels within Sonoma Creek and its tributaries as the source categories that generate pathogens also contain nutrients.

3.2.2 Petaluma River

The Petaluma River watershed has been separated into tidal (1.1 miles) and non-tidal (22 miles) segments for the 2012 Integrated Report for 303(d) listing. The tidal and non-tidal segments have the same TMDLs in development for Bacteria, as well as being subject to the Diazinon and Pesticide-Related Toxicity in Urban Creeks TMDL. A TMDL for Nutrients was also in development in conjunction with the TMDL for Bacteria, but recent results have indicated that a TMDL for Nutrients is not warranted at this time (SFRWQCB, 2018). Only the tidal segment has a TMDL in development for Nickel; and only the non-tidal segment is on the 303(d) list for Sediment and Trash. The TMDL development process and each constituent are described in more detail below.

Sediment

The Petaluma River (non-tidal portion) was listed on the Clean Water Act 303(d) list of impaired water bodies for sediment in 1998. The Sediment TMDL is currently under development at the SFRWQCB, with an expected TMDL completion date of 2019. Potential sources of sediment in the Petaluma River are from agriculture, construction and land development, and urban runoff and storm sewers (SWRCB, 2010; Aquatic Science Center, 2010). Variability in annual rainfall influences sediment production, sediment transport capacity, and water quantity and quality. In addition, the Petaluma River watershed is composed of a highly erodible rock type, which has the potential to generate large volumes of sediment. A combination of these natural processes and characteristics, combined with land uses such as grazing, viticulture, and urban

development can exacerbate natural erosional processes and contribute to sediment supply in the Petaluma River (Aquatic Science Center, 2010).

Fine sediments can adversely impact beneficial uses in waterbodies related to aquatic wildlife habitat by reducing habitat complexity and via accumulation of pollutants in sediments. As such, the Basin Plan specifies that, "The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses. Controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic pollutants in sediments or aquatic life." (SFRWQCB, 2007)

Listing decisions for sediment impairment in the Petaluma River made prior to 2006 were not held in an assessment database; the SFRWQCB will update listing decisions when new data and information become available and are assessed (SWRCB, 2010). The Petaluma River Impairment Report (2010) prepared by the Aquatic Science Center (ASC) for the SFRWQCB, assessed data collected on sediment in the Petaluma River watershed for the period 1999-2009. Compared to data sets from other Bay Area watersheds, the ASC concluded that the Petaluma River generally lacks sediment data sets that are useful, and in most cases, sediment data has not been collected. A forthcoming part of this assessment aims to recommend appropriate datasets required to inform impairment assessment and eventually TMDL development.

Bacteria

The Petaluma River was listed on the Clean Water Act 303(d) list of impaired water bodies due to elevated levels of fecal coliform bacteria. High fecal coliform bacteria levels indicate presence of pathogenic organisms generally resulting from the presence of human and/or animal waste streams entering waterways through surface water and/or dry weather runoff, and pose potential health risks to people using the Petaluma River for recreational purposes. The Petaluma River Bacteria and Nutrients TMDL was initiated to address the current impairment of recreational beneficial uses (SFRWQCB, 2017h).

Table 11 summarizes the timeline that the SFRWQCB has established for development of the Petaluma River Bacteria and Nutrients TMDL.

TABLE 11
PETALUMA RIVER BACTERIA AND NUTRIENTS TMDL DEVELOPMENT TIMELINE

Action	Anticipated Timeline
Initial public meeting	June 2017
Project workshop and CEQA scoping meeting	Fall 2017
Release of draft documents for preliminary public review	Fall 2017
Release of final documents for formal public review	Fall 2018

SOURCE: SFRWQCB, 2017h

The initial public meeting was held June 28, 2017, and presentation slides from this meeting are available at the Petaluma River Bacteria TMDL website (SFRWQCB, 2017h). The public meeting summarized the TMDL process, and also presented preliminary data from the ongoing monitoring and bacteria impairment assessment effort. The sampling schedule included winter, spring, and summer in 2015 and 2016, and winter 2017. There are a total of 18 sites included within the program that cover perennial and non-perennial streams in both the tidal and non-tidal sections of the watershed. Constituents included within the monitoring program include bacteria, nutrients, algae, and DO and pH.

Table 12 summarizes the bacteria numeric targets being used to achieve Basin Plan's narrative water quality objectives for coliform bacteria in contact recreational waters. Impairment is being defined as >16% exceedance of the following standards per California Listing Policy.

TABLE 12
BACTERIA WATER QUALITY TARGETS FOR PETALUMA RIVER TMDL DEVELOPMENT

Indicator	Water Quality Target/Standard
Enterococcus (estuarine & fresh water)	Geometric mean < 30 CFU/100 mL [a]; single sample maximum < 110 CFU/100 mL [b]
E. coli (fresh water only)	Geometric mean < 100 CFU/100 mL [a]; single sample maximum < 320 CFU/100 mL [b]

NOTES:
[a] Based on a minimum of five consecutive samples collected at approximately equal intervals over a 30-day period.
[b] Based on individual samples.

SOURCE: SFRWQCB, 2017h

The monitoring data suggest the following:

1. The *E. coli* geometric mean of all stations for a given sampling season far exceeded the 16% impairment threshold target in all 6 seasons when monitoring was conducted. Percent exceedances ranged from approximately 60% to 100% above the geometric mean target for *E. coli*. The exceedances were considered significant, and were higher in wet season than dry season (2016).

2. The mean of *E. coli* single sample values at each of the 18 sampling stations exceeded the single sample maximum threshold target. Mean concentrations for each sampling station ranged from approximately 500 – 3500 FU/100 mL compared to the target of <320 CFU/100 mL. The main stem and San Antonio Creek stations showed higher levels.

3. The *Enterococcus* geometric mean standard was evaluated at a total of 6 stations located on the mainstem Petaluma River for winter 2017 sampling season. All stations exceeded the geometric mean target of 30 CFU/100 mL, with geometric means ranging from approximately 50 -180 CFU/100 mL. Subsequent monitoring is proposed for the future.

4. Bacteroides sampling which allows for identification of source-specific fecal bacteria (human, horse, dog, ruminant) revealed that all four host-specific bacteroides were

present during wet weather sampling, and all host-specific bacteroides with the exception of dog were present during dry weather sampling.

Table 13 summarizes potential sources of bacterial contamination identified as part of TMDL development.

TABLE 13
POTENTIAL BACTERIA SOURCE CATEGORIES FOR PETALUMA RIVER TMDL DEVELOPMENT

Source Categories	Potential Sources	Bacteria Source
Human Waste	Wastewater treatment plant	X
	Sanitary sewer systems	X
	Private sewer laterals	X
	Septic systems	X
	Vessel marinas	X
Animal Waste	Livestock – confined animal facilities	X
	Livestock – grazing lands/operations	X
	Domestic pets	X
	Wildlife	X
Municipal Storm Water Runoff	Runoff from residential, commercial, industrial, and recreational areas	X

SOURCE: SFRWQCB, 2017h

Results of the additional monitoring complete in 2017-2018, combined with the historical data, indicate that the "Petaluma River is still impaired due to exceedances of bacterial water quality standards" and "the impairment is both temporally and spatially widespread" (SFRWCB, 2018).

Nutrients

The Petaluma River was also listed as impaired with respect to nutrients due to excessive algal growth, or eutrophication, which is generally caused by high nutrient levels. Eutrophic waters can significantly alter dissolved oxygen and pH levels within a water body, negatively impacting aquatic life. Algae growth is also considered an aesthetic impact which impacts recreational beneficial uses (SFRWQCB, 2017h).

Nutrient monitoring has also been conducted in conjunction with bacteria monitoring as part of the combined TMDL development process. The sampling schedule included winter, spring, and summer in 2015 and 2016, and winter 2017. There are a total of 18 sites included within the program that cover perennial and non-perennial streams in both the tidal and non-tidal sections of the watershed. The nutrient impairment assessment is focused on two types of impacts: toxic effects and eutrophication. Table 14 summarizes numeric targets established for nutrients and eutrophication within the Petaluma River watershed.

Data collected during the 2015 and 2016 monitoring period showed that nutrient concentrations were meeting water quality objectives and relevant benchmarks, and there was no strong evidence of eutrophication supported by either direct or indirect indicators considered within the monitoring program (SFRWQCB, 2017h). Additional monitoring for nutrients in 2017-2018 produced similar results to the 2015 and 2016 monitoring efforts, and as such a TMDL for nutrients has been determined to not be warranted at this time (SFRWQCB, 2018). However, given the co-associated nature of the fecal indicator bacteria and nutrient sources, the control measures for the Bacteria TMDL are likely to address nutrient pollution sources as well.

TABLE 14
NUTRIENT WATER QUALITY TARGETS FOR PETALUMA RIVER

Impairment Category	Constituent/Analyte	Water Quality Target/Standard
Nitrogen	Total Ammonia as N (NH_3 + NH_4^+)	0.6-3.3 mg/L as N
	Unionized Ammonia as N (NH_3)	0.025 mg/L as N - annual median
	Nitrate as N (NO_3-N)	10 mg/L as N
Direct Indicators of Eutrophication	Benthic algal chlorophyll a (COLD)	150 mg/m^2
	Percent macroalgae cover	30%
	Benthic algal biomass (AFDW) (COLD)	60 g/m^2
	Water column chlorophyll a	15 µg/L
	Algae taxonomy indicators	--
Indirect Indicators of Eutrophication	pH-Instantaneous	6.5-8.5 units
	Dissolved oxygen-Instantaneous (WARM)	5.0 mg/L
	Dissolved oxygen-Instantaneous (COLD)	7.0 mg/L
	Daily dissolved oxygen change	5 mg/L
	Daily pH change	1 unit

SOURCE: SFRWQCB, 2017h

Trash

The Petaluma River (non-tidal portion) was listed on the Clean Water Act 303(d) list of impaired water bodies due to elevated levels of trash. Trash is a type of "settleable material" and objectives for surface waters in the Basin Plan specify that, "Waters shall not contain substances in concentrations that result in the deposition of material that cause nuisance or adversely affect beneficial uses" (SFRWQCB, 2007). Trash adversely impacts aquatic life and aesthetic and recreational benefits in waterbodies and in adjacent riparian and shore areas. Plastic trash in particular, persists in the environment for years (SWRCB, 2013).

To support 303(d) listing decisions for trash impairment, the SWRCB developed and implemented a Rapid Trash Assessment (RTA) method from 2002 to 2005 as part of its Surface Water Ambient Monitoring Program (SWAMP). The RTA method scores sites according to cleanliness, documents the number of pieces of trash per one hundred feet of stream or shoreline, and the rate of return of trash under different hydrologic conditions. The data help to

identify problem areas where trash accumulates during dry and wet weather, and to assess the effectiveness of management measures (SFRWQCB, 2007).

Data collected via field visits/trash surveys conducted according to the RTA methodology show Petaluma River "level of trash" in the poor category for non-contact water recreational beneficial uses and a threat to aquatic life score, which indicates a threat to wildlife habitat beneficial uses (SWRCB, 2012). Out of 26 sites assessed in the San Francisco Bay Region, the highest dry season trash deposition rate was recorded at Washington Creek, at the corner of Washington and McDowell in the City of Petaluma. Fifty-nine percent of trash found above the high water line were plastics, and 56 percent (130 of 233 pieces) of the total pieces were plastic. The winter survey was also dominated by plastic trash, at 291 out of 338 pieces (SFRWQCB, 2007).

Trash impairment is being addressed by implementing the trash control provisions of the Phase II Small MS4 General Permit, rather than adopting a TMDL (SWRCB, 2016). Such permit provisions particular to trash control include the following:

- Provision E.11.f. Storm Drain System Assessment and Prioritization, which assigns high priority to catch basins that are known to accumulate a significant amount of trash;
- Provision E.11.g. Maintenance of Storm Drain System, which assigns high priority to facilities with recurrent illegal dumping and calls for removal of trash and debris from high-priority areas annually prior to the rainy season; and
- Provision E.14.a. Program Effectiveness Assessment and Improvement Plan, which tracks the annual and long-term effectiveness of the storm water program, documents compliance with Permit conditions, and assists with adaptive management of the storm water program. The Plan identifies strategies to gauge effectiveness of prioritized BMPs based on pollutants of concern (SWRCB, 2013).

Nickel

Only the tidal segment of the Petaluma River is on the 303(d) list for nickel. The expected TMDL completion date is 2019. The sources of the nickel pollution are from atmospheric deposition, municipal point sources, and urban runoff and storm sewers (SFRWQCB, 2010).

3.2.3 San Francisco Bay

The San Francisco Bay has three TMDLs that incorporate wasteload allocations for storm water and wastewater within both the Sonoma Creek and Petaluma River watersheds. These TMDLs include the Diazinon and Pesticide-Related Toxicity in Bay Area Urban Creeks TMDL, and TMDLS for both mercury and PCBs. Each of these TMDLs is described in further detail below.

Diazinon and Pesticide-Related Toxicity in Urban Creeks

The Petaluma River was included on the 303(d) list for pesticide-related aquatic toxicity, primarily attributed to diazinon, along with a total of 37 other urban creeks within the San Francisco Bay Area in the early 2000s. Pursuant to the Clean Water Act, the SFRWQCB

developed the Diazinon and Pesticide-Related Toxicity in San Francisco Bay Area Urban Creeks TMDL. The SFRWQCB's website for this TMDL states:

> The Diazinon and Pesticide-Related Toxicity in Urban Creeks TMDL was adopted by the Water Board on November 16, 2005 and State Water Resources Control Board on November 15, 2006. The TMDL was approved by the State Office of Administrative Law and became effective on January 28, 2007. On May 21, 2007, the U.S. Environmental Protection Agency (U.S. EPA) approved a Basin Plan amendment incorporating a TMDL for Diazinon and Pesticide-Related Toxicity in Urban Creeks and an implementation plan to achieve the TMDL. (SFRWQCB, 2017i).

Diazinon is an insecticide that was commonly used throughout the Bay Area to manage a broad spectrum of pests until 1999. Beginning in 2000, diazinon use began to decline substantially. In 2004, the U.S. EPA phased out most urban diazinon applications, which increased the use of alternative pesticides which are still of concern due to their potential for aquatic toxicity. In some cases, the alternatives have higher cause for concern related to sediment toxicity as well.

Due to overall concern with pesticide toxicity, the SFRWQCB adopted an approach to address not only diazinon but also more general pesticide-related toxicity in all Bay Area urban creeks. It is important to note that the TMDL is focused exclusively on urban pesticide sources, and does not address the Petaluma River's other potential pesticide sources, such as agriculture (SFRWQCB, 2005). While urban uses of diazinon have largely been discontinued, diazinon is still commercially available for agricultural uses and may still be in use in Petaluma's agricultural areas.

The Basin Plan Amendment incorporating the TMDL includes an implementation plan with strategy, goals, and specific actions listed to achieve the water quality attainment strategy. Promoting integrated pest management is at the core of eliminating and preventing toxicity in Bay Area urban creeks, and strategic goals to achieve this strategy are focused on proactive regulation, education and outreach, and research and monitoring. From the Basin Plan Amendment and TMDL Staff Report,

> The intent of proactive regulation is to prevent pollution by using existing regulatory tools to ensure that pesticides are not applied in a manner that results in discharges that threaten urban creek habitats. Education and outreach programs will focus on decreasing demand for pesticides that threaten water quality, while increasing awareness of alternatives that pose less water quality risk. Programs will increase both the demand for and supply of less toxic products and services. Research will fill existing information gaps, and monitoring will be used to measure implementation progress and success. (SFRWQCB, 2005)

Proposed actions needed to achieve these goals include:

1. Several regulatory agencies (Water Board, U.S. EPA, CA Department of Pesticide Regulation, Country Agricultural Commission, CA Department of Consumer Affairs) to effectively use their regulatory authorities to reduce urban runoff discharges as much as possible;

2. University of California Statewide Integrated Pest Management Program to help with education and outreach and program development;

3. Actions by private and professional pesticide users to change behaviors and usage to reduce potential for discharges to waterways;

The TMDL established the following water column toxicity test protocols (both acute and chronic) related to toxicity targets for the Petaluma River and other Bay Area urban creeks (see Table 15).

TABLE 15
TMDL WATER QUALITY TOXICITY TARGETS FOR PETALUMA RIVER AND URBAN CREEKS

Species	Common Name	Acute Exposure Duration	Biological Endpoint Assessed	Chronic Exposure Duration	Biological Endpoint Assessed
Pimephales promelas	Fathead minnow	1, 2, or 4 days	Survival	7 days	Survival & growth
Ceriodaphnia dubia	Water flea	1, 2, or 4 days	Survival	6-8 days	Survival & reproduction
Selenastrum capricornutum	Green algae			4 days	Cell division

SOURCE: SFRWQCB, 2005

Pesticide sources are manufactured. Thus, the source assessment portion of the TMDL focuses on conveyance pathways of pesticides. While several conceivable though improbable pathways were considered, the TMDL determined that urban runoff (both wet weather and dry weather) is the primary source of pesticides to Bay Area urban creeks. Therefore, allocations are only established for urban runoff at this time.

Given the concentration-dependent toxicity concerns with diazinon and other pesticides, the allocation of assimilative capacity of urban creeks has been expressed in concentration as opposed to mass. The allocation has been set based on a concentration that provided added measure of protection beyond a CDFW acute criterion of 160 mg/L, and has been set to a one-hour average concentration of diazinon in freshwater not to exceed 100 ng/L.

Mercury

The SWRCB adopted a mercury TMDL in 2004 for San Francisco Bay and an implementation plan into the Basin Plan by Resolution No. R2-2004-0082 (SFRWQCB, 2006). The TMDL was developed due to water quality problems associated with impacts to beneficial uses such as fishing and habitat for wildlife and endangered species (SFRWQCB, 2017j). The SFRWQCB website for the Mercury TMDL states:

> On February 12, 2008, the U.S. Environmental Protection Agency approved a Basin Plan amendment incorporating a TMDL for mercury in San Francisco Bay and an implementation plan to achieve the TMDL. The TMDL was approved by the State Office of Administrative Law and became effective on November 7, 2007. The Water Board is now implementing the TMDL on the variety of fronts. (SFRWQCB, 2017j).

Mercury pollution within the San Francisco Bay has led to fish consumption advisories for the public, and mercury also poses a threat to wildlife in the Bay, including rare and endangered species.

The most significant sources of mercury pollution are related to legacy sources including mining during the California Gold Rush and from mercury mines in the San Francisco Bay area, primarily located in South San Francisco Bay. Mercury continues to enter the Bay from the Central Valley Watershed and local watersheds with legacy mines, and from bed erosion of mercury-laden sediment that accumulated on the Bay floor. Other sources include wastewater and storm water, along with direct atmospheric deposition. Mercury load and wasteload allocations by source category for San Francisco Bay are presented in Table 16.

TABLE 16
MERCURY LOAD AND WASTELOAD ALLOCATIONS BY SOURCE CATEGORY FOR SAN FRANCISCO BAY

Mercury Sources	2003 Annual Loading to Bay (kg/year)	TMDL Allocation (kg/year)
Bed Erosion [a]	460	220
Central Valley Watershed	440	330
Urban Storm Water Runoff	160	82
Guadalupe River Watershed	92 [b]	2
Direct Atmospheric Deposition	27	27
Non-Urban Storm Water Runoff	25	25
Wastewater Discharges (municipal + industrial)	18	12
Sediment dredging and disposal [c]	Net loss	0

NOTES:
[a] Bed erosion occurs as mercury buried in Bay sediment becomes available for biological uptake when overlying sediment erodes.
[b] This load does not account for mercury captured in ongoing sediment removal programs conducted in the watershed.
[c] Sediment dredging and disposal often moves mercury-containing sediment from one part of the Bay to another. The dredged sediment mercury concentration generally reflects ambient conditions in San Francisco Bay sediment. This allocation is both mass-based and concentration-based. The allocation will be implemented by confirming both that the combined effect of dredging and disposal continues to be a net loss and that the mercury concentration of dredged material disposed in the Bay must be at or below the Baywide ambient mercury concentration. This allocation ensures that this source category continues to represent a net loss of mercury.

SOURCE: SFRWQCB, 2006b

The wasteload allocations for urban storm water runoff apply to the unincorporated areas of Sonoma County that drain to the Bay and both municipalities within the SWRP planning area. The statewide municipal storm water general permit issued by the SWRCB covers both municipalities. The TMDL does not include any implementation actions to control non-urban storm water runoff (SFRWQCB, 2006b).

PCBs

The SWRCB adopted a PCBs (polychlorinated biphenyls) TMDL for the San Francisco Bay in 2009, and approved the amendment to the Basin Plan under Resolution R2-2008-0012 (SWRCB, 2009).

The TMDL was developed due to water quality problems associated with PCBs because they are toxic, persist in the environment, and accumulate in the tissues of fish, wildlife, and humans (SFRWQCB, 2017k). The SFRWQCB website for the PCBs TMDL states:

> On March 29, 2010, the U.S. Environmental Protection Agency approved a TMDL for Polychlorinated Biphenyls in San Francisco Bay. The TMDL was approved by the State Office of Administrative Law and became effective on March 1, 2010. The Water Board is now implementing the TMDL on the variety of fronts (SFRWQCB, 2017k).

Similar to mercury, there are bioaccumulative concerns with PCBs as these chemicals accumulate at the very base of the food web. PCBs are found more often in Bay sediments more than in the water column. Much of the PCB pollution within the Bay happened decades ago; however, a small amount of PCBs still enters the Bay from several source categories (SWRCB, 2008). These are summarized below for the San Francisco Bay, along with TMDL wasteload allocations in Table 17.

TABLE 17
PCB LOAD AND WASTELOAD ALLOCATIONS BY SOURCE CATEGORY FOR SAN FRANCISCO BAY

PCB Source Categories	Current PCB Loading to Bay (kg/year)	TMDL Allocation (kg/year)
Atmospheric	Net Loss	0
Central Valley Watershed	11	5
Municipal Wastewater Dischargers	2.3	2
Industrial Wastewater Dischargers	0.035	0.035
Urban and Non-urban Storm Water Runoff	20	2

SOURCE: SFRWQCB, 2008

As shown, urban and non-urban storm water runoff is the source category with the largest current loading to the Bay and also requiring the largest reduction in terms of wasteload allocation. Given PCBs proclivity to adsorb to soils and sediments, sediment reduction within storm water discharges may be a viable approach to PCB load reduction.

This page intentionally left blank

4. ORGANIZATION, COORDINATION, AND COLLABORATION

Collaboration and coordination with watershed stakeholders and the public was a fundamental and guiding feature to the Southern Sonoma County SWRP planning process. Stakeholders included a wide array of representatives reflective of the landscape and land use composition of these two North Bay watersheds, which are generally characterized by urban towns and suburban lands surrounded by agricultural lands, open spaces and rural land uses.

SWRP Guidelines Checklist

- ☒ Consultation with local agencies and nongovernmental organizations
- ☒ Community participation
- ☒ Descriptions of the existing integrated regional water management group(s) implementing an integrated regional water management plan.
- ☒ Identification of and coordination with agencies to address the storm water and dry weather runoff management objectives for the targeted watershed.
- ☒ Nonprofit organizations working on storm water and dry weather resource planning.
- ☒ Public engagement efforts and community participation.
- ☒ Required decisions that must be made by local, state or federal regulatory agencies and coordinated monitoring.
- ☒ Coordination of existing local governmental agencies to support collaboration among two or more lead local agencies.
- ☒ Relationship of the Plan to other existing planning documents, ordinance, and programs established by local agencies
- ☒ Individual agency participation in isolated efforts.

4.1 Coordination and Collaboration with Stakeholders

Sonoma Water convened a Technical Advisory Committee (TAC) consisting of 13 collaborating entities, including the San Francisco Bay Regional Water Quality Control Board and the State Water Resources Control Board. TAC members were instrumental in building upon the network of stakeholders, inviting and advising on participation by additional NGOs and other groups which included local interest groups, water and natural resource managers, community-based organizations as well as private landowners. From this collaboration, a large network of supporting entities and individuals formed to conduct outreach, solicit participation and encourage and seek input. A list of all stakeholders identified and engaged in the planning process can be found in Appendix A.

Numerous participating agencies adhere to mandated storm water management policies with ongoing collaboration to meet the storm water and dry weather runoff management objectives of the Plan. Collaboration between agencies responsible for storm water compliance will continue through the lifetime of the Plan. The Phase II MS4 Permit covering the planning area includes the Cities of Sonoma and Petaluma, the County of Sonoma (surrounding unincorporated areas) and non-traditional permittees (Sonoma Water, Sonoma Development Center and Sonoma-Marin Fair- 4th

District Agricultural Association). Collaboration among these and other MS4 entities within the San Francisco Bay Area occurs through participation in the Bay Area Stormwater Management Agencies Association (BASMAA). Sonoma Water, the County of Sonoma, and the Cities of Petaluma and Sonoma are active BASMAA members.

Many TAC members and local stakeholders are also members and actively participate in the following water management groups: North Bay Watershed Association, North Bay Water Reuse Authority, Sonoma Valley Groundwater Sustainability Agency and Advisory Committee, and the Petaluma Valley Groundwater Sustainability Agency and Advisory Committee, Association of California Water Agencies, California Water Efficiency Partnership, Alternate Water Sources Working Group, California Stormwater Quality Association, Bay Area Integrated Regional Monitoring Program, North Bay Climate Adaptation Initiative, and Re-Inventing the Nation's Urban Water Infrastructure (ReNUWIt). Although individual project proponents will be responsible for the implementation of storm water management projects, continued collaboration with members of the public and local stakeholder groups will be essential for successful Plan implementation. Additional details on the engagement and outreach mechanisms used during development of the Plan can be found in Section 7.

The Sonoma Ecology Center, Sonoma Land Trust and Sonoma Resource Conservation District acted in individual capacities to aid in outreach and education with other organizations, as well as with local private landowners, ranchers, farmers, vineyard managers and dairy operators in regards to storm water management and project opportunities. The relationships formed between each of these entities and the communities they serve was invaluable in providing an opportunity for potential project partners to ensure their concerns and interests were captured by the Plan.

4.2 Identification of Non-Profits

Non-profit organizations working on storm water and dry weather resource planning or management in either or both watersheds have been identified in Table 18. Sonoma County is fortunate to have an abundance of non-profit and NGO entities providing technical services and land management to private and public entities in the planning area. Identification and participation of non-profits and NGOs in the planning process was important to capture the breadth of community values and engage NGO services and expertise.

TABLE 18
NON-PROFIT ORGANIZATIONS ENGAGED IN STORM WATER MANAGEMENT

Organization	Short Description
Sonoma Ecology Center	Non-profit organization established in 1990, whose mission is to work with the community to enhance and preserve ecological health in Sonoma Valley. The SEC works on a broad range of programs, including education and outreach, sustainability, climate adaptation and watershed planning, creek mapping, creek restoration, and watershed organizing to help preserve and restore the natural areas and ecosystems of Sonoma County. The SEC has worked collaboratively with the Water Board, Sonoma RCD, and other partners over the years to promote watershed stewardship and protect habitats in the Sonoma Creek Watershed.
Friends of the Petaluma River	Non-profit organization dedicated to celebrating and conserving the Petaluma River Watershed system. Through education, and providing access and conservation initiatives, the group is committed to long-term sustainable stewardship to protect a valuable resource. Host annual river clean-ups engaging volunteers to remove trash and debris and administer successful classroom education curriculum teaching water resource management and environmental stewardship.
Daily Acts	A sustainability non-profit that inspires action to create more nourishing, connected, and resilient communities. Their education programs, action campaigns, and strategic alliances connect people to each other and to their own power to harvest rainwater, implement permaculture techniques, restore habitat, grow food, conserve and protect water resources and build local capacity for resilience. Teach water conservation, rainwater harvesting, LID, and greywater re-use.
Petaluma Wetlands Alliance	Committed to the creation, restoration and continued stewardship of wetlands supporting wildlife habitat. They support restoration and conservation efforts in Shollenberger Park, Alman Marsh and at the Ellis Creek water recycling in the Petaluma River Watershed.
Sonoma Land Trust	A local, non-governmental, non-profit organization that preserves and protects land. They work closely with land owners, SCAPOSD, and an array of public agencies and government. They conserve scenic, natural, agricultural and open land through developing long-term land protection strategies, active stewardship, conservation easements, and provide educational opportunities. The SLT has protected more than 50,000 acres of land since their establishment in 1976.
University of California Cooperative Extension	Local problem-solving centers to connect issues with the latest UC research, collaborating with federal, state and local entities. They are advocates for healthy landscapes and communities, helping farmers become more efficient, educate on stewardship, promote water-wise solutions and irrigation methods, support 4-H Youth Development, and help to preserve natural areas.
Point Blue Conservation Science	A non-profit leader that has been assessing changes in the environment and advancing conservation through bird and ecosystem studies since 1965. They do this through innovative science and data driven leadership, extensive collaboration and community based restoration and conservation, as well as outreach and education.
North Coast Resource Conservation and Development Council	Grassroots non-profit organization that works with youth in environmental education projects and with community members to promote environmentally-sound agriculture practices and protection of natural resources. Their projects focus on pollinator habitat protection, water conservation and rainwater harvesting, landfill waste and greenhouse gas reduction, new sustainable farming support, and carbon sequestration.

4.3 San Francisco Bay Integrated Regional Water Management

The Bay Area Integrated Regional Water Management Plan (Bay Area IRWMP) is a nine-county regional planning effort to coordinate and improve water supply reliability, protect water quality, manage flood protection, maintain public health standards, protect habitat and watershed resources, and enhance the overall health of the San Francisco Bay. The Bay Area IRWMP synchronizes regional planning priorities with local planning efforts and serves as a platform to secure state and federal funding. Most of the TAC members actively participate in Bay Area IRWMP activities, planning and project implementation. Sonoma Water, Sonoma

Ecology Center, and County of Sonoma, City of Petaluma, City of Sonoma, and Sonoma Resource Conservation District are all participants in the Bay Area IRWMP. The array of goals, objectives, selected resource management strategies and prioritized projects of the Bay Area IRWMP represents a collective view and approach to integrating water resources management throughout the region. The Storm Water Grant Program and SWRP planning objectives are directly aligned with the BA IRWMP.

The five overarching goals of the Bay Area IRWMP are to:

1. Promote environmental, economic and social sustainability
3. Improve water supply reliability and quality
4. Protect and improve watershed health and function and Bay water quality
5. Improve regional flood management
6. Create, protect, enhance, and maintain environmental resources and habitats

4.4 Bay Area Stormwater Management Agencies Association

The Bay Area Stormwater Management Agencies Association (BASMAA) is a consortium of nine San Francisco Bay Area municipal storm water management programs. BASMAA was formed and organized to share information and resources, encourage cooperation, promote regional consistency and facilitate effective use of public resources. The association is grappling with how to implement storm water regulations and members are active in:

- Working with regional air quality districts in linking air quality to water quality,
- Working to strengthen the integration of storm water with wastewater management,
- Working with trade associations to develop practical industrial/commercial water quality programs, and
- Working with rural-focused agencies and programs in upper watersheds.

4.5 Required Decision Making

The SWRP is a required plan that must be in place for projects to be implemented using state bond funding for storm water projects. The SWRP will be adopted by the Bay Area IRWMP for incorporation and updated regularly to serve as a valid and effective planning tool to identify and fund projects. Projects are self-described by project proponents. The quantification metrics and prioritization methodology has been reviewed and accepted by the TAC members; however, the individual project descriptions and benefit quantifications have been self-reported and not TAC reviewed or approved, per se. The rankings therefore are based on proponent supplied information with rankings modified based on updated project information or additional projects proposed in future.

Additional stakeholders and members of the public are anticipated to be involved in identifying future project opportunities and contributing to plan updates. It is not anticipated that a new or altered governance structure to support collaboration for Plan implementation will be required.

Plan implementation will require decision making and coordination between local, State and Federal agencies. Decision making and coordination will include:

- **Plan Updates and Project Prioritization:** Coordination among the members of the existing TAC, as well as additional partners involved in storm water management and planning, will be required to solicit, develop, submit, and prioritize projects for future implementation. Coordination and collaboration among the TAC and state entities will also be required for future plan updates. Over a period of time, under a dynamic planning horizon, new projects identified will require quantification review and acceptance by TAC for plan inclusion. Additionally, previously-included projects may require modification and a determination whether further review and reconsideration is warranted. The quantification metrics and prioritization methodology has been reviewed and accepted by the TAC members. The projects are self-described and benefit quantifications have been self-reported. The initial rankings therefore are based on proponent supplied information. Future rankings and prioritization will be modified over time based on additionally identified projects or changes or updated project information.

- **Permitting and Environmental Review:** Environmental review and securing of regulatory permits will be required to implement a project. Proponents will be responsible for coordination, consultation and acquisition of all required permits. Permit requirements will vary due to project scope. Key state and federal regulatory agencies include: California Department of Fish and Wildlife, U.S. Army Corps of Engineers, SFBRWQCB, State Water Resources Control Board and/or U.S. Fish & Wildlife. New standards and regulations will require inclusion into the plan. Additional detail on implementation permitting is described in Section 6.1.1.

- **Securing Funding:** Project proponents are responsible for securing funding for implementation of projects and determining structure and financing for ongoing operations and maintenance. Funding for implementation may be derived from a variety of public and private sources, including Prop 1 Implementation funding from the Storm Water Grant Program. The Southern Sonoma SWRP TAC provided opportunities to private land owners and organizations to identify and submit projects for consideration and prioritization. During the project solicitation process, it was acknowledged that to implement a public-serving, multiple benefit project pursuant to the Storm Water Grant Program, a private land owner would need to partner with an eligible agency or nonprofit entity in order to apply for future state grant funding. Potential funding sources are listed in Section 6.

4.6 Relationship to Other Plans

The Southern Sonoma SWRP is just one of many concurrent local and regional efforts that county partners are undertaking to manage storm water, provide flood protection, manage groundwater, conserve natural resources, protect riparian corridors, habitats and open space, and adapt to

climate change. Table 19 lists applicable local planning efforts that contain goals and objectives found to be consistent with the management benefits of the Plan. Additional local and regional planning efforts this Plan is consistent with, as well as local storm water ordinances and programs that advance regional storm water management goals, are described below.

TABLE 19
CONSISTENCY WITH LOCAL PLANNING EFFORTS

SWRP Management Benefits	City of Sonoma General Plan	City of Petaluma General Plan	County of Sonoma General Plan	Sonoma Creek & Petaluma River Watershed Enhancement Plans	Sonoma Valley Groundwater Management Plan	Bay Area IRWMP
Water Quality while contributing to compliance with applicable permit and/or TMDL requirements	ER-2	4-P-1 E, 8-G-10	WR-1	Improve water quality and ground water recharge in the Petaluma River and its tributaries with the ultimate purpose of removing the Petaluma River from the RWQCB Impaired Waterbody List 303d Decrease anthropogenic sediment inputs into Sonoma Creek and meet water quality standards for sediment/siltation	BMO-5	3.2, 3.3, 3.4, 3.6, 3.7
Water Supply through groundwater management and/or runoff capture and use		8-P-5, 8-G-6, 8-P-27	LU-8, WR-2, WR-3, WR-4	Improve water conservation and reliability Conserve and improve the natural resources of the watershed. Protect the quality and quantity of water.	BMO-2, BMO-3, BMO-4	2.1, 2.6, 2.7
Flood Management	PS-1 1.7	4-P-1 L, 8-G-6, 8-P-37		Assess flood zones and implement watershed-scale flood mitigation measures		4.1, 4.3
Environmental	ER-2	4-P-1 G	OSRC-8	Assess and enhance riparian habitat and associated flood plains Conserve and enhance existing wildlife habitat Maintain streams to maximize beneficial uses		3.1, 5.1
Community	ER-4, CE-1	4-P-1 I, 8-P-35 D, 6-P-1 G	WR-2b, WR-6	Educate the community about the natural features of the watershed, its people, ecology, and economy.		1.8, 1.13

San Francisco Bay Basin Water Quality Control Plan

The Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) is the SFRWQCB master water quality control planning document. This plan designates beneficial uses and water quality objectives for waters of the State, including surface waters and groundwater. It also includes implementation programs to achieve water quality objectives. The Basin Plan has been adopted and approved by the State Water Resources Control Board, U.S. EPA, and the Office of Administrative Law where required. The SWRP incorporates the water quality objectives listed in the SFRWQCB Basin Plan. Like the SWRP, the Basin Plan is required to be updated regularly, and the 2018 triennial review of the Basin Plan is underway.

Groundwater Sustainability Plans

Landmark legislation was enacted by State of California in 2015 requiring medium- and high-priority groundwater basins to form Groundwater Sustainability Agencies (GSAs) to manage groundwater. The Sustainable Groundwater Management Act gave local agencies powers to sustainably manage groundwater over the long-term and requires Groundwater Sustainability Plans (GSPs) be developed by 2022. The Petaluma Valley Basin and the Sonoma Valley Basin (both designated as medium-priority basins by the Department of Water Resources (DWR) in Bulletin 118) are each governed by a separate GSA, both formed in June 2017. Diverse stakeholders and the public at large have been involved in the formation of the GSAs and will continue to be involved in the development of the GSPs. Opportunities for public involvement include open public meetings of the GSA boards and advisory committees, advisory committee membership, and periodic community meetings. A majority of the SWRP TAC member organizations are participating in the GSAs and will be involved in the development of the GSPs. The Sonoma Resource Conservation District serves as the Interim Administrator of the Petaluma Valley Basin GSA under direction of the GSA Board. The Valley of the Moon Water District serves as the Administrator of the Sonoma Valley Basin GSA. Sonoma Water's Chief Engineer and Director of Groundwater serve as the Plan Manager for both GSPs.

A number of common water and environmental management, sustainable water supply, and water quality objectives highlight the relationships between surface water and groundwater management and integrate our work towards achieving these common objectives for public benefit. Project types such as storm water capture and reuse, interconnected surface water, interflow, recharge and infiltration, share similar data sets and information needs. Research and planning in this new regulatory arena requires considerable agency coordination and stakeholder cooperation to conduct integrated assessments and planning necessary to address our surface water and groundwater issues and manage for the future. The GSAs were recently awarded grant funds from DWR to develop GSPs for the two basins, in addition to the Santa Rosa Plain basin. Preliminary steps are being taken to begin development of plans.

Data and information collected regarding permeability and groundwater conditions in conjunction with the SWRP field investigation task results will be shared for incorporation in development of the groundwater plans. In addition, the evaluation and field investigation methodology will be incorporated into a guidance template for reference and use in conducting future feasibility studies.

Urban Water Management Plans

Urban Water Management Plans (UWMPs) serve as the long-range planning document for urban water supplies. These plans are prepared in accordance with the Urban Water Management Planning Act, which is in the California Water Code, Sections 10610 through 10656. The Act requires every urban water supplier that provides water for municipal purposes to more than 3,000 connections, or supplying more than 3,000 acre-feet (ac-ft) of water annually, to adopt and submit a plan every five years to the California Department of Water Resources (DWR). This plan outlines an urban water supplier's wholesale water supply and includes a description of the water supply sources, historical and projected water use, and a comparison of water supply to water demands during normal, single-dry, and multiple-dry years. The City of Petaluma, City of Sonoma, Sonoma Water, Valley of the Moon Water District and North Marin Water District all maintain UWMPs.

Storm Drain Master Plans

Storm Drain Master Plans (SDMPs) are comprehensive plans and design concepts for upgrading storm drainage and flood control collection systems. These plans are prepared by municipalities for purposes of evaluating existing infrastructure, identifying deficiencies and recommending improvements and new systems. The Cities of Petaluma and Sonoma maintain SDMPs to manage drainage, provide flood protection, guide their storm water compliance and manage water quality issues.

Petaluma River and Valley of the Moon Watershed Master Drainage Plans

Sonoma Water developed a Master Drainage Plan for Flood Zone 2A- Petaluma Watershed, last updated 2003 (SCWA, 2003). Within Flood Zone 3A - Valley of the Moon (Sonoma Creek) Watershed, there are drainage plans for two areas: Boyes Hot Springs/Aqua Caliente and El Verano. These drainage plans contain information on storm water runoff and provide basic information on areas of flooding and drainage problems. Plans also identify structural solutions to those problems. The information is used by public agencies, planning and engineering consultants, land developers and property owners to better understand the flood hazard to certain lands and plan for the drainage improvements to mitigate those hazards.

In addition to these master plans, each of the municipalities develop capital improvement plans (also known as capital project plans) which identify individual projects for implementation. The Master Drainage Plan is used by Sonoma Water and the Cities of Petaluma and Sonoma in their capital improvement planning and construction, as well as in review and approval of land developments. It provides a valuable tool for consulting engineers by alerting them to the approximate scope of the drainage improvements needed for land development. Plan review of proposed storm water facilities is conducted by multiple agencies, depending on project location (incorporated or unincorporated lands).

Flood Management Design Manual

The Flood Management Design Manual (FMDM) is an update to the 1983 Sonoma County Water Agency Flood Control Design Criteria (FCDC), widely adopted as defining design standards for facilities and land development. The FCDC provided design guidance, procedures and performance criteria to guide hydrologic and hydraulic analysis to the engineering community, prospective builders, engineers, and city and county planners proposing new developments or redevelopments in Sonoma County. The updated FMDM includes revised approaches for precipitation analysis, runoff calculation, hydraulic evaluation, and provides resources to inform sediment transport analyses. While the revised FMDM is primarily a presentation of design standards and calculation methods, it is also a useful planning document that includes runoff management policies, strategies, and performance criteria. The FMDM promotes construction of drainage systems that are designed to function properly with existing or future downstream or upstream conveyance systems. Projects reaching implementation should, where applicable, utilize approaches consistent with the design guidance in the FMDM. Plan review of proposed storm water facilities is conducted by multiple agencies, depending on project location (incorporated or unincorporated lands).

Water Smart Development Guidebook

Sonoma Water developed the Water Smart Development Guidebook to provide Sonoma County land developers, city and county planning officials, and environmental regulatory agencies with a reference guide to avoid and minimize potential adverse impacts to water resources that can result from development projects. The guidebook provides guidance for the planning and design of residential and commercial developments for water resource related project elements.

The three core subjects of the guidebook focus on ways to increase water conservation, increase water reuse, and reduce stormwater impacts. The guidebook seeks to integrate these subjects within a single document to highlight potential areas of synergy and mutual benefit between topics. The multi-objective scope of the Water Smart Development Guidebook also supports several regional goals and initiatives, including: energy savings and sustainability initiatives, integrated regional water management, and flood management programs.

The Water Smart Development Guidebook also supports requirements of the National Pollution Discharge Elimination System (NPDES) Permit for discharges from municipal separate storm sewer systems for the applicable cities and urbanized areas within Sonoma County. Direct compliance with the Phase 1 NPDES permit requirements related to low impact development (LID) is primarily guided by the LID Technical Design Manual prepared by the NPDES co-permittees. LID is a planning and design strategy used to avoid and reduce potentially harmful impacts on water resources associated with stormwater runoff from land development. The co-permitttees document contains specific requirements and measures which may be required for some development projects. The Water Smart Development Guidebook is intended to complement the LID Technical Design Manual for discussion of stormwater management.

Living in a Fire-Adapted Landscape: Priorities for Resiliency

In direct and immediate response to the October 2017 fires, under the direction of the Sonoma County Board of Supervisors, a collaborative planning effort was established to identify and propose short- and long-term actions for natural and working lands impacted by the fires. These tasks and actions were deemed critical to the health and resiliency of Sonoma County watersheds. The community rallied to participate and the collaborative planning effort became known as the 'Watershed Collaborative' with an emphasis placed on the protection of working lands, native habitats, wildlife, streams and wetlands, as well as human health and safety. The Watershed Collaborative was open to all with working groups led by Sonoma County Ag + Open Space and Sonoma Resource Conservation District. Each working group included representatives from local, state and federal agencies, resource conservation districts, non-profits, agricultural groups, academic entities, watershed and community groups. The Living in a Fire-Adapted Landscape report was the product of a rapid assessment process that engaged many people during an unprecedented, challenging time, and therefore serves as important starting point for more robust planning. The report can be found at www.sonomaopenspace.org/watershed-collaborative/ (Watershed Collaborative, 2018).

Ongoing storm water management, especially post-fire storm water management in affected areas, was identified among the priority short- and long-terms actions. This report outlines a set of strategic, actionable priorities to protect natural and working lands, public and private landowner investments in these watershed lands, and acknowledges the continuing ability of these lands to provide multiple benefits to human and natural communities. Many of the priorities outlined in this report will apply not only to future fires, but to other disasters such as floods, droughts and earthquakes. As development pressure in the wildland-urban interface intensifies, and the impacts of climate change increase, so does the risk of catastrophic wildfire spreading into urban areas.

Bayland Habitat Goals

A consortium of scientists and interagency resource managers identified a need for habitat goals in 1993 and the Goals Project was undertaken in 1994 to established a long-term vision for a healthy and sustainable baylands ecosystem. The Habitat Goals report was prepared in 1999 and serves as a foundation to baylands habitat research, monitoring and ecosystem restoration work being implemented today (EPA, 1999). The geographic scope of the Goals project included portions of the San Francisco estuary that are downstream of the Sacramento-San Joaquin Delta and include Suisun Bay, San Pablo Bay and San Francisco Bay. A series of subregional, general recommendations were developed to guide future planning, research and implementation efforts. Recommendations for tidal and upland marsh restoration could reestablish hydrologic gradients in addition to habitat benefits. Recommendations include: a) restore large patches of tidal marsh and wide bans along the bayshore, b) enhance riparian habitat, c) establish managed marsh or enhanced seasonal pond habitat, and d) provide natural transitions at marsh ecotone and buffers as well as encourage seasonal wetlands. In 2015 the Bayland Ecosystem Habitat Goals Science Update was released in response to the great advances in climate-change science and the need for a technical synthesis of climate-change projections and updated recommendations.

Implementing the Goals recommendations requires close coordination and cooperation among landowners, agencies, and others. A fundamental tenant of the Goals project is collaboration and identifying appropriate research and monitoring and improving agency policies and procedures to protect and restore habitat for a variety of ecosystem and community benefits.

4.7 Storm Water Policies and Ordinances

Several storm water policies and ordinances apply to the planning watershed. These ordinances, presented in Table 20, are enacted by the Cities of Petaluma and Sonoma and by the County of Sonoma to manage storm water and minimize pollution in adherence to federal and state regulations.

Although Sonoma Water is a co-permittee in the Phase II Small MS4 Permit program, the Agency's role is unique in that it is a flood control district, not a regulator nor a land use authority, and thus does not issue permits, regulate or inspect industrial or commercial facilities, impose controls on new development, or initiate enforcement actions.

TABLE 20
STORM WATER ORDINANCES

Entity	Ordinance
City of Petaluma	Chapter 15.80 Stormwater Management and Pollution Control Ordinance (Ord. 2209 NCS §1 (part), 2005.)
City of Sonoma	Chapter 13.32 Stormwater Management and Discharge Control Ordinance (Ord. 02-2006 § 1, 2006)
County of Sonoma	Chapter 11 Grading, Drainage, and Vineyard and Orchard Site Development (Ord. No. 5988, § I, 5-15-2012) (b) Chapter 11A Stormwater Quality (Ord. No. 5819, § 6, 12-9-2008.)

4.8 Storm Water Programs

In 2003, the State Water Board adopted a general storm water permit for small municipal storm sewer systems (Phase II MS4 permit), which addresses municipal areas with populations less than 100,000 that are either located within a census-defined “urbanized area” or designated as ‘subject to permit’ pursuant to the terms of the Phase II MS4 permit. The MS4 permits require the implementation of programs that have many substantive elements, including, but not limited to: public education and outreach; commercial, industrial and construction activities inspection; illegal connection/illicit discharge detection and elimination; and post-construction storm water controls. The City of Sonoma, City of Petaluma and County of Sonoma each maintain storm water pollution prevention programs. These programs provide assistance to the public, elected officials, developers, industrial and commercial entities to aid in regulatory compliance through education, outreach, inspections, field visits, tracking and routine water quality monitoring and reporting.

The storm water programs listed below are efforts undertaken by members of the TAC and participating stakeholders who provide storm water management, outreach, policy and planning

leadership in both watersheds. These programs have a broad reach to provide education, funding, collaboration opportunities and support to municipalities, private land owners and managers, citizen groups, neighbors, schools and other organizations.

4.8.1 Vital Lands Initiative

The Vital Lands Initiative (VLI) is a comprehensive planning effort undertaken to guide Sonoma County Ag + Open Space into the next 15 years. VLI charts the District's conservation priorities and outlines strategies for protecting vital open space lands to preserve agriculture, natural resources, recreation, scenic vistas, greenbelt areas, and urban open space. Fundamental synergies exist between the two planning efforts of VLI and SWRP as acquisition of lands or use of conservation easements to protect riparian corridors, allow floodplain expansion, protect wetlands or recharge areas. These are key tools of the District that provide a myriad of community and ecosystem benefits, including: riparian corridor function and protection, habitat for special status species such as wetlands and streams, water quality improvements, protection of recharge areas and groundwater basins, provision of opportunities for recreation, and open space for health and enjoyment.

The District has engaged broadly with the community and organizational partners to develop the plan to leverage impact of our collective actions. VLI has included significant community input and stakeholder coordination throughout the planning process, which has in turn enhanced partnerships with community groups and organizations.

This initiative, coupled with the Venture Conservation Partnership, described below, will identify and implement priority investments in the protection of Sonoma County agricultural lands critical to water supply and habitat.

4.8.2 Sonoma County Venture Conservation Partnership

Under the leadership of Sonoma County Ag + Open Space, Sonoma County partners including USDA Natural Resources Conservation Service (NRCS), Sonoma Resource Conservation District, Gold Ridge Resource Conservation District, Sonoma Land Trust, Sonoma Water, and Pepperwood Preserve have engaged in a federally sponsored conservation program, entitled "Sonoma County Venture Conservation." The NRCS Regional Conservation Partnership Program establishes an extended local collaborative based on leveraging missions, resources, and talents to achieve shared outcomes. The Partnership will identify and implement priority investments in the protection of Sonoma County agricultural lands critical to water supply and habitat.

Conservation activities (land acquisition, planning and on-the-ground practices) will address the following priority resource concerns: soil quality degradation, insufficient water, and inadequate habitat for fish and wildlife. The partnership seeks to focus conservation activities located in priority groundwater basins such as Petaluma and Sonoma Valley Basins where conservation planning and practices would result in multiple benefits to priority resource concerns.

The primary objectives for the Sonoma County Venture Conservation Partnership are to:

- Develop and implement a shared, proactive and positive vision for conservation of working lands and natural areas, resulting in agriculture systems that conflict less and are more symbiotic with natural resources; and,

- Strengthen the resilience of Sonoma County agriculture and natural systems to drought and climate change by using a broad suite of NRCS programs and practices to address priority resource concerns in an integrated, multi-benefit fashion.

This program's features are consistent and aligned with the SWRP guidelines, featuring: a) shared data (best available science) and methodologies, b) inter-disciplinary and collaborative approach, and c) implementation priorities designed to meet multiple objectives and provide multiple benefits. Cost-share funding through the Venture Conservation program serves as a potential federal matching fund source for future SWRP project implementation.

4.8.3 Bay Area Integrated Regional Water Management (IRWM) Disadvantaged Community Involvement Program

Through funding from Bay Area Integrated Regional Water Management (IRWM) Disadvantaged Community Involvement Program, local non-profits Sonoma Ecology Center and Daily Acts will partner with other community-based organizations in Southern Sonoma County to conduct outreach, needs assessments, site assessments, and education on storm water, flooding and other water related issues over a three-year period. A suite of strategies will be used to engage these communities including workshops, meetings, presentations, asset mapping, surveys, and needs assessments. Wherever appropriate, outreach efforts will be conducted in both English and Spanish by bilingual staff.

The intention of these engagement activities is to build relationships with these communities, align around concerns, needs, opportunities, and gain an understanding of roles that specific individuals or groups may take in relation to future projects or initiatives. The envisioned outcomes of this program are focused on direct behavior change associated with reduced water use and greater water security that leads to a more positive relationship to water. By connecting local disadvantaged residents with experts to assist, inspire, and support project implementation this effort will also promote alternative development strategies, improvements to riparian areas, enhancement of green spaces and recreational amenities, greater infiltration of storm water and improved surface water quality.

4.8.4 Neighborhood Water Teams (NeWTs)

This is a program of the Sonoma Ecology Center aimed at educating Sonoma Valley residents on various water management topics including water conservation, storm water management, impacts to water quality, low impact design concepts, rain gardens, water friendly landscaping, and building soil. This program encourages community members create more small, dispersed projects that allow groundwater recharge through "slow it, spread it, sink it" methods

throughout the watershed. The NeWTs program engages the community through neighborhood leaders and first-adopters as well as through community-based workshops and activities bringing techniques, examples through hands-on learning. The goal of NeWTs is to change the water-related behavior of people living and working in the Sonoma Creek watershed, and to establish a model program of locally relevant outreach, replicable in similar communities. Changed behavior will reduce rapid polluted runoff into streams, improve water quality, reduce flood damage, raise groundwater levels, and increase streamflow during summer and fall. Changes in water use and management are documented by participants, so that results can be quantified. The practices promoted by the program will result in pollution prevention, storm water retention and detention, removing infrastructure from flood-prone areas, riparian enhancement, and outdoor and indoor water conservation.

4.8.5 Community Resilience Challenge (CRC)

The Community Resilience Challenge (CRC) is an annual action campaign organized by Daily Acts that mobilizes hundreds of residents, schools, churches, businesses and agencies to take action and create projects that increase personal and community health and resilience. The Challenge is a catalyst for behavior change, encouraging people to save water, grow food, conserve energy, reduce waste, and build community. Website and materials are in English and Spanish. Daily Acts supports groups serving low-income populations such as schools and community gardens. Since 2010, over 40,000 local actions and projects have been registered, 9,866,203 gallons of water saved and 568 storm water capture installations registered. Through its tool kits and resources, the Challenge has been replicated by Sustainable Contra Costa, the NorCal Resilience Network and grassroots organizations nationally.

4.8.6 LandSmart Planning

The Sonoma Resource Conservation District's LandSmart® Program is carried out through partnerships with landowners striving to achieve productive lands and thriving streams. These Planning and On-The-Ground services complement one another as assistance is provided to landowners and land managers to identify and prioritize management practices according to their individual needs, conservation goals and timelines. Projects help people put their conservation plan recommendations into action. Recommended multi-beneficial practices include those that prepare properties for storm events, reduce erosion, protect habitat, support healthy soils and sequester carbon. LandSmart® helps landowners to comply with environmental regulations. Recently, LandSmart® was approved by the SFBRWQCB as a Third-Party Program to help vineyard owners in the Sonoma Creek watershed comply with new Waste Discharge Requirements adopted in 2017. Vineyard properties in the Napa River and Sonoma Creek watersheds with five or more acres planted to winegrapes are required to comply, and LandSmart® plans serve as one pathway to compliance.

4.8.7 Lower Sonoma Creek & Baylands Strategy

A consortium of baylands managers are cooperating to collectively support ecosystem services and function in the lower Sonoma and Tolay Creeks to enhance resilience despite climate

change and sea level rise. A strategy is being developed for the purpose of coordinating the protection, acquisition, restoration and enhancement of habitat and natural processes (such as sedimentation) to achieve ecosystem goals. The strategy has a long-term planning horizon of 100 years and includes adaptability and feasibility as core principles. The Strategy will be designed to meet the goals of multiple regional plans and includes a core goal to advance the Recovery Plan for tidal Marsh Ecosystems of Northern and Central California (U.S. Fish and Wildlife Service, 2013) and guided by recommendations in the Baylands Ecosystem Habitat Goals Science Update (BEHGU, 2015). Consistent with the SWRP goals, strategy objectives include:

- Habitat Restoration
- Community benefits (recreation, access)
- Restore hydrologic function, stream corridor function
- Reduce flooding
- Enhancements for water quality improvement

4.8.8 Sonoma-Marin Water Savings Partnership

The Sonoma-Marin Saving Water Partnership (Partnership) represents 11 water utilities in Sonoma and Marin counties that have joined together to provide regional solutions for water use efficiency. Each of the partners implements water conservation programs that assist customers in reducing their water use. The Partnership was formed to identify and recommend implementation of water use efficiency projects, and maximize the cost-effectiveness of water use efficiency programs in the region. Regional programs for encouraging low water use, beneficial landscaping choices include the water smart plant label program, Garden Sense and the Water Smart Plant Guide, as well as the Qualified Water Efficient Landscaper (QWEL) training program. This is a U.S. Environmental Protection Agency WaterSense-approved training program for landscapers to receive education on principles of proper plant selection for the local climate, irrigation system design and maintenance, irrigation system programming and operation and sustainable landscaping. Partner water utilities also offer unique water use efficiency rebates and low-flow hardware, as well as other conservation programming.

4.8.9 Sonoma Water Flood Control Zones 2A (Petaluma Watershed) and 3A (Valley of the Moon Watershed)

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 management works within Sonoma County. Flood Control Zones 2A and 3A represent the upper Petaluma River watershed and Valley of the Moon watershed (Sonoma Creek watershed), respectively. The officially-formed zones have financed the construction of flood protection and drainage facilities, the maintenance of natural waterways, the preparation of master drainage plans for areas subject

to flooding, and erosion and sediment control activities. The zones have also financed the flood protection operation and maintenance activities of Sonoma Water.

4.8.10 Sonoma Water's Stormwater Management & Groundwater Recharge Initiative

An immediate action of Sonoma Water's 2010 Water Supply Strategies Action Plan was to identify projects within Sonoma Water's flood control zones that reduce flooding and increase groundwater recharge, providing multiple benefits. As a first step, Sonoma Water completed Scoping Studies in 2012 for each of three groundwater basins/watersheds (Santa Rosa Plain basin, Sonoma Valley basin and Petaluma Valley basin). As a second phase, Feasibility Studies were envisioned for Petaluma River and Sonoma Creek watersheds with a goal to develop one or more multiple benefit storm water/recharge projects that address reducing flood hazards and increase opportunities for recharge. In Petaluma watershed, feasibility studies began in 2012 with initial steps of conducting topographic surveys, flood modeling and development of early concept designs. The SWRP is consistent with the goals and objectives of this Initiative to develop multiple benefit storm water projects. The data, evaluations and public input developed during the scoping and feasibility phases has been incorporated into the SWRP.

4.8.11 Friends of the Petaluma River Watershed Classroom and River Clean Ups

Friends of the Petaluma River (FOPR) introduced the Watershed Classroom in 2013 to educate local youth about the Petaluma Watershed, build capacity to increase experiential learning opportunities in Petaluma, and inspire youth to protect and conserve their local watershed. The program provides educators with a $500 stipend, field trips, access to educational tools and supplies, lesson plans and classroom support. The program allows local youth and their teachers to explore storm water and dry weather runoff impacts to water quality. FOPR has also mobilized hundreds of local volunteers to participate in two annual river clean ups.

5. QUANTITATIVE METHODOLOGIES AND IDENTIFICATION AND PRIORITIZATION OF PROJECTS

One of the central tenets summarized within Section VI of the SWRP Guidelines relates to the need for *"appropriate quantitative methods for identifying and prioritizing opportunities for storm water and dry weather runoff capture projects. (Wat. Code, § 10565, subd. (b).)"* The guidance is clear in that at a minimum, *"Plans shall include a metrics-based and integrated evaluation and analysis of multiple benefits to maximize water supply, water quality, flood management, environmental, and other community benefits within the watershed. (Wat. Code, § 10562, subd.(b)(2).)"*

Pursuant to the SWRP Guidelines, Sonoma Water developed and refined the project submission, project evaluation and prioritization process, and quantification methodologies in collaboration with and including input from the TAC and stakeholders. This report documents the project submission process, presents proposed projects for inclusion in the Southern Sonoma SWRP, and summarizes initial and detailed quantification results to be used for project prioritization and selection.

5.1 Evaluation Process and Quantitative Methods

The Southern Sonoma SWRP established a multiple-stepped process to determine project eligibility and to quantify and prioritize projects and programs.

- Step 1 – **Eligibility** - determines if a project meets the minimum requirements of being within the project area and providing at least two main benefits. The Southern Sonoma SWRP project team and technical advisory committee members (TAC) established benefit criteria to be used to quantify and prioritize projects and programs within the SWRP as summarized in Table 21. If a project meets Step 1 – Eligibility requirements (blue cells and bolded text in Table 21), benefit criteria will be evaluated and quantified in a two-step process

- Step 2 – **Initial Quantification** - requires a yes/no response of all benefit criteria (green cells in Table 21)

- Step 3 - **Detailed Quantification** - requires a quantitative response of those benefit criteria that lend themselves to more detailed metrics (orange cells in Table 21).

- Step 4 – **Bonus Points**- following initial and detailed quantification, projects will be evaluated for bonus points (purple cells in Table 21) based priorities identified in the SWRP Guidelines.

SWRP Checklist Guidelines Quantitative Methods

For all analyses:

☒ Plan includes an integrated metrics-based analysis to demonstrate that the Plan's proposed storm water and dry weather capture projects and programs will satisfy the Plan's identified water management objectives and multiple benefits.

For water quality project analysis (section VI.C.2.a)

☒ Plan includes an analysis of how each project and program complies with or is consistent with an applicable NPDES permit. The analysis should simulate the proposed watershed-based outcomes using modeling, calculations, pollutant mass balances, water volume balances, and/or other methods of analysis. Describes how each project or program will contribute to the preservation, restoration, or enhancement of watershed processes (as described in Guidelines section VI.C.2.a)

For storm water capture and use project analysis (section VI.C.2.b):

☒ Plan includes an analysis of how collectively the projects and programs in the watershed will capture and use the proposed amount of storm water and dry weather runoff.

For water supply and flood management project analysis (section VI.C.2.c):

☒ Plan includes an analysis of how each project and program will maximize and/or augment water supply.

For environmental and community benefit analysis (section VI.C.2.d):

☒ Plan includes a narrative of how each project and program will benefit the environment and/or community, with some type of quantitative measurement.

Data management (section VI.C.3):

☒ Plan describes data collection and management, including: a) mechanisms by which data will be managed and stored; b) how data will be accessed by stakeholders and the public; c) how existing water quality and water quality monitoring will be assessed; d) frequency at which data will be updated; and e) how data gaps will be identified.

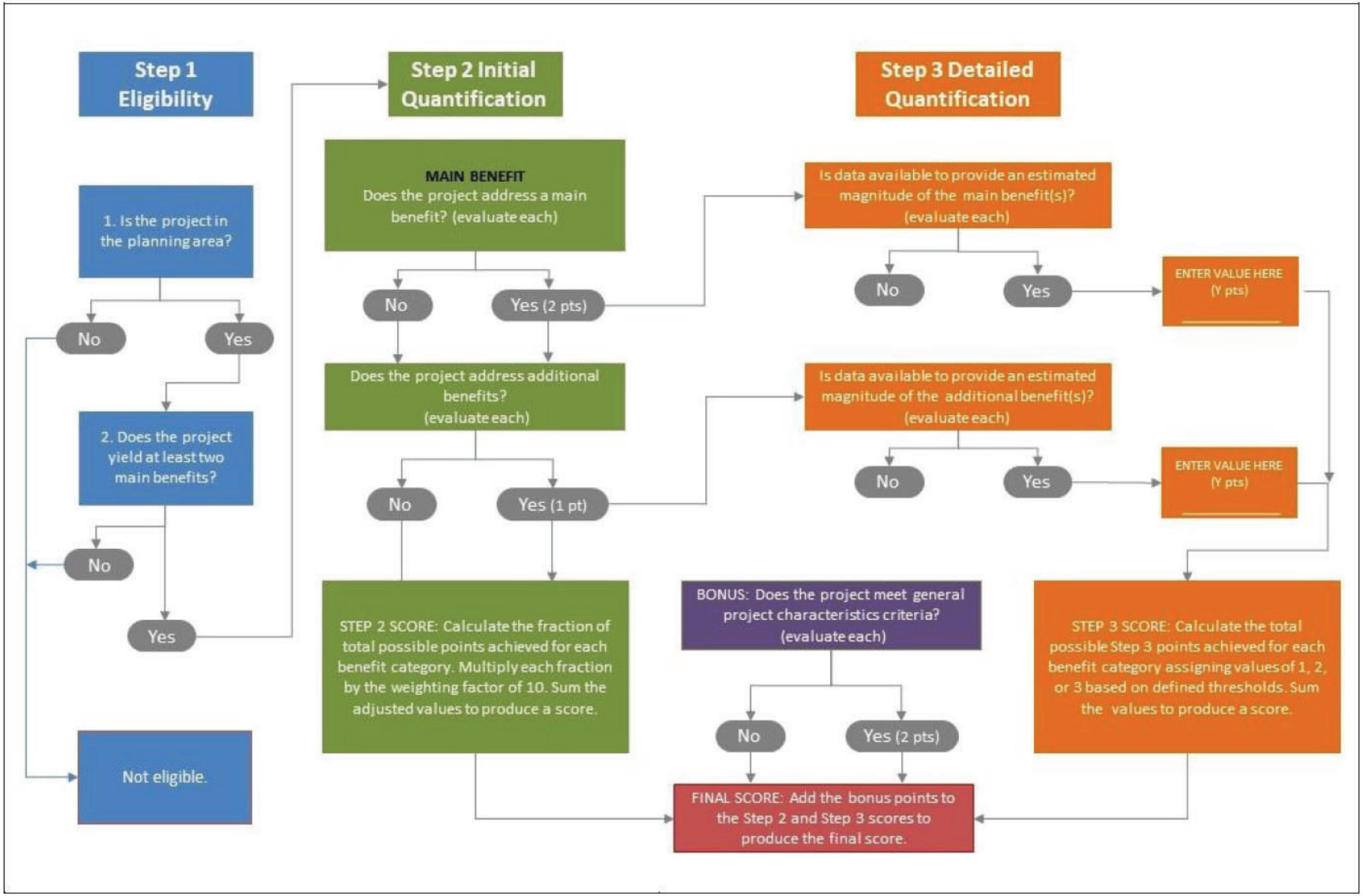
Total points from each step will be summed to determine a score for each project. This process can be seen graphically in Figure 14 with additional details found in Appendix B. Scoring indicates position based on values identified through the evaluation process. Projects are prioritized adhering to the 4-step process described above and demonstrating the evaluation and prioritization process used.

TABLE 21
SOUTHERN SONOMA SWRP BENEFIT CRITERIA AND QUANTIFICATION METHODS

Benefit Categories	Benefit Criteria	Units of Measurement	Quantification Method
General	Project is located within planning area		
	Project is located on public land		
	Project is located on private land with a cooperating landowner		
	Project will provide synergistic benefits due to location relative to other existing or proposed projects		
	Project is supported by entities that have created permanent, local, or regional funding		
Water Quality	**303(d) listed pollutant load removal through increased filtration and/or treatment**		
	Amount of pollutant load removed through filtration and/or treatment	lb/year, MPN/year, or gal/yr	Water Quality Benefit – Pollutant Load Reduction
	Storm water diversion through infiltration and/or evapotranspiration		
	Volume of storm water diverted through infiltration and/or evapotranspiration	acre-feet/year	Water Quality Benefit – Volume Diverted
	Enhances groundwater quality		
	Reduces non-point source pollution		
	Amount of pollutant load removed through non-point source pollution control	lb/year, or MPN/year	To be Supplied by Applicant
	Reestablishes natural water drainage and treatment		
	Incorporates strategy(ies) or BMP(s) previously identified in current TMDL, Basin Plan, Salt and Nutrient Management Plan, NPDES MS4 permit, or other locally-relevant water quality planning document or guidance manual		
	Project addresses water quality through source reduction or treatment in a high priority drainage area based on prior assessment		
	Results in reduced mixing of storm water and wastewater		
Water Supply	**Storm water collected and stored or diverted above ground for potable or non-potable use**		
	Volume of storm water collected, stored, and diverted offsetting irrigation use	gal/year	Water Supply Benefit – Irrigation Offset
	Storm water infiltrated into water supply aquifer		
	Volume of storm water infiltrated into water supply aquifer	acre-feet/year	Water Supply Benefit – Volume Infiltrated
	Storm water infiltrated into non-water supply aquifer		
	Volume of storm water infiltrated into non-water supply aquifer	acre-feet/year	Water Supply Benefit – Volume Infiltrated
	Enhances water supply reliability through means other than storage, diversion, or infiltration of storm water (e.g., water conservation)		
	Furthers conjunctive use management through means other than direct recharge of storm water		
	Project previously identified as water supply/conservation project in any watershed planning document		
	Project produces increased water use efficiency (i.e., water conservation)		
Flood Management	**Peak flood flow and/or volume reduction**		
	Magnitude of peak flow reduction	cfs	Flood Benefit - Peak Flow
	Magnitude of flood volume reduction	Acre-feet/year	Flood Benefit - Volume
	Modeling completed to ensure detention will not result in increased flooding due to timing considerations		
	Reduces flooding problem known or anticipated to occur locally		
	Project previously identified to reduce flood risk in local flood management plan, master plan, or watershed plan		
Environmental	**Conservation, creation, or enhancement of wetlands, aquatic, and/or riparian habitat**		
	Area of wetlands and/or riparian habitat created or enhanced	acres	To be Supplied by Applicant
	Increase in streamflows during low flow season for benefit of habitats and endangered/threatened species		
	Magnitude of increase in streamflows during low flow season	% of seasonal flow	To be Supplied by Applicant
	Creation of urban green space		
	Area of urban green space added	acres	To be Supplied by Applicant
	Re-establishment of the natural hydrograph (e.g., slowing in timing of peak flow, conversion of impervious area to pervious)		
	Magnitude of slowing in timing of peak flow (minutes or hours)	% of lag time	To be Supplied by Applicant
	Water temperature improvement for benefit of habitats and endangered/threatened species		
	Magnitude of water temperature improvement	degrees C or linear feet of riparian canopy	To be Supplied by Applicant
	Reduction in energy use or GHG emissions, or increase in carbon sinks		
	Magnitude of reduction in energy use or GHG emissions, or increase in carbon sinks	lb CO_2e/year or kwH/yr	To be Supplied by Applicant
	Project previously identified in conservation, restoration, watershed management, urban greening and/or other watershed-based plan		
Community	**Job creation**		
	Number of jobs created	FTE	To be Supplied by Applicant
	Public education opportunities and/or incorporation of a public education element		
	Recreational and public use areas enhanced and/or created		
	Area of recreational and public use areas enhanced and/or created	acres, or miles of trails	To be Supplied by Applicant
	Community involvement and/or volunteer opportunities		
	Number of persons engaged through community involvement and/or volunteer opportunities	People/year	To be Supplied by Applicant
	Project or project benefits are located in and/or adjacent to disadvantaged community		
	Incentivizes behavior or actions consistent with SWRP goals		
	Project was previously identified in a community, recreational, education, development, active transportation, job opportunity plan and/or another watershed-based plan		

TABLE LEGEND
Blue Cells - used for eligibility requirements; Green Cells - used for initial quantification; Orange Cells - used for detailed quantification; Purple Cells - used for bonus points based on identified priorities
Bolded text - Main benefit. Project must provide at least two main benefits for SWRP eligibility

This page intentionally left blank



SOURCE: ESA

Southern Sonoma SWRP

Figure 14

Project Evaluation Process

ESA Sonoma Water SWGP STORM WATER GRANT PROGRAM

5.2 Proposed Projects

Potential projects for inclusion in the Southern Sonoma SWRP were submitted by project proponents using an online Google Form questionnaire consisting of three steps. Step 1 required input of general project information including a short project description, location information, and identification of project proponents and supporting partners. Step 2 required input of project details to determine project eligibility and to complete initial quantification using yes/no responses to benefit criteria for those projects that were eligible. Step 3 required input of additional project information to complete detailed quantification for each benefit criteria.

The project submission period ran from September 8 to December 9, 2017. Sixty-three (63) projects were submitted for inclusion by project proponents, including members of the TAC and the general public solicited through various outreach forms including: website, public meetings, and TAC and other watershed planning group meetings. Three of these projects, Projects 51, 54 and 63, were subsequently withdrawn by the project proponent and were not included for project analysis or prioritization. Table 22 provides a list of projects included in the SWRP, Note: Number within each pie slice indicates the total number of projects for each management action type

SWRP Checklist Guidelines

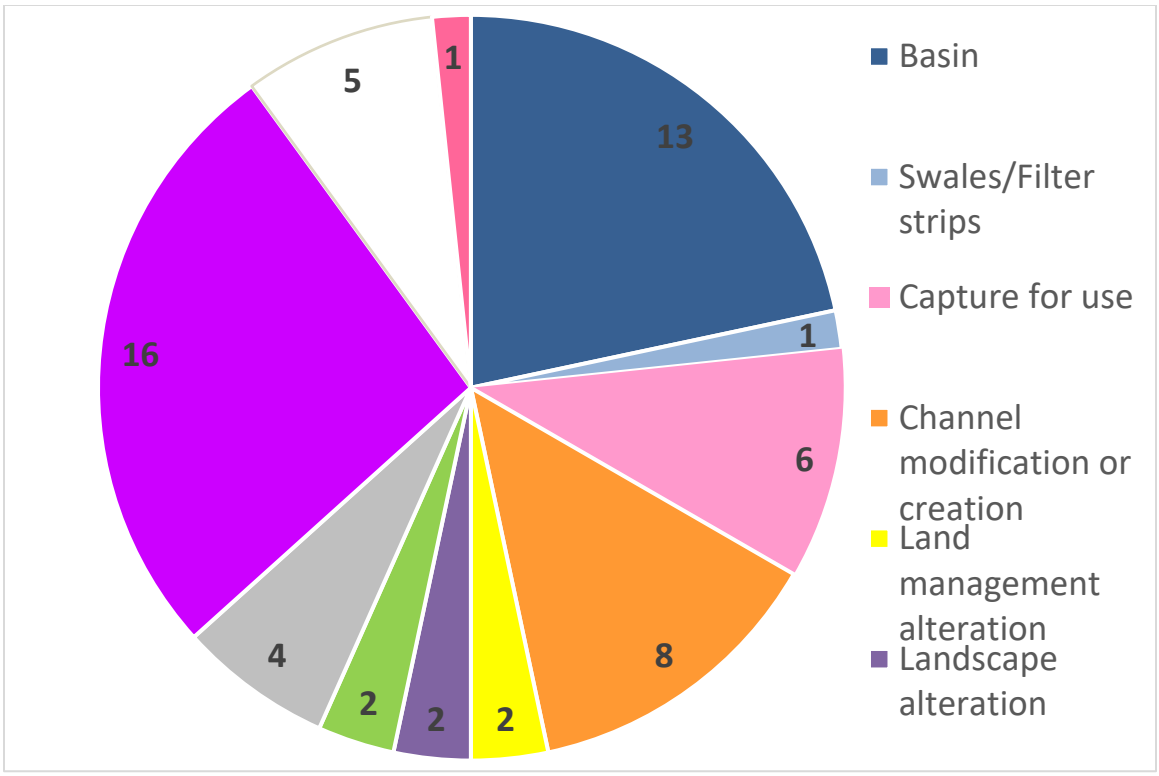
Identification and Prioritization of Projects

- ☒ Plan identifies opportunities to augment local water supply through groundwater recharge or storage for beneficial use of storm water and dry weather runoff.
- ☒ Plan identifies opportunities for source control for both pollution and dry weather runoff volume, onsite and local infiltration, and use of storm water and dry weather runoff.
- ☒ Plan identifies projects that reestablish natural water drainage treatment and infiltration systems, or mimic natural system functions to the maximum extent feasible.
- ☒ Plan identifies opportunities to develop, restore, or enhance habitat and open space through storm water and dry weather runoff management, including wetlands, riverside habitats, parkways, and parks.
- ☒ Plan identifies opportunities to use existing publicly owned lands and easements, including, but not limited to, parks, public open space, community gardens, farm and agricultural preserves, school sites, and government office buildings and complexes, to capture, clean, store, and use storm water and dry weather runoff either onsite or offsite.
- ☒ For new development and redevelopments (if applicable): Plan identifies design criteria and best management practices to prevent storm water and dry weather runoff pollution and increase effective storm water and dry weather runoff management for new and upgraded infrastructure and residential, commercial, industrial, and public development.
- ☒ Plan uses appropriate quantitative methods for prioritization of projects. (This should be accomplished by using a metrics-based and integrated evaluation and analysis of multiple benefits to maximize water supply, water quality, flood management, environmental, and other community benefits within the watershed.)
- ☒ Overall: Plan prioritizes projects and programs using a metric-driven approach and a geospatial analysis of multiple benefits to maximize water supply, water quality, flood management, environmental, and community benefits within the watershed.
- ☒ Multiple benefits: Each project in accordance with the Plan contributes to at least two or more Main Benefits and the maximum number of Additional Benefits as listed in Table 4 of the Guidelines. (Benefits are not counted twice if they apply to more than one category.)

Figure 15 shows the distribution of main management action types, and Figure 16 shows the project locations. A compilation of information provided for each project can be found in Appendix C.

In addition to providing a summarized list of the projects submitted for inclusion in the Southern Sonoma SWRP, Table 22 also provides information on the watershed within which the project is located, the source of submitted project information, and the main management action type. Based on local experience and early input from the TAC, the main management action types were determined by the Southern Sonoma SWRP project team and include the following:

- Basin – *creation of a detention basin for water quality, water supply, and/or flood management benefits*
- Capture for Use – *installation of a storm water collection system for water supply benefits (non-aquifer)*
- Channel modification or creation – *modification to existing channels or creation of new channels for water quality, flood management, and/or environmental benefits*
- Education – *implementation of educational program to address one or more prioritized benefits*
- Infrastructure – *creation or modification of infrastructure (bridges, bypass channels, trash capture devices) for water quality and/or flood management benefits*
- Land management alteration - *modification to residential, agricultural, and natural land management practices for water quality, water supply, flood management, and environmental benefits*
- Landscape alteration – *modification to landscape for water quality, water supply, flood management, and/or environmental benefits*
- Programmatic - *project is within an indeterminate set of locations, or incentivizes private action for one or more prioritized benefits*
- Revegetation – *riparian or wetland habitat restoration for water quality, flood management, and/or environmental benefits*
- Study – *project is in the initial planning stages and will consist of a study to define project components and benefits*
- Swales/Filter Strips - *creation of swales or filter strips for water quality, water supply, and/or flood management benefits*



Note: Number within each pie slice indicates the total number of projects for each management action type

Figure 15 Southern Sonoma SWRP Projects by Management Action Type

TABLE 22
SOUTHERN SONOMA SWRP PROJECTS

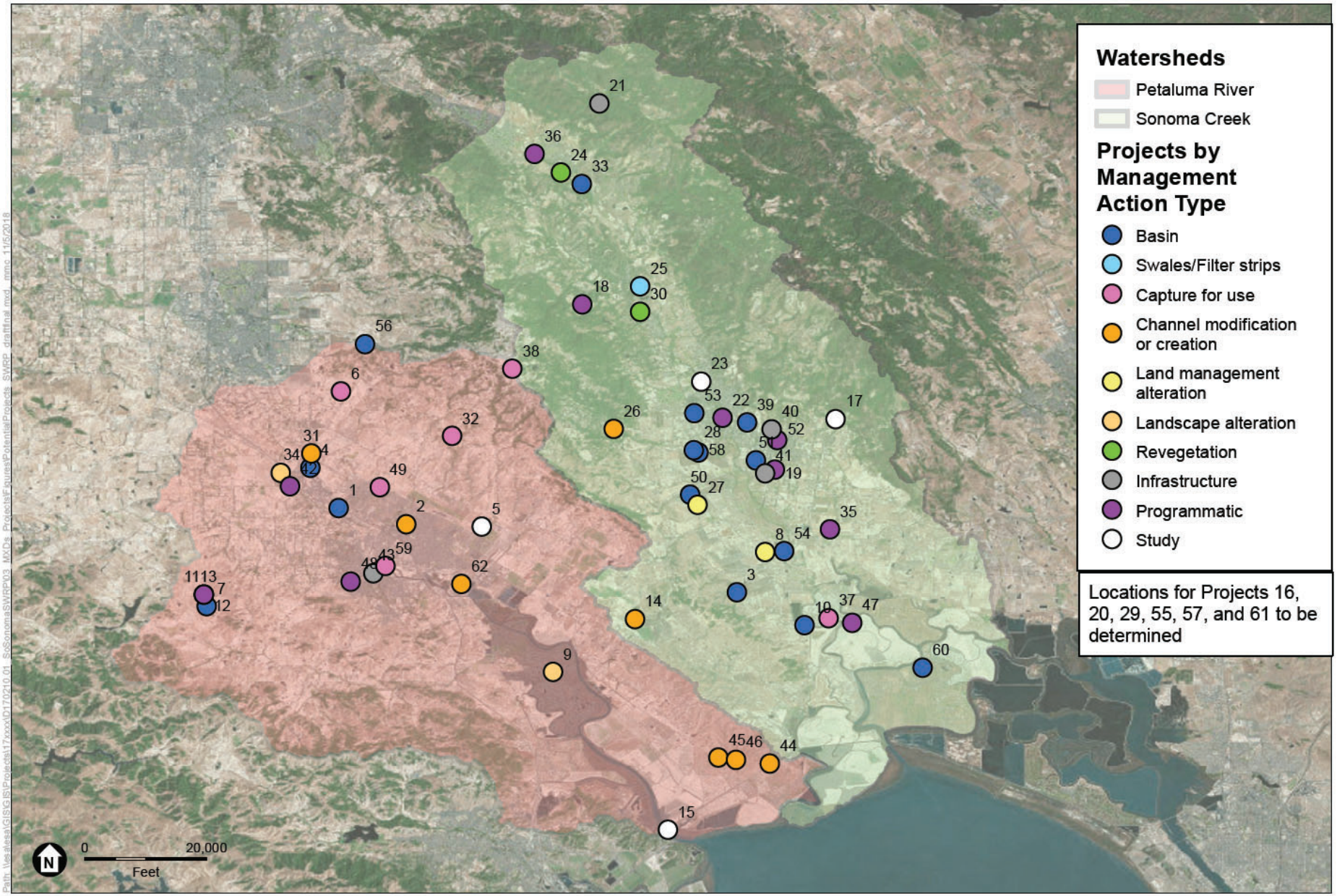
Project ID	Watershed	Project Name	Project Source	Main Management Action Type
1	Petaluma	Petaluma River Corona Reach Linear Overflow Channel	City of Petaluma	Basin
2	Petaluma	Washington Creek Enhancement	City of Petaluma	Channel modification or creation
3	Petaluma	Kelly Creek Enhancements	City of Petaluma	Basin
4	Petaluma	Willow Brook Flood Detention Basin	City of Petaluma	Basin
5	Petaluma	Adobe Creek Floodplain Management and Sediment Study	Sonoma Resource Conservation District	Study
6	Petaluma	Lichau Creek Rainwater Catchment and Wildlife Pond	Sonoma Resource Conservation District	Capture for use
7	Petaluma	King Creek Wetland Development and Riparian Enhancement	Sonoma Resource Conservation District	Basin
8	Sonoma	Multi-Benefit Conservation Plan Implementation for Enhanced Water Quality and Quantity	Sonoma Resource Conservation District	Land management alteration
9	Petaluma	Petaluma River Watershed Multi-Benefit Flood Alleviation, Groundwater Recharge, and Habitat Restoration Project	Sonoma Resource Conservation District	Landscape alteration
10	Sonoma	Circle Bar Ranch Groundwater Recharge	Sonoma Resource Conservation District and ESA with Sue Smith	Basin

TABLE 22 (CONTINUED)
SOUTHERN SONOMA SWRP PROJECTS

Project ID	Watershed	Project Name	Project Source	Main Management Action Type
11	Petaluma	Increasing Groundwater Recharge on Rangelands	Sonoma Resource Conservation District	Programmatic
12	Petaluma	Installing Vegetative Filter Strips to Clean and Infiltrate Water on Ranchlands	Sonoma Resource Conservation District	Programmatic
13	Petaluma	Keyline Ploughing to Increase Groundwater Infiltration on Ranches	Sonoma Resource Conservation District	Programmatic
14	Sonoma	Tolay Lake Restoration	Sonoma County Regional Parks	Channel modification or creation
15	Petaluma	Lower Petaluma River Valley Conservation Strategy	Sonoma Land Trust	Study
16	Both/Either	Erosion Control, Habitat Restoration, Stormwater Capture, and Trash Removal along Sonoma County Roads	Sonoma Ecology Center	Programmatic
17	Sonoma	Stormwater Capture & Groundwater Recharge in Upper Nathanson Creek	Sonoma Ecology Center	Study
18	Sonoma	Stormwater Improvements to Roads and Trails in Sonoma Valley State Parks	Sonoma Ecology Center	Programmatic
19	Sonoma	Middle & Lower Nathanson Creek Flood Management and Habitat Restoration	Sonoma Ecology Center	Programmatic
20	Both/Either	QWEL Rainwater Harvesting Training Module	Sonoma-Marin Saving Water Partnership	Programmatic
21	Sonoma	Sugarloaf State Park Erosion Reduction, Habitat Restoration, and Bridge Repair	Sonoma Ecology Center	Infrastructure
22	Sonoma	Stormwater Management and Habitat Enhancement at Maxwell Farms Regional Park	Sonoma Ecology Center	Programmatic
23	Sonoma	Creek Restoration and Spillway Replacement or Dam Modification at Larson Park	Sonoma Ecology Center	Study
24	Sonoma	Restoration of Natural Hydrology and Salmonid Habitat at Alder Park	Sonoma Ecology Center	Revegetation
25	Sonoma	Stormwater Management at Sonoma Valley Regional Park	Sonoma Ecology Center	Swales/Filter strips
26	Sonoma	Erosion Control and Riparian Restoration at Van Hoosear Wildflower Preserve	Sonoma Ecology Center	Channel modification or creation
27	Sonoma	Stormwater Management and Water Conservation along Rodgers Creek	Sonoma Ecology Center	Land management alteration
28	Sonoma	Carriger Creek Stormwater Capture and Groundwater Recharge	Sonoma Ecology Center	Basin
29	Sonoma	Stormwater Management at Sonoma Valley School Campuses	Sonoma Ecology Center	Programmatic
30	Sonoma	Sonoma Creek Watershed Stream Restoration: Sonoma Developmental Center Reach	Sonoma Ecology Center	Revegetation
31	Petaluma	Willow Brook Creek Groundwater Recharge	Sonoma Resource Conservation District	Channel modification or creation
32	Petaluma	Sonoma Mountain Rainwater Storage and Forbearance of Groundwater Extraction	Sonoma Resource Conservation District	Capture for use
33	Sonoma	Kenwood Marsh Restoration	Sonoma Ecology Center	Basin
34	Petaluma	Upper Petaluma River Watershed Multi-Benefit Flood Alleviation, Groundwater Recharge, and Habitat Restoration Project	Sonoma Resource Conservation District	Landscape alteration
35	Sonoma	Lower Watershed Flood Plain Restoration in Freshwater Streams	Sonoma Ecology Center	Programmatic

TABLE 22 (CONTINUED)
SOUTHERN SONOMA SWRP PROJECTS

Project ID	Watershed	Project Name	Project Source	Main Management Action Type
36	Sonoma	Upper Sonoma Creek Flood Management and Habitat Restoration	Sonoma Ecology Center	Programmatic
37	Sonoma	Lower Sonoma Creek Rainwater Catchment and Stormwater Infiltration Project	Sonoma Resource Conservation District	Capture for use
38	Petaluma	Sonoma Mountain Institute Rainwater Catchment Project	Sonoma Resource Conservation District	Capture for use
39	Sonoma	Olsen Park Detention and Trash Capture	City of Sonoma	Basin
40	Sonoma	First Street West Green Street and Flood Reduction Project	City of Sonoma	Infrastructure
41	Sonoma	Broadway and Leveroni Road Flood Reduction and Trash Capture Project	City of Sonoma	Infrastructure
42	Petaluma	Lichau Creek Flood Mitigation and Detention Basin	City of Petaluma	Programmatic
43	Petaluma	City of Petaluma trash capture device pilot project	City of Petaluma	Infrastructure
44	Petaluma	Cougar Mountain Creek Riparian Restoration	Sonoma Land Trust	Channel modification or creation
45	Petaluma	Lakeville Creek Riparian Restoration	Sonoma Land Trust	Channel modification or creation
46	Petaluma	Frog Creek Riparian Restoration	Sonoma Land Trust	Channel modification or creation
47	Sonoma	Land Acquisition from willing seller in Lower Sonoma Creek	Sonoma Land Trust	Programmatic
48	Petaluma	Stormwater-Friendly Landscape Transformations at Petaluma Schools, Churches, Community Centers and other Public Sites	City of Petaluma & Daily Acts	Programmatic
49	Petaluma	Santa Rosa Junior College Rain Gardens	SRJC & Daily Acts	Capture for use
50	Sonoma	Rodgers Creeks Stormwater Detention	Sonoma County Water Agency	Basin
52	Sonoma	Stormwater Detention on Multiuse Areas in Nathanson Creek	Sonoma County Water Agency	Programmatic
53	Sonoma	El Verano Area Stormwater Detention	Sonoma County Water Agency	Basin
55	Petaluma	Equine Water Stewardship	Equine Environmental Management	Programmatic
56	Petaluma	Upper Lichau Creek Stormwater Detention	Sonoma County Water Agency	Basin
57	Petaluma	Watershed Classroom - Pollution Monitoring & Education in the Petaluma Watershed	Friends of the Petaluma River	Education
58	Sonoma	Carriger Creek Stormwater Detention	Sonoma County Water Agency	Basin
59	Petaluma	Storm Water Capture & Re-Use at Steamer Landing Park	Friends of the Petaluma River	Capture for use
60	Sonoma	Sonoma Creek Stormwater Capture Project	North Bay Agriculture Alliance	Basin
61	Petaluma	Adopt A Creek Project	Friends of the Petaluma River	Study
62	Petaluma	Petaluma River Dredging and Beneficial Re-use of dredge material	City of Petaluma	Channel modification or creation



SOURCE: Projects (ESA/SCWA 2017), Watersheds (SCWA 2017)

Southern Sonoma SWRP

Figure 16

Southern Sonoma SWRP Project Locations

5.3 Eligibility and Initial Quantification Results

5.3.1 Eligibility

To be eligible for inclusion in the Southern Sonoma SWRP, projects must meet two criteria: the project must be located in the project planning area and yield at least two main benefits. All projects submitted to the Southern Sonoma SWRP met the eligibility criteria.

5.3.2 Initial Quantification Results

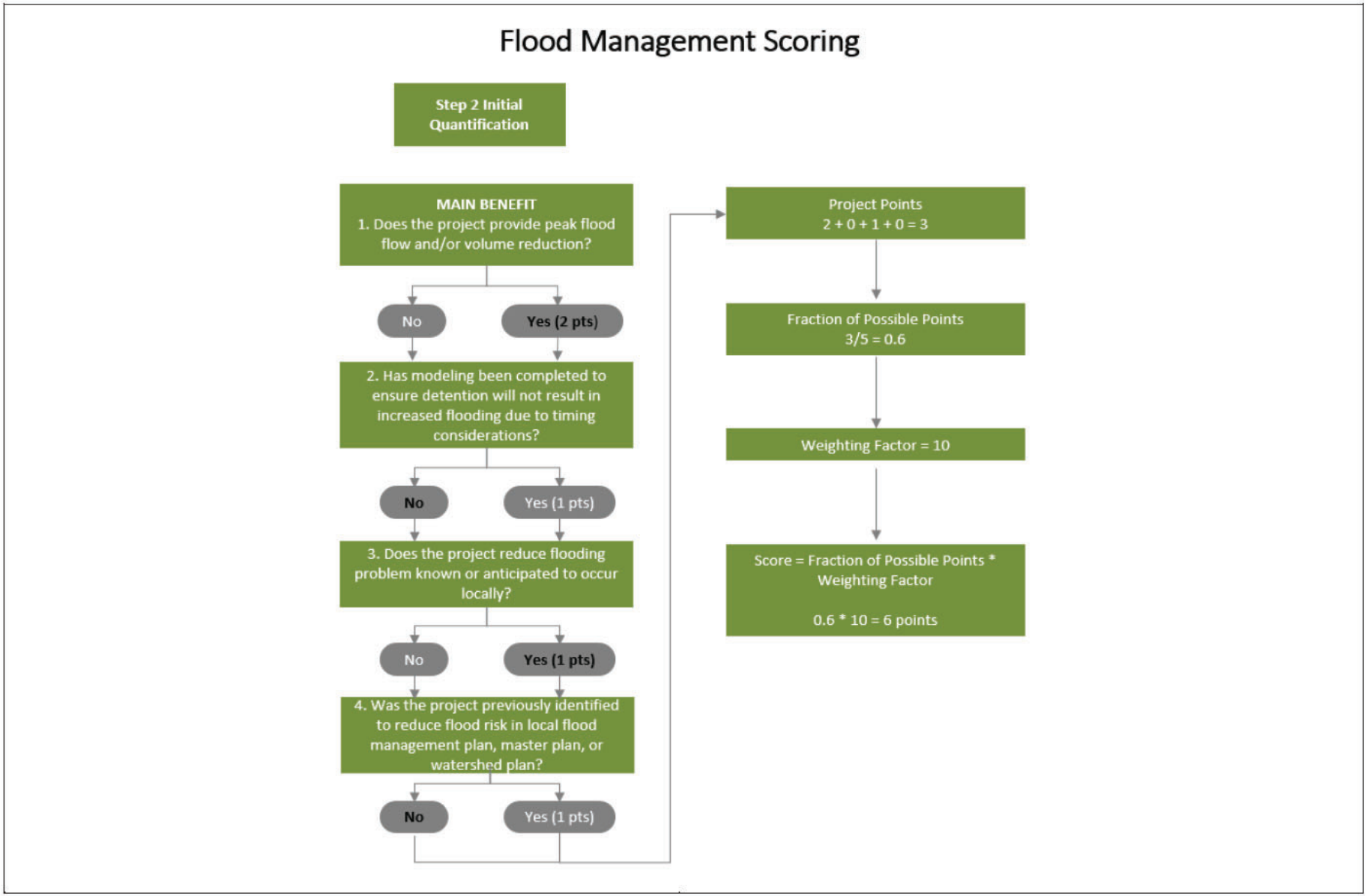
Initial quantification of each project was completed for each benefit using the answers provided by the project proponent. Initial quantification answers were reviewed by the project team for completeness and reasonableness using the project descriptions provided. Revisions and updates to answers provided were then coordinated with each project proponent as needed.

A project received two (2) points for each main benefit addressed and one (1) point for each additional benefit addressed. The total points received for each benefit category were then summed and used to calculate the fraction of total possible points achieved. The total fraction was then multiplied by a benefit weighting factor of 10 to normalize values across the benefit categories. The adjusted values were then summed to produce a total initial score. The maximum possible initial quantification score is fifty (50) points. An example initial scoring calculation for the flood management benefit category can be seen in Table 23 and graphically in Figure 17.

TABLE 23
EXAMPLE FLOOD MANAGEMENT BENEFIT INITIAL SCORING CALCULATION

Flood Management Benefit Category	Possible Points	Answer	Points Scored	Total Points	Fraction of Possible Points	Weighting Value	Initial Score
Does the project provide peak flood flow and/or volume reduction? (Main Benefit)	Yes = 2 No = 0	Yes	2	3	0.6	10	6
Has modeling been completed to ensure detention will not result in increased flooding due to timing considerations?	Yes = 1 No = 0	No	0				
Does the project reduce flooding project reduce flooding problem know or anticipated to occur locally?	Yes = 1 No = 0	Yes	1				
Was the project previously identified to reduce flood risk in a local flood management plan, master plan, or watershed plan?	Yes = 1 No = 0	No	0				

The results of the initial quantification can be seen for the Petaluma and Sonoma watersheds in Table 24 and Table 25, respectively and scoring details can be found in Appendix C. The tables provide the initial score for each benefit category, the total score, and indicate if information was provided to complete detailed quantification.



SOURCE: ESA

Southern Sonoma SWRP

Figure 17

Example Flood Management Benefit Scoring

This page intentionally left blank

TABLE 24
INITIAL QUANTIFICATION RESULTS PETALUMA WATERSHED

Project ID	Watershed	Project Name	Project Source	Eligibility	Water Quality			Water Supply Score		Flood Management		Environment		Community		Total Initial Score
					Initial Score	Detailed Quantification	Source Control	Initial Score	Detailed Quantification	Initial Score	Detailed Quantification	Initial Score	Detailed Quantification	Initial Score	Detailed Quantification	
1	Petaluma	Petaluma River Corona Reach Linear Overflow Channel	City of Petaluma	YES	7.8	Yes	Yes	1.7	Yes	6.0	Yes	7.0	Yes	8.0	Yes	30.4
2	Petaluma	Washington Creek Enhancement	City of Petaluma	YES	5.6	Yes	Yes	1.7	Yes	6.0	Yes	8.0	Yes	6.0	Yes	27.2
3	Petaluma	Kelly Creek Enhancements	City of Petaluma	YES	4.4	No	Yes	1.7	No	8.0	No	5.0	No	5.0	No	24.1
4	Petaluma	Willow Brook Flood Detention Basin	City of Petaluma	YES	5.6	Yes	Yes	1.7	Yes	8.0	Yes	5.0	Yes	8.0	Yes	28.2
5	Petaluma	Adobe Creek Floodplain Management and Sediment Study	Sonoma Resource Conservation District	YES	8.9	No	Yes	5.0	No	6.0	No	10.0	Yes	4.0	Yes	33.9
6	Petaluma	Lichau Creek Rainwater Catchment and Wildlife Pond	Sonoma Resource Conservation District	YES	3.3	No	Yes	4.2	Yes	4.0	No	3.0	Yes	3.0	No	17.5
7	Petaluma	King Creek Wetland Development and Riparian Enhancement	Sonoma Resource Conservation District	YES	6.7	No	Yes	3.3	No	4.0	No	8.0	Yes	4.0	Yes	26.0
9	Petaluma	Petaluma River Watershed Multi-Benefit Flood Alleviation, Groundwater Recharge, and Habitat Restoration Project	Sonoma Resource Conservation District	YES	7.8	No	Yes	1.7	No	8.0	No	5.0	No	7.0	Yes	29.4
11	Petaluma	Increasing Groundwater Recharge on Rangelands	Sonoma Resource Conservation District	YES	3.3	Yes	Yes	3.3	Yes	4.0	Yes	2.0	Yes	3.0	No	15.7
12	Petaluma	Installing Vegetative Filter Strips to Clean and Infiltrate Water on Ranchlands	Sonoma Resource Conservation District	YES	5.6	Yes	Yes	3.3	Yes	4.0	Yes	2.0	Yes	3.0	No	17.9
13	Petaluma	Keyline Ploughing to Increase Groundwater Infiltration on Ranches	Sonoma Resource Conservation District	YES	3.3	Yes	Yes	3.3	Yes	4.0	Yes	2.0	Yes	3.0	No	15.7
15	Petaluma	Lower Petaluma River Valley Conservation Strategy	Sonoma Land Trust	YES	4.4	No	Yes	1.7	No	6.0	No	7.0	No	7.0	No	26.1
16	Both/Either	Erosion Control, Habitat Restoration, and Stormwater / Trash Capture along Roads in Sonoma County	Sonoma Ecology Center	YES	6.7	No	Yes	0.0	No	0.0	No	2.0	No	1.0	No	9.7
20	Both/Either	QWEL Rainwater Harvesting Training Module	Sonoma-Marin Saving Water Partnership	YES	3.3	No	Yes	7.5	No	4.0	No	0.0	No	7.0	No	21.8
31	Petaluma	Willow Brook Creek Groundwater Recharge	Sonoma Resource Conservation District	YES	6.7	No	Yes	7.5	No	6.0	No	10.0	Yes	5.0	Yes	35.2
32	Petaluma	Sonoma Mountain Rainwater Storage and Forbearance of Groundwater Extraction	Sonoma Resource Conservation District	YES	6.7	No	Yes	3.3	Yes	4.0	Yes	6.0	Yes	4.0	Yes	24.0
34	Petaluma	Upper Petaluma River Watershed Multi-Benefit Flood Alleviation, Groundwater Recharge, and Habitat Restoration Project	Sonoma Resource Conservation District	YES	8.9	No	Yes	0.0	No	8.0	No	6.0	No	7.0	Yes	29.9
38	Petaluma	Sonoma Mountain Institute Rainwater Catchment Project	Sonoma Resource Conservation District	YES	2.2	No	Yes	1.7	Yes	4.0	Yes	4.0	Yes	1.0	No	12.9
42	Petaluma	Lichau Creek Flood Mitigation and Detention Basin	City of Petaluma	YES	6.7	No	Yes	1.7	No	8.0	No	3.0	No	7.0	No	26.3
43	Petaluma	City of Petaluma trash capture device pilot project	City of Petaluma	YES	5.6	Yes	Yes	0.0	No	0.0	No	0.0	No	6.0	Yes	11.6
44	Petaluma	Cougar Mountain Creek Riparian Restoration	Sonoma Land Trust	YES	4.4	No	Yes	1.7	No	4.0	No	2.0	No	5.0	No	17.1
45	Petaluma	Lakeville Creek Riparian Restoration	Sonoma Land Trust	YES	5.6	No	Yes	1.7	No	4.0	No	4.0	No	3.0	No	18.2
46	Petaluma	Frog Creek Riparian Restoration	Sonoma Land Trust	YES	6.7	No	Yes	2.5	No	4.0	No	5.0	No	3.0	No	21.2
48	Petaluma	Stormwater-Friendly Landscape Transformations at Petaluma Schools, Churches, Community Centers and other Public Sites	City of Petaluma & Daily Acts	YES	1.1	No	No	3.3	No	0.0	No	1.0	No	6.0	No	11.4
49	Petaluma	Santa Rosa Junior College Rain Gardens	SRJC & Daily Acts	YES	0.0	No	No	4.2	No	0.0	No	3.0	No	6.0	No	13.2

TABLE 24 (CONTINUED)
INITIAL QUANTIFICATION RESULTS PETALUMA WATERSHED

Project ID	Watershed	Project Name	Project Source	Eligibility	Water Quality			Water Supply Score		Flood Management		Environment		Community		Total Initial Score
					Initial Score	Detailed Quantification	Source Control	Initial Score	Detailed Quantification	Initial Score	Detailed Quantification	Initial Score	Detailed Quantification	Initial Score	Detailed Quantification	
55	Petaluma	Equine Water Stewardship	Equine Environmental Management	YES	10.0	No	Yes	10.0	No	10.0	No	8.0	Yes	8.0	Yes	46.0
56	Petaluma	Upper Lichau Creek Stormwater Detention	Sonoma County Water Agency	YES	6.7	Yes	Yes	1.7	Yes	6.0	Yes	1.0	Yes	5.0	Yes	20.3
57	Petaluma	Watershed Classroom - Pollution Monitoring & Education in the Petaluma Watershed	Friends of the Petaluma River	YES	6.7	No	Yes	0.0	No	4.0	No	3.0	No	4.0	No	17.7
59	Petaluma	Storm Water Capture & Re-Use at Steamer Landing Park	Friends of the Petaluma River	YES	5.6	No	Yes	4.2	No	4.0	No	6.0	No	6.0	No	25.7
61	Petaluma	Adopt A Creek Project	Friends of the Petaluma River	YES	3.3	No	Yes	0.8	No	0.0	No	3.0	No	7.0	No	14.2
62	Petaluma	Petaluma River Dredging and Beneficial Re-use of dredge material	City of Petaluma	YES	0.0	No	No	0.0	No	8.0	No	2.0	No	6.0	No	16.0

TABLE 25
INITIAL QUANTIFICATION RESULTS SONOMA WATERSHED

Project ID	Watershed	Project Name	Project Source	Eligibility	Water Quality			Water Supply Score		Flood Management		Environment		Community		Total Initial Score
					Initial Score	Detailed Quantification	Source Control	Initial Score	Detailed Quantification	Initial Score	Detailed Quantification	Initial Score	Detailed Quantification	Initial Score	Detailed Quantification	
8	Sonoma	Multi-Benefit Conservation Plan Implementation for Enhanced Water Quality and Quantity	Sonoma Resource Conservation District	YES	8.9	No	Yes	5.8	No	6.0	No	7.0	No	6.0	No	33.7
10	Sonoma	Circle Bar Ranch Groundwater Recharge	Sonoma Resource Conservation District and ESA with Sue Smith	YES	6.7	Yes	Yes	4.2	Yes	4.0	Yes	4.0	Yes	3.0	No	21.8
14	Sonoma	Tolay Lake Restoration	Sonoma County Regional Parks	YES	7.8	No	Yes	0.0	No	0.0	No	7.0	Yes	6.0	Yes	20.8
16	Both/Either	Erosion Control, Habitat Restoration, and Stormwater / Trash Capture along Roads in Sonoma County	Sonoma Ecology Center	YES	6.7	No	Yes	0.0	No	0.0	No	2.0	No	1.0	No	9.7
17	Sonoma	Stormwater Capture & Groundwater Recharge in Upper Nathanson Creek	Sonoma Ecology Center	YES	5.6	No	Yes	1.7	No	6.0	No	2.0	No	0.0	No	15.2
18	Sonoma	Stormwater Improvements to Roads and Trails in Sonoma Valley State Parks	Sonoma Ecology Center	YES	6.7	No	Yes	0.0	No	4.0	No	2.0	No	4.0	No	16.7
19	Sonoma	Middle & Lower Nathanson Creek Flood Management and Habitat Restoration	Sonoma Ecology Center	YES	6.7	No	Yes	0.0	No	6.0	No	4.0	No	4.0	No	20.7
20	Both/Either	QWEL Rainwater Harvesting Training Module	Sonoma-Marin Saving Water Partnership	YES	3.3	No	Yes	7.5	No	4.0	No	0.0	No	7.0	No	21.8
21	Sonoma	Sugarloaf State Park Erosion Reduction, Habitat Restoration, and Bridge Repair	Sonoma Ecology Center	YES	4.4	No	Yes	0.0	No	0.0	No	2.0	No	4.0	No	10.4
22	Sonoma	Stormwater Management & Habitat Enhancement at Maxwell Park	Sonoma Ecology Center	YES	5.6	No	Yes	2.5	No	6.0	No	3.0	No	4.0	No	21.1
23	Sonoma	Creek Restoration and Spillway Replacement or Dam Modification at Larson Park	Sonoma Ecology Center	YES	6.7	No	Yes	1.7	No	0.0	No	4.0	No	4.0	No	16.3
24	Sonoma	Restoration of Natural Hydrology and Salmonid Habitat at Alder Park	Sonoma Ecology Center	YES	0.0	No	Yes	0.0	No	0.0	No	3.0	No	3.0	No	6.0
25	Sonoma	Stormwater Management at Sonoma Valley Regional Park	Sonoma Ecology Center	YES	5.6	No	Yes	1.7	No	4.0	No	2.0	No	4.0	No	17.2
26	Sonoma	Erosion Control and Riparian Restoration at Van Hoosear Wildflower Preserve	Sonoma Ecology Center	YES	4.4	No	Yes	0.0	No	4.0	No	3.0	No	3.0	No	14.4
27	Sonoma	Stormwater Management and Water Conservation along Rodgers Creek	Sonoma Ecology Center	YES	7.8	No	Yes	5.0	No	4.0	No	4.0	No	4.0	No	24.8
28	Sonoma	Carriger Creek Stormwater Capture and Groundwater Recharge	Sonoma Ecology Center	YES	7.8	No	Yes	3.3	No	4.0	No	2.0	No	1.0	No	18.1
29	Sonoma	Stormwater Management at Sonoma Valley School Campuses	Sonoma Ecology Center	YES	5.6	No	Yes	1.7	No	6.0	No	4.0	No	5.0	No	22.2
30	Sonoma	Sonoma Creek Watershed Stream Restoration: Sonoma Developmental Center Reach	Sonoma Ecology Center	YES	7.8	No	Yes	1.7	No	4.0	No	2.0	No	3.0	No	18.4
33	Sonoma	Kenwood Marsh Restoration	Sonoma Ecology Center	YES	7.8	No	Yes	7.5	No	6.0	No	3.0	No	1.0	No	25.3
35	Sonoma	Lower Watershed Flood Plain Restoration in Freshwater Streams	Sonoma Ecology Center	YES	2.2	No	Yes	0.0	No	6.0	No	3.0	No	4.0	No	15.2
36	Sonoma	Upper Sonoma Creek Flood Management and Habitat Restoration	Sonoma Ecology Center	YES	7.8	No	Yes	5.8	No	8.0	No	3.0	No	4.0	No	28.6
37	Sonoma	Lower Sonoma Creek Rainwater Catchment and Stormwater Infiltration Project	Sonoma Resource Conservation District	YES	4.4	Yes	Yes	3.3	Yes	4.0	Yes	4.0	Yes	1.0	No	16.8
39	Sonoma	Olsen Park Detention and Trash Capture	City of Sonoma	YES	6.7	Yes	Yes	1.7	No	6.0	Yes	1.0	No	1.0	Yes	16.3
40	Sonoma	First Street West Green Street and Flood Reduction Project	City of Sonoma	YES	6.7	Yes	Yes	1.7	No	6.0	Yes	4.0	No	1.0	No	19.3

TABLE 25 (CONTINUED)
INITIAL QUANTIFICATION RESULTS SONOMA WATERSHED

Project ID	Watershed	Project Name	Project Source	Eligibility	Water Quality			Water Supply Score		Flood Management		Environment		Community		Total Initial Score
					Initial Score	Detailed Quantification	Source Control	Initial Score	Detailed Quantification	Initial Score	Detailed Quantification	Initial Score	Detailed Quantification	Initial Score	Detailed Quantification	
41	Sonoma	Broadway and Leveroni Road Flood Reduction and Trash Capture Project	City of Sonoma	YES	5.6	Yes	Yes	0.0	No	8.0	No	0.0	No	0.0	No	13.6
47	Sonoma	Land Acquisition from willing seller in Lower Sonoma Creek	Sonoma Land Trust	YES	1.1	No	Yes	0.0	No	6.0	No	3.0	No	2.0	No	12.1
50	Sonoma	Rodgers Creeks Stormwater Detention	Sonoma County Water Agency	YES	6.7	Yes	Yes	1.7	Yes	8.0	Yes	6.0	Yes	8.0	Yes	30.3
51	Sonoma	Stormwater detention- Southern Fryer Creek watershed	Sonoma County Water Agency	YES	3.3	No	Yes	0.8	No	6.0	No	1.0	No	5.0	No	16.2
52	Sonoma	Stormwater Detention on Multiuse Areas in Nathanson Creek	Sonoma County Water Agency	YES	5.6	Yes	Yes	2.5	Yes	8.0	Yes	2.0	Yes	7.0	Yes	25.1
53	Sonoma	El Verano Area Stormwater Detention	Sonoma County Water Agency	YES	5.6	Yes	Yes	1.7	Yes	2.0	No	3.0	Yes	8.0	Yes	20.2
54	Sonoma	Lower Sonoma Creek Stormwater Capture Project	Tito Sasaki	YES	0.0	No	Yes	3.3	No	6.0	No	0.0	No	0.0	No	9.3
58	Sonoma	Carriger Creek Stormwater Detention	Sonoma County Water Agency	YES	6.7	Yes	Yes	1.7	Yes	4.0	No	3.0	Yes	3.0	Yes	18.3
60	Sonoma	Sonoma Creek Stormwater Capture Project	North Bay Agriculture Alliance	YES	5.6	No	Yes	9.2	No	6.0	No	9.0	No	6.0	Yes	35.7
63	Sonoma	Circle Bar Ranch Groundwater Recharge	ESA with Sue Smith	YES	6.7	No	Yes	1.7	No	4.0	No	3.0	No	1.0	No	16.3

5.4 Detailed Quantification

This section provides a summary of the process used to complete the detailed quantification of projects submitted for the Southern Sonoma SWRP. It also presents point system thresholds used to score the detailed quantification and the results of the quantification. Twenty-five (25) of the sixty (60) projects eligible for the SWRP provided data to support detailed quantification.

5.4.1 Methods and Results

Detailed quantification was completed using a combination of applicant-submitted information and results derived by analysis. Project data and information submitted by the applicants for detailed quantification was reviewed by the project team for agreement with initial quantification answers, completeness and reasonableness using the project descriptions provided, and consistency across projects. Revisions and updates to answers provided were then coordinated with each project proponent as needed. Applicant-submitted information was used to quantify benefits under the Environmental and Community benefit categories. Analysis using applicant-submitted information was conducted to determine most benefits under the Water Quality, Water Supply, and Flood Management benefit categories.

The overall detailed quantification approach for the Water Quality, Water Supply, and Flood Management benefit was to develop regional relationships and approaches that rely on modeling to establish curves that relate benefits to project scale or proposed BMP size (ESA 2017). Project data was reviewed and relationships were developed for the most common BMPs included in the projects submitted: extended detention basins/constructed wetlands, bioswales, and filter strips. The sections below provide information on how benefits were quantified for each benefit category.

Water Quality Benefits

Pollutant Load Reduction

Pollutant load reduction was determined by calculating and combining the load reduction due to volume capture and the load reduction due to treatment for each project using the formula below.

$$BMP_{\text{Total Load Removed}} = BMP_{\text{Load Lost to Volume Reduction}} + BMP_{\text{Load Lost to Treatment}}$$

where: $BMP_{\text{Load Lost to Volume Reduction}} = APL_{\text{Total}} * \%VR$

$BMP_{\text{Load Lost to Treatment}} = APL_{\text{Total}} * (1-\%VR) * (\text{BMP Efficiency}_{\text{Treatment}})$

APL = Annual Pollutant Load = Annual Runoff * Pollutant Loading Rate

%VR = Volume Reduction Rate

Annual Pollutant Load

Annual pollutant loading rates documented in the report *Contaminant Loads From Stormwater to Coastal Water in the San Francisco Bay Region* (SFEI 2000) were used for the project area as summarized in Table 26. Projects in the Sonoma Creek watershed were analyzed for sediment and pathogens/bacteria; projects in the Petaluma River watershed were analyzed for sediment and pathogens/bacteria, nutrients, trash, and nickel; and projects from both watersheds were analyzed for diazinon, mercury, and PCBs based on TMDLs for the watersheds.

TABLE 26
POLLUTANT LOADING RATES BY WATERSHED AND LAND USE

Watershed	Land Use	Sediment (lb/ac/yr)	Pathogens (MPN/af/yr)	Nutrients (lb/ac/yr)	Trash (gal/ac/yr)	Nickel (lb/ac/yr)	Diazinon (lb/af/yr)	Mercury (lb/af/yr)	PCBs (lb/af/yr)
Petaluma	Rural	861	1E+07	7.3	0.17	2E-01	1E-05	1E-04	3E-06
Petaluma	Urban	477	1E+07	2.3	1.25	3E-02	7E-05	7E-04	1E-05
Sonoma	Rural	1581	1E+07	na	na	na	1E-05	1E-04	3E-06
Sonoma	Urban	475	1E+07	na	na	na	7E-05	7E-04	1E-05
Both/Either	Rural	861	1E+07	7.3	0.17	2E-01	1E-05	1E-04	3E-06

Trash baseline loading rates specific to the Petaluma watershed are not available at this time. Therefore, trash baseline loading rates are based on Bay Area averages determined for San Francisco Bay Area MS4s as shown in Table 27 below (EOA, 2012).

TABLE 27
TRASH LOADING RATES BY LAND USE CATEGORY

Land Use	Annual Generation Rate (gal/ac/yr)
Retail and Wholesale	29.99
High Density Residential	17.04
K-12 Schools	13.14
Commercial/Services and Heavy, Light and Other Residential	7.08
Urban Parks	2.14
Low Density Residential	1.25
Rural Residential	0.17

BMP Treatment Efficiency

Treatment efficiencies applicable to the SWRP are listed below and are based on data from the International Stormwater BMP Database (2016), which provides data for solids, bacteria, nutrients, and metals. Total Suspended Solids (TSS) treatment efficiency was applied to sediments, pathogens, bacteria, and PCB loading rates. TSS is an effective proxy as pathogens, bacteria, and PCBs all sorb to sediment. In addition, reported treatment efficiencies for bacteria and pathogens are similar to those of TSS. Treatment efficiencies for mercury and diazinon (an organophosphorus pesticide) are not currently available in the BMP Database. However, both

mercury and diazinon have been found to behave similarly to sediment particles, and thus TSS was used as proxy for treatment of these pollutant loads (Yee and McKee 2010, Schueler and Youngk, 2015). Treatment efficiency for nutrients was estimated using data for total nitrogen removal.

Treatment efficiencies ($BMP_{EfficiencyTreatment}$ = 1-[$C_{effluent}$]/[$C_{influent}$]) for each of the three BMP types modeled are included below.

- Extended Detention Basin/Constructed Wetland
  - TSS = 0.69
  - Total Nitrogen = 0.13
  - Dissolved Nickel = NA. Treatment efficiencies for dissolved nickel in extended detention basins/constructed are inconclusive. The reasons for this are not fully documented; however, native soils are often high in nickel, leading to leaching of naturally-occurring nickel from the soils. The efficiency of an extended detention basin/constructed wetland in removing nickel will be dependent on the project site soil conditions.
- Filter Strip
  - TSS = 0.16
  - Total Nitrogen = 0.19
  - Dissolved Nickel = 0.19
- Bioswale
  - TSS = 0.57
  - Total Nitrogen = NA. Treatment efficiencies for total nitrogen in bioswales are inconclusive. The reasons for this are not fully documented, but could be related to management and maintenance practices.
  - Dissolved Nickel = 0.59

Trash removal efficiency was based on the volume capture.

Volume Reduction

Environmental Protection Agency Storm Water Management Model (EPA-SWMM), version 5, was used to establish general relationships for BMP performance with respect to volume capture. EPA-SWMM is a hydrology model used to simulate runoff quality and quantity of single event or continuous rainfall. A suite of volume reduction curves was developed based on subcatchments that varied based on size, land use type, soil type, and routing type, as provided by the project proponents. Runoff from subcatchment areas was routed to each of the identified BMP's (detention basin, filter strip/bioswale) and output runoff was recorded. Pollutant load reductions were based on volume captured by the treatment area. Curves were developed to encompass the range of drainage area parameters and BMP types and sizes

submitted by the project applicants. The curves used to evaluate the projects can be found in Appendix D.

Pollutant Load Reduction Results

Of the 60 projects included the SWRP, 48 will provide water quality benefits through increased filtration and/or treatment. Of these 48 project, 12 projects provided sufficient project data to calculate pollutant load reductions, 4 located in the Petaluma River watershed and 8 located in the Sonoma Creek watershed. The results of the pollutant load reduction analysis for projects that supplied quantifiable data are summarized in Table 28 below.

The collective level of potential pollutant load reduction from the SWRP projects as summarized in Table 28 is very modest, however the results represent only a portion of the projects and the actual total potential pollutant load reduction for all 48 projects will likely be much higher than the amount currently calculated. Sediment load reduction appears to be the most significant water quality enhancement that would result from the implementation of the proposed projects in both watersheds. For Sonoma Creek, where loading estimates have been developed, the SWRP projects are estimated to address as much as 5% of the estimated human-induced loading of sediment within the Sonoma Creek watershed. The projects appear to have the least effects on nickel, diazinon, mercury, and PCB's. Nickel reduction applies to the Petaluma River watershed only and of the projects submitted in the watershed, only one proposed the use of a BMP effective for removal of nickel.

In addition to the pollutants summarized above, 39 of the 60 projects will provide non-point source pollution reduction. Only one project provided data on non-point source pollution reduction; Project 42, the City of Petaluma's Trash Capture Device Pilot Program, which is estimated to remove 92 lbs/year.

TABLE 28
POLLUTANT LOAD REDUCTION RESULTS

Project ID	Watershed	Project Name	BMP Type	Pollutant Load Reduction							
				Sediment (lb/yr)	Pathogens (MPN/yr)	Nutrients (lb/yr)	Trash (gal/yr)	Nickel (lb/yr)	Diazinon (lb/yr)	Mercury (lb/yr)	PCB's (lb/yr)
1	Petaluma	Petaluma River Corona Reach Linear Overflow Channel	Detention Basin	110,378	7.09E+09	284	127	na	0.03	0.34	0.01
4	Petaluma	Willow Brook Flood Detention Basin	Detention Basin	3,704,287	7.32E+10	7,769	52	na	0.07	0.70	0.02
10	Sonoma	Circle Bar Ranch Groundwater Recharge	Detention Basin	35,609	3.44E+08	na	na	na	0.00	0.00	0.00
12	Petaluma	Installing Vegetative Filter Strips to Clean and Infiltrate Water on Ranchlands	Filter Strip	1,056	1.88E+07	9	0.18	0.22	0.00	0.00	0.00
37	Sonoma	Lower Sonoma Creek Rainwater Catchment and Stormwater Infiltration Project	Detention Basin	1,982	1.45E+07	na	na	na	0.00	0.00	0.00
39	Sonoma	Olsen Park Detention and Trash Capture	Detention Basin	51,031	2.19E+09	na	na	na	0.01	0.11	0.00
40	Sonoma	First Street West Green Street and Flood Reduction Project	Bioswale	221	1.62E+07	na	na	na	0.00	0.00	0.00
50	Sonoma	Rodgers Creeks Stormwater Detention	Detention Basin	699,975	3.95E+10	na	na	na	0.19	1.90	0.04
52	Sonoma	Stormwater Detention on Multiuse Areas in Nathanson Creek	Detention Basin	1,011,794	6.72E+10	na	na	na	0.32	3.23	0.07
53	Sonoma	El Verano Area Stormwater Detention	Detention Basin	28,883	1.49E+09	na	na	na	0.01	0.07	0.00
56	Petaluma	Upper Lichau Creek Stormwater Detention	Detention Basin	49,965	1.45E+09	347	8	na	0.00	0.01	0.00
58	Sonoma	Carriger Creek Stormwater Detention	Detention Basin	5,107,193	1.26E+11	na	na	na	0.12	1.21	0.03
TOTAL	**Petaluma**			**3,865,686**	**8.18E+10**	**8,410**	**187**	**0.22**	**0.11**	**1.06**	**0.02**
TOTAL	**Sonoma**			**6,936,687**	**2.37E+11**	**na**	**na**	**na**	**0.65**	**6.52**	**0.15**

Volume of Storm Water Diverted

The volume capture curves developed to calculate the pollutant load reduction due to volume capture were also used to calculate the water quality benefits from the volume of storm water diverted through infiltration and/or evapotranspiration. Of the 60 projects included in the SWRP, 49 will provide water quality benefits through storm water diversion. Of these 49 projects, 14 projects provided sufficient project data to calculate pollutant load reductions, 7 located in the Petaluma River watershed and 7 located in the Sonoma Creek watershed. The results of the volume diversion analysis for projects that supplied quantifiable data are summarized in Table 29 below. While the diverted volume totals, and therefore the associated pollutant load reduction, are relatively modest, they would be incrementally beneficial to the watersheds. In addition, the results represent only a portion of the projects in the SWRP and the actual total potential water quality benefits via storm water diversion for all 49 projects will likely be much higher than the amount currently calculated.

TABLE 29
WATER QUALITY STORM WATER DIVERSION RESULTS

Project ID	Watershed	Project Name	BMP Type	Volume of storm water diverted (acre-feet/yr)
1	Petaluma	Petaluma River Corona Reach Linear Overflow Channel	Detention Basin	228
2	Petaluma	Washington Creek Enhancement	Channel Modification/ Creation	1,418
4	Petaluma	Willow Brook Flood Detention Basin	Detention Basin	381
10	Sonoma	Circle Bar Ranch Groundwater Recharge	Detention Basin	19
11	Petaluma	Increasing Groundwater Recharge on Rangelands	Infiltration Trench	19
12	Petaluma	Installing Vegetative Filter Strips to Clean and Infiltrate Water on Ranchlands	Filter Strip	1.2
13	Petaluma	Keyline Ploughing to Increase Groundwater Infiltration on Ranches	Infiltration Trench	1.2
37	Sonoma	Lower Sonoma Creek Rainwater Catchment and Stormwater Infiltration Project	Detention Basin	0.6
40	Sonoma	First Street West Green Street and Flood Reduction Project	Bioswale	0.7
50	Sonoma	Rodgers Creeks Stormwater Detention	Detention Basin	946
52	Sonoma	Stormwater Detention on Multiuse Areas in Nathanson Creek	Detention Basin	1,069
53	Sonoma	El Verano Area Stormwater Detention	Detention Basin	54
56	Petaluma	Upper Lichau Creek Stormwater Detention	Detention Basin	82
58	Sonoma	Carriger Creek Stormwater Detention	Detention Basin	4,544
TOTAL	**Petaluma**			**2,151**
TOTAL	**Sonoma**			**6,652**

Water Supply Benefits

Water supply quantification includes volume of storm water collected, stored, and diverted above ground offsetting irrigation use (acre-ft/year) and volume of storm water infiltrated into water supply and non-water supply groundwater aquifers (acre-ft).

Irrigation Offset

Above ground storage to offset irrigation use was calculated using the formula below and values provided by the applicants. The results of the analysis for projects that supplied quantifiable data are summarized in Table 30 below. Twenty-three of the 60 projects included in the SWRP will provide water supply benefits through above ground collection and storage of storm water. Of these 23 project, 4 projects provided sufficient project data to calculate irrigation offset volumes, 3 located in the Petaluma River watershed and 1 located in the Sonoma Creek watershed. For context, the total volume of storm water collected to offset irrigation use would be equivalent to the yearly average landscaping use of approximately 17 residents in Petaluma and 2 residents in Sonoma. These estimations are based on an average of 75 gallons per capita per day (GPCD) for Petaluma and 128 GPCD for Sonoma (Sonoma Marin Saving Water Partnership, 2014-2017). While the offset volume totals are extremely modest, they would represent beneficial increases in water supply. In addition, the results represent only a small portion of the 23 projects in the SWRP providing irrigation offset and the actual total volume would be much greater.

$$BMP_{Volume\ Offset} = V_{STORAGE} * \#_{AnnualCycles}$$

TABLE 30
IRRIGATION OFFSET QUANTIFICATION RESULTS

Project ID	Watershed	Project Name	BMP Type	Volume of water collected, stored, or diverted to offset irrigation use (gal/yr)
6	Petaluma	Lichau Creek Rainwater Catchment and Wildlife Pond	Rainwater catchment tank	20,000
32	Petaluma	Sonoma Mountain Rainwater Storage and Forbearance of Groundwater Extraction	Rainwater catchment tank	300,000
37	Sonoma	Lower Sonoma Creek Rainwater Catchment and Stormwater Infiltration Project	Rainwater catchment tank	90,000
38	Petaluma	Sonoma Mountain Institute Rainwater Catchment Project	Rainwater catchment tank	150,000
Total	**Petaluma**			**470,000**
Total	**Sonoma**			**90,000**

Twenty-three of the 60 projects included in the SWRP will provide water supply benefits through above ground collection and storage of storm water. Of these 23 project, 4 projects provided sufficient project data to calculate irrigation offset volumes, 3 located in the Petaluma River watershed and 1 located in the Sonoma Creek watershed. For context, the total volume of storm water collected to offset irrigation use would be equivalent to the yearly average

landscaping use of approximately 17 residents in Petaluma and 2 residents in Sonoma. These estimations are based on an average of 75 gallons per capita per day (GPCD) for Petaluma and 128 GPCD for Sonoma (Sonoma Marin Saving Water Partnership, 2014-2017). While the offset volume totals are extremely modest, they would represent beneficial increases in water supply. In addition, the results represent only a small portion of the 23 projects in the SWRP providing irrigation offset and the actual total volume would be much greater.

Groundwater Infiltration

Groundwater infiltration is proportional to volume capture per BMP type. The volume capture relationships developed for the water quality benefit analysis were applied to the water supply analysis to determine the volume of storm water infiltrated into the water supply and non-water supply aquifers (see curves in Appendix D). The designation of water supply or non-water supply aquifers was provided by the project applicant. The results of the analysis for water supply and non-water supply infiltration are summarized in Table 31 and Table 32 below.

Of the 60 projects included in the SWRP, 26 will provide water supply benefits through infiltration to a water supply aquifer and 23 will provide water supply benefits through infiltration to a non-water supply aquifer. Of these 49 totals project, 13 projects provided sufficient project data to calculate recharge volume, 7 located in the Petaluma River watershed, and 6 located in the Sonoma Creek watershed. The estimated volume of water to be recharged if all proposed projects were implemented, particularly if successful in reaching depleted aquifers, appears to be significant. For the Sonoma Valley, where such data is available, the estimated total recharge amount exceeds the current estimate of annual deficit in the Sonoma Groundwater basin.

TABLE 31
VOLUME OF WATER INFILTRATED INTO A WATER SUPPLY AQUIFER

Project ID	Watershed	Project Name	BMP Type	Volume of water infiltrated into a water supply aquifer (acre-ft/yr)
1	Petaluma	Petaluma River Corona Reach Linear Overflow Channel	Detention Basin	228
2	Petaluma	Washington Creek Enhancement	Channel Modification/ Creation	1,418
4	Petaluma	Willow Brook Flood Detention Basin	Detention Basin	381
37	Sonoma	Lower Sonoma Creek Rainwater Catchment and Stormwater Infiltration Project	Detention Basin	1
50	Sonoma	Rodgers Creeks Stormwater Detention	Detention Basin	946
52	Sonoma	Stormwater Detention on Multiuse Areas in Nathanson Creek	Detention Basin	1,069
53	Sonoma	El Verano Area Stormwater Detention	Detention Basin	54
56	Petaluma	Upper Lichau Creek Stormwater Detention	Detention Basin	82
58	Sonoma	Carriger Creek Stormwater Detention	Detention Basin	4,544
TOTAL	**Petaluma**			**2,109**
TOTAL	**Sonoma**			**6,613**

TABLE 32
VOLUME OF WATER INFILTRATED INTO A NON-WATER SUPPLY AQUIFER

Project ID	Watershed	Project Name	BMP Type	Volume of water infiltrated into a non-water supply aquifer (acre-ft/yr)
10	Sonoma	Circle Bar Ranch Groundwater Recharge	Infiltration Trench	19
11	Petaluma	Increasing Groundwater Recharge on Rangelands	Infiltration Trench	19
12	Petaluma	Installing Vegetative Filter Strips to Clean and Infiltrate Water on Ranchlands	Filter Strip	1
13	Petaluma	Keyline Ploughing to Increase Groundwater Infiltration on Ranches	Infiltration Trench	1
TOTAL	**Petaluma**			**21**
TOTAL	**Sonoma**			**19**

Additional Water Supply Benefits

In addition to the irrigation offset and groundwater infiltration benefits discussed above, the projects will also collectively provide the following water supply benefits:

- 6 of the projects will enhance water supply reliability through means other than storage, diversion, or infiltration
- 6 of the projects will further conjunctive use management through means other than direct recharge
- 11 of the projects will produce increased water use efficiency

Flood Management Benefits

A HEC-HMS model was used for flood reduction benefit analysis and development of general rule curves that can be applied within the planning area. Modeling was limited to detention basins, relating proposed detention basin size to peak flow reduction for a range of subbasin parameters including composite curve number and lag time.

The Southern Sonoma SWRP covers two main watershed areas; Petaluma River and Sonoma Creek. Rainfall data for the analysis was based on point precipitation frequencies at the centroid of the watersheds (NOAA, 2017). A drainage size of 100 acres was used to develop the curves. Peak flow reduction and detention volume are scalable by drainage area size, so the curve results can be easily estimated for any flood management project size. To address different basin losses based on land use, curve numbers of 55, 80, and 95, representing rural agricultural/ farmstead, urban open space, and urban commercial respectively, were used. To address different hydrograph transformations based on watershed area, lag times of 0.1, 0.5, and 1 hour were used. Relationships were developed for 25, 50 and 100-year storm events. The flood management curves created for the analysis can be found in Appendix E.

While relationship curves were developed for multiple storm events, benefits were only analyzed for the 25-year storm event. The results of this analysis for peak flow reduction and flood volume reduction can be seen in Table 33. Of the 60 projects included in the SWRP, 49 will provide flood management benefits through peak flood flow and/or volume reduction. Of these 49 project, 15 projects provided sufficient project data to calculate peak flow and flood volume reductions, 9 located in the Petaluma River watershed and 6 located in the Sonoma Creek watershed. The peak flow reduction is likely to translate into the most significant flood benefit of the proposed projects. It would be expected to have the greatest effect immediately downstream of any given project and may provide modest localized benefits in reduced stage and overbank flooding. Benefits would continue to also accrue for some distance downstream, due to the reduction in flow, and may compound due to the presence of additional projects.

TABLE 33
PEAK FLOOD AND FLOOD VOLUME REDUCTION RESULTS FOR A 25-YEAR STORM

Project ID	Watershed	Project Name	Peak Flow Reduction (cfs)	Flood Volume Reduction (acre-feet/yr)
1	Petaluma	Petaluma River Corona Reach Linear Overflow Channel	350	10
2	Petaluma	Washington Creek Enhancement	600	9
4	Petaluma	Willow Brook Flood Detention Basin	350	6
10	Sonoma	Circle Bar Ranch Groundwater Recharge	14	12.5
11	Petaluma	Increasing Groundwater Recharge on Rangelands	15	12.5
12	Petaluma	Installing Vegetative Filter Strips to Clean and Infiltrate Water on Ranchlands	7	0.1
13	Petaluma	Keyline Ploughing to Increase Groundwater Infiltration on Ranches	7	0.1
32	Petaluma	Sonoma Mountain Rainwater Storage and Forbearance of Groundwater Extraction	1	0.6
37	Sonoma	Lower Sonoma Creek Rainwater Catchment and Stormwater Infiltration Project	1	0.1
38	Petaluma	Sonoma Mountain Institute Rainwater Catchment Project	1	0.5
39	Sonoma	Olsen Park Detention and Trash Capture	50	2.8
40	Sonoma	First Street West Green Street and Flood Reduction Project	70	3
50	Sonoma	Rodgers Creeks Stormwater Detention	85	9
52	Sonoma	Stormwater Detention on Multiuse Areas in Nathanson Creek	60	36
56	Petaluma	Upper Lichau Creek Stormwater Detention	80	87.6
TOTAL*	**Petaluma**		**1,411**	**126**
TOTAL*	**Sonoma**		**280**	**63**

NOTE:
* Note that while a total value is calculated for peak flow reduction as a way of visualizing project impacts, this value does not represent a reduction in peak flows at any given location. Specific modeling of a system of projects within a watershed context would be needed to assess the cumulative benefit of multiple projects on flows at any given location.

Environmental and Community Benefits

Quantifiable values for environmental and community benefit analysis were provided by the project applicant and are shown in Table 34 and Table 35 respectfully. Most benefits are quite modest, except for the areas of enhanced or created wetlands and/or riparian, created urban green space, and enhanced or created recreational and public use areas, which are at a regionally-significant scale. Similarly to the water quality, water supply, and flood benefits, the collective benefits in Table 34 and Table 35 results represent only a portion of the projects and the actual total potential environmental and community benefits will likely be much higher than the amount currently calculated. Additional details are provided below. More refined project descriptions may provide increased levels and quantification of environmental and community benefits.

Environmental Benefits

- 48 projects will protect, conserve, create or enhance wetlands, aquatic, and/or riparian habitat, 13 of which provided detailed quantification for a total of approximately 340 acres of habitat benefits
- 14 projects will increase streamflow during the low flow season, only 1 of which provided detailed quantification
- 10 projects will create urban green space, 5 of which provided detailed quantification for a total of 32 acres of green space in the Petaluma River watershed and 1.5 acres in the Sonoma Creek watershed
- 36 projects will contribute to the re-establishment of the natural hydrograph by slowing the timing of peak flow (12 of which provided detailed quantification)
- 12 projects will improve water temperatures. Of these 12 projects, 9 are in the Petaluma River watershed, 5 of which provided detailed quantification resulting in a total of 10,150-linear feet of new riparian canopy. No calculated details were provided for the 3 Sonoma Creek watershed projects
- 23 projects will reduce energy use or GHG emissions, 4 of which provided detailed quantification

Community Benefits

- 20 projects will create jobs, of which 9 projects provided detailed quantification for a total of roughly 10 full time jobs
- 49 of the 60 projects will provide public education opportunities and/or incorporate a public education element
- 26 of the 60 projects will enhance or create recreational and public use areas. 9 projects provided detailed quantification (4 in the Petaluma River watershed and 5 in the Sonoma Creek watershed) for a total of 3,461 acres and 6.7 miles of trails
- 45 of the projects include community involvement and/or volunteer opportunities, of which 15 projects provided detailed quantification for a total involvement of slightly over 1,000 people per year
- 12 of the projects are located in or within a 1-mile radius of a disadvantaged community

TABLE 34
ENVIRONMENTAL BENEFITS DETAILED QUANTIFICATION VALUES

Project ID	Watershed	Project Name	Area of wetlands and/or riparian created or enhanced (acres)	Magnitude of Increase in Streamflows During Low Flow Season (%)	Area of Urban Green Space Created (acres)	Magnitude of Slowing in Timing of Peak Flow (% of lag time)	Magnitude of Water Temperature Improvement (linear feet of riparian canopy)	Magnitude in Reduction of Energy Use (kwH/yr)	Magnitude in Reduction in GHG emission (lbs/yr)	Magnitude of Increase in Carbon Sequestration (kwH/yr)
1	Petaluma	Petaluma River Corona Reach Linear Overflow Channel	3	na	3	na	na	na	na	na
2	Petaluma	Washington Creek Enhancement	1.5	50%	na	na	2000	na	na	na
4	Petaluma	Willow Brook Flood Detention Basin	2	na	2	na	na	na	na	na
5	Petaluma	Adobe Creek Floodplain Management and Sediment Study	na	na	25	na	3500	na	na	na
6	Petaluma	Lichau Creek Rainwater Catchment and Wildlife Pond	1	na	na	na	na	na	na	na
7	Petaluma	King Creek Wetland Development and Riparian Enhancement	65	na	na	na	3300	na	na	na
10	Sonoma	Circle Bar Ranch Groundwater Recharge	na	na	na	50%	na	1000	1640	0
11	Petaluma	Increasing Groundwater Recharge on Rangelands	na	na	na	50%	na	na	na	na
12	Petaluma	Installing Vegetative Filter Strips to Clean and Infiltrate Water on Ranchlands	na	na	na	20%	na	na	na	na
13	Petaluma	Keyline Ploughing to Increase Groundwater Infiltration on Ranches	na	na	na	30%	na	na	na	na
14	Sonoma	Tolay Lake Restoration	200	na	na	na	na	na	na	na
31	Petaluma	Willow Brook Creek Groundwater Recharge	2	na	2	na	350	na	na	na

TABLE 34 (CONTINUED)
ENVIRONMENTAL BENEFITS DETAILED QUANTIFICATION VALUES

Project ID	Watershed	Project Name	Area of wetlands and/or riparian created or enhanced (acres)	Magnitude of Increase in Streamflows During Low Flow Season (%)	Area of Urban Green Space Created (acres)	Magnitude of Slowing in Timing of Peak Flow (% of lag time)	Magnitude of Water Temperature Improvement (linear feet of riparian canopy)	Magnitude in Reduction of Energy Use (kwH/yr)	Magnitude in Reduction in GHG emission (lbs/yr)	Magnitude of Increase in Carbon Sequestration (kwH/yr)
32	Petaluma	Sonoma Mountain Rainwater Storage and Forbearance of Groundwater Extraction	1	na	na	100%	na	834	1400	0
37	Sonoma	Lower Sonoma Creek Rainwater Catchment and Stormwater Infiltration Project	0.1	na	na	25%	na	33	54	0
38	Petaluma	Sonoma Mountain Institute Rainwater Catchment Project	na	na	na	100%	na	750	1300	0
50	Sonoma	Rodgers Creeks Stormwater Detention	1.5	na	1.5	5%	na	na	na	na
52	Sonoma	Stormwater Detention on Multiuse Areas in Nathanson Creek	na	na	na	2%	na	na	na	na
53	Sonoma	El Verano Area Stormwater Detention	5	na	na	25%	na	na	na	na
55	Petaluma	Equine Water Stewardship	50	na	na	na	1000	na	na	na
56	Petaluma	Upper Lichau Creek Stormwater Detention	na	na	na	2%	na	na	na	na
58	Sonoma	Carriger Creek Stormwater Detention	7.4	na	na	2%	na	na	na	na
TOTAL	**Petaluma**		**125.5**	**50%***	**32**	**na****	**10,150**	**1,584**	**2,700**	**0**
TOTAL	**Sonoma**		**214**	**0**	**1.5**	**na****	**0**	**1,033**	**1,694**	**0**

NOTES:
* Note that while a total value is calculated as a way of visualizing the magnitude of project impacts, this value does not represent a total % change at any given location.
** Total values not applicable to this benefit type.

TABLE 35
COMMUNITY BENEFITS DETAILED QUANTIFICATION VALUES

Project ID	Watershed	Project Name	Number of Full Time Jobs Created	Area of Enhanced or Created Recreational and Public Use Areas (acres)	Length of Enhanced or Created Recreational and Public Use Areas (miles of trail)	Number of Volunteer Opportunities (people/yr)
1	Petaluma	Petaluma River Corona Reach Linear Overflow Channel	1	3	0.8	5
2	Petaluma	Washington Creek Enhancement	na	1.5	0.6	10
3	Petaluma	Kelly Creek Enhancements	na	na	na	na
4	Petaluma	Willow Brook Flood Detention Basin	1	0	0.3	3
5	Petaluma	Adobe Creek Floodplain Management and Sediment Study	na	na	na	200
7	Petaluma	King Creek Wetland Development and Riparian Enhancement	na	na	na	30
9	Petaluma	Petaluma River Watershed Multi-Benefit Flood Alleviation, Groundwater Recharge, and Habitat Restoration Project	na	na	na	40
14	Sonoma	Tolay Lake Restoration	na	3434	4	50
31	Petaluma	Willow Brook Creek Groundwater Recharge	na	11	0.1	500
32	Petaluma	Sonoma Mountain Rainwater Storage and Forbearance of Groundwater Extraction	na	na	na	50
34	Petaluma	Upper Petaluma River Watershed Multi-Benefit Flood Alleviation, Groundwater Recharge, and Habitat Restoration Project	na	na	na	40
39	Sonoma	Olsen Park Detention and Trash Capture	na	1	0	na
43	Petaluma	City of Petaluma trash capture device pilot project	0.5	na	na	1
50	Sonoma	Rodgers Creeks Stormwater Detention	1	0	0.2	10
52	Sonoma	Stormwater Detention on Multiuse Areas in Nathanson Creek	1	6	0	30
53	Sonoma	El Verano Area Stormwater Detention	1	5	0.7	5
55	Petaluma	Equine Water Stewardship	undetermined	na	na	100
56	Petaluma	Upper Lichau Creek Stormwater Detention	1	na	na	na
58	Sonoma	Carriger Creek Stormwater Detention	1	na	na	na
60	Sonoma	Sonoma Creek Stormwater Capture Project	3	na	na	na
TOTAL	**Petaluma**		**3.5**	**15.5**	**1.8**	**979**
TOTAL	**Sonoma**		**7**	**3,446**	**5.9**	**95**

5.4.2 Detailed Quantification Scoring Thresholds

In order to translate the quantified values into a numeric score, to be combined with the initial quantification and bonus scores, scoring parameters were established for each criteria based on a combination of results calculated and best judgement. These parameters and thresholds were reviewed and approved by the TAC. The suggested scoring parameters for each benefit are listed in Table 36.

Detailed quantification scoring of each project was completed for each benefit using adopted parameters and thresholds. A project received between one and three (1-3) points depending on the quantified values, or zero (0) points if detailed quantification was not possible. The total points received for each benefit were then summed. The maximum possible detailed quantification score is eighty-one (81) points.

TABLE 36
DETAILED QUANTIFICATION THRESHOLDS

Benefit		Range	Point Thresholds		
			3	2	1
Water Quality	Sediment (lb/yr)	221 to 5,100,000	> 500,000	500,000 -10,000	< 10,000
	Pathogens (MPN/yr)	1.4E+7 to 1.3E+11	> 1.0E+8	1.0E+8 - 1.0E+6	< 1.0E+6
	Nutrients (Petaluma) (lb/yr)	9 to 7,770	> 1,000	1000 - 100	< 100
	Trash (Petaluma) (gal/yr)	78 to 788	> 100	100 - 20	< 20
	Nickel (Petaluma) (lb/yr)	Only detention basin projects proposed in Petaluma watershed and detention basins are not effective for treatment of nickel.			
	Diazinon (lb/yr)	0.01 to 0.19	> 0.5	0.5 - 0.05	< 0.05
	Mercury (lb/yr)	0.01 to 1.9	> 1	1 - 0.5	< 0.5
	PCBs (lb/yr)	0.01 to 0.04	> 0.5	0.5 - 0.05	< 0.05
	Volume of storm water diverted (acre-feet/yr)	1 to 4500	>2000	2000 - 500	<500
	Non-point Source Pollutant Load Reduction	Only one quantifiable answer provided			
Water Supply	Volume of water collected, stored, or diverted to offset irrigation use (gal/yr)	20,000 to 300,000	>150000	150,000 - 30000	<30,000
	Volume of water infiltrated into a water supply aquifer (acre-ft/yr)	1 to 600	>2000	2000 - 500	<500
	Volume of water infiltrated into a non-water supply aquifer (acre-ft/yr)	1 to 19	>2000	2000 - 500	<500
Flood Management	Peak Flow Reduction (cfs)	1 to 600	>500	500 - 100	< 100
	Flood Volume Reduction (acre-feet/yr)	0.05 to 100	>100	100 - 50	<50
Environmental	Area of wetlands and/or riparian created or enhanced (acres)	1 to 200	>10	10 - 3	<3
	Magnitude of Increase in Streamflows During Low Flow Season (%)	Only one quantifiable answer provided			
	Area of Urban Green Space Created (acres)	2 to 25	>10	10 - 3	<3
	Magnitude of Slowing in Timing of Peak Flow (% of lag time)	2 to 100%	>100	100 - 20	<20
	Magnitude of Water Temperature Improvement (linear feet of riparian canopy)	350 to 3,500	>5280	5280 - 1500	<1500
	Magnitude in Reduction of Energy Use (kwH/yr)	33 to 1,000	>500	500 - 100	<100
	Magnitude in Reduction in GHG emission (lbs/yr)	54 to 1,640	>500	500 - 100	<100
	Magnitude of Increase in Carbon Sequestration (kwH/yr)	Only one quantifiable answer provided			
Community	Number of Full Time Jobs Created	0.5 to 1	>10	10 - 3	<3
	Area of Enhanced or Created Recreational and Public Use Areas (acres)	1 to 3,434	>10	10 - 3	<3
	Length of Enhanced or Created Recreational and Public Use Areas (miles of trail)	0.2 to 4	>5	5 - 0.5	<0.5
	Number of Volunteer Opportunities (people/yr)	1 to 500	>100	100 - 20	<20

5.5 Bonus Points

Following initial and detailed quantification, bonus points were assessed for each project. Bonus points were awarded if a project is located on public land, if the project is located on private land with a cooperating landowner, if the project provides synergistic benefits due to location relative to other existing or proposed projects, and/or if the project is supported by entities that have created permanent, local, or regional funding (i.e., entities who have established a new, multi-year local or regional source of funding dedicated to storm water and/or dry weather runoff capture projects, and who provide funds for both capital and operations and maintenance). No projects were identified that met the new funding bonus criteria. For each bonus criteria the project met, it received two (2) points, with a total maximum bonus score of eight (8) points.

5.6 Project Prioritization

The results of the initial, detailed, and bonus scoring can be seen for the Petaluma and Sonoma watersheds in Table 37 and Table 38 respectively and scoring details can be found in Appendix C. For the purposes of this planning effort, the prioritized SWRP projects are organized into three tiers: A, B, and C. Tier A projects have the highest scores, Tier C the lowest, and Tier B falling in the mid-range. This grouping was done for two reasons. First, given the uncertainty associated with the scoring of projects, many of which are early in the concept development stage, the Plan did not want to focus attention on the specific, often minor, differences in scoring results between projects. Secondly, for the purpose of incorporating future projects into the Plan, there was a desire to be able to add projects to a general group, rather than re-prioritizing the entire list of projects. To establish the breakpoints in tiering, which to some extent are driven by the structure of the scoring systems, the scoring results were examined to identify appropriate divides to segregate the highest- and lowest-scoring projects. Lowest-scoring projects were identified initially based on a review of initial quantification results alone, and then checked against project scoring totals. The highest-scoring projects were selected by examining the total scoring range and identifying a reasonable divide between the collection of projects with the highest scores and the mid-range that would put approximately the same number of projects into the highest-scoring tier in the two watersheds. The adopted scoring breakpoints used to identify these tiers are as follows:

- Tier A: 33 points and above
- Tier B: between 22 and 33 points
- Tier C: less than 22 points

5.7 Data Management

Sonoma Water will maintain and manage data collected and submitted by the collaborating entities on behalf of Plan development and for use in future implementation. All public data will be shared and available via data catalog which will be updated as needed and maintained by Sonoma Water through periodic updates. See Section 6.2.4 for additional details on monitoring and data management.

This page intentionally left blank

TABLE 37
PRIORITIZATION - PETALUMA AND BOTH/EITHER WATERSHEDS

Project Number	Watershed	Project Name	Project Source	Eligibility	Water Quality		Water Supply		Flood Management		Environment		Community		Total Initial Score	Total Detailed Score	Bonus	Total Score	Total Ranking	Prioritization Tier
					Initial Score	Detailed Results	Initial Score	Detailed Results	Initial Score	Detailed Results	Initial Score	Detailed Results	Initial Score	Detailed Results						
1	Petaluma	Petaluma River Corona Reach Linear Overflow Channel	City of Petaluma	YES	7.8	14.0	1.7	1.0	6.0	3.0	7.0	4.0	8.0	6.0	30.4	28.0	4.0	62.4	1	A
4	Petaluma	Willow Brook Flood Detention Basin	City of Petaluma	YES	5.6	17.0	1.7	1.0	8.0	3.0	5.0	2.0	8.0	4.0	28.2	27.0	4.0	59.2	2	A
55	Petaluma	Equine Water Stewardship	Equine Environmental Management	YES	10.0	0.0	10.0	0.0	10.0	0.0	8.0	4.0	8.0	5.0	46.0	9.0	4.0	59.0	3	A
2	Petaluma	Washington Creek Enhancement	City of Petaluma	YES	5.6	5.0	1.7	2.0	6.0	4.0	8.0	3.0	6.0	4.0	27.2	18.0	4.0	49.2	4	A
5	Petaluma	Adobe Creek Floodplain Management and Sediment Study	Sonoma Resource Conservation District	YES	8.9	0.0	5.0	0.0	6.0	0.0	10.0	5.0	4.0	3.0	33.9	8.0	6.0	47.9	5	A
31	Petaluma	Willow Brook Creek Groundwater Recharge	Sonoma Resource Conservation District	YES	6.7	0.0	7.5	0.0	6.0	0.0	10.0	3.0	5.0	7.0	35.2	10.0	2.0	47.2	6	A
56	Petaluma	Upper Lichau Creek Stormwater Detention	Sonoma County Water Agency	YES	6.7	12.0	1.7	1.0	6.0	3.0	1.0	1.0	5.0	1.0	20.3	18.0	4.0	42.3	7	A
32	Petaluma	Sonoma Mountain Rainwater Storage and Forbearance of Groundwater Extraction	Sonoma Resource Conservation District	YES	6.7	0.0	3.3	3.0	4.0	2.0	6.0	8.0	4.0	2.0	24.0	15.0	2.0	41.0	8	A
7	Petaluma	King Creek Wetland Development and Riparian Enhancement	Sonoma Resource Conservation District	YES	6.7	0.0	3.3	0.0	4.0	0.0	8.0	5.0	4.0	2.0	26.0	7.0	4.0	37.0	9	A
34	Petaluma	Upper Petaluma River Watershed Multi-Benefit Flood Alleviation, Groundwater Recharge, and Habitat Restoration Project	Sonoma Resource Conservation District	YES	8.9	0.0	0.0	0.0	8.0	0.0	6.0	0.0	7.0	2.0	29.9	2.0	4.0	35.9	10	A
9	Petaluma	Petaluma River Watershed Multi-Benefit Flood Alleviation, Groundwater Recharge, and Habitat Restoration Project	Sonoma Resource Conservation District	YES	7.8	0.0	1.7	0.0	8.0	0.0	5.0	0.0	7.0	2.0	29.4	2.0	4.0	35.4	11	A
12	Petaluma	Installing Vegetative Filter Strips to Clean and Infiltrate Water on Ranchlands	Sonoma Resource Conservation District	YES	5.6	11.0	3.3	1.0	4.0	2.0	2.0	1.0	3.0	0.0	17.9	15.0	2.0	34.9	12	A
15	Petaluma	Lower Petaluma River Valley Conservation Strategy	Sonoma Land Trust	YES	4.4	0.0	1.7	0.0	6.0	0.0	7.0	0.0	7.0	0.0	26.1	0.0	6.0	32.1	13	B
59	Petaluma	Storm Water Capture & Re-Use at Steamer Landing Park	Friends of the Petaluma River	YES	5.6	0.0	4.2	0.0	4.0	0.0	6.0	0.0	6.0	0.0	25.7	0.0	4.0	29.7	14	B
42	Petaluma	Lichau Creek Flood Mitigation and Detention Basin	City of Petaluma	YES	6.7	0.0	1.7	0.0	8.0	0.0	3.0	0.0	7.0	0.0	26.3	0.0	2.0	28.3	15	B
38	Petaluma	Sonoma Mountain Institute Rainwater Catchment Project	Sonoma Resource Conservation District	YES	2.2	0.0	1.7	2.0	4.0	2.0	4.0	7.0	1.0	0.0	12.9	11.0	4.0	27.9	16	B
3	Petaluma	Kelly Creek Enhancements	City of Petaluma	YES	4.4	0.0	1.7	0.0	8.0	0.0	5.0	0.0	5.0	0.0	24.1	0.0	2.0	26.1	17	B
46	Petaluma	Frog Creek Riparian Restoration	Sonoma Land Trust	YES	6.7	0.0	2.5	0.0	4.0	0.0	5.0	0.0	3.0	0.0	21.2	0.0	4.0	25.2	18	B
44	Petaluma	Cougar Mountain Creek Riparian Restoration	Sonoma Land Trust	YES	4.4	0.0	1.7	0.0	4.0	0.0	2.0	0.0	5.0	0.0	17.1	0.0	6.0	23.1	19	B
11	Petaluma	Increasing Groundwater Recharge on Rangelands	Sonoma Resource Conservation District	YES	3.3	1.0	3.3	1.0	4.0	2.0	2.0	1.0	3.0	0.0	15.7	5.0	2.0	22.7	20	B
13	Petaluma	Keyline Ploughing to Increase Groundwater Infiltration on Ranches	Sonoma Resource Conservation District	YES	3.3	1.0	3.3	1.0	4.0	2.0	2.0	1.0	3.0	0.0	15.7	5.0	2.0	22.7	20	B
20	Both/Either	QWEL Rainwater Harvesting Training Module	Sonoma-Marin Saving Water Partnership	YES	3.3	0.0	7.5	0.0	4.0	0.0	0.0	0.0	7.0	0.0	21.8	0.0	0.0	21.8	22	C
57	Petaluma	Watershed Classroom - Pollution Monitoring & Education in the Petaluma Watershed	Friends of the Petaluma River	YES	6.7	0.0	0.0	0.0	4.0	0.0	3.0	0.0	4.0	0.0	17.7	0.0	4.0	21.7	23	C
6	Petaluma	Lichau Creek Rainwater Catchment and Wildlife Pond	Sonoma Resource Conservation District	YES	3.3	0.0	4.2	1.0	4.0	0.0	3.0	1.0	3.0	0.0	17.5	2.0	2.0	21.5	24	C
45	Petaluma	Lakeville Creek Riparian Restoration	Sonoma Land Trust	YES	5.6	0.0	1.7	0.0	4.0	0.0	4.0	0.0	3.0	0.0	18.2	0.0	2.0	20.2	25	C
62	Petaluma	Petaluma River Dredging and Beneficial Re-use of dredge material	City of Petaluma	YES	0.0	0.0	0.0	0.0	8.0	0.0	2.0	0.0	6.0	0.0	16.0	0.0	4.0	20.0	26	C
43	Petaluma	City of Petaluma trash capture device pilot project	City of Petaluma	YES	5.6	3.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	2.0	11.6	5.0	2.0	18.6	27	C
61	Petaluma	Adopt A Creek Project	Friends of the Petaluma River	YES	3.3	0.0	0.8	0.0	0.0	0.0	3.0	0.0	7.0	0.0	14.2	0.0	4.0	18.2	28	C
49	Petaluma	Santa Rosa Junior College Rain Gardens	SRJC & Daily Acts	YES	0.0	0.0	4.2	0.0	0.0	0.0	3.0	0.0	6.0	0.0	13.2	0.0	4.0	17.2	29	C
48	Petaluma	Stormwater-Friendly Landscape Transformations at Petaluma Schools, Churches, Community Centers and other Public Sites	City of Petaluma & Daily Acts	YES	1.1	0.0	3.3	0.0	0.0	0.0	1.0	0.0	6.0	0.0	11.4	0.0	4.0	15.4	30	C
16	Both/Either	Erosion Control, Habitat Restoration, Stormwater Capture, and Trash Removal along Sonoma County Roads	Sonoma Ecology Center	YES	6.7	0.0	0.0	0.0	0.0	0.0	2.0	0.0	1.0	0.0	9.7	0.0	4.0	13.7	31	C

TABLE 38
PRIORITIZATION - SONOMA AND BOTH/EITHER WATERSHEDS

Project Number	Watershed	Project Name	Project Source	Eligibility	Water Quality		Water Supply		Flood Management		Environment		Community		Total Initial Score	Total Detailed Score	Bonus	Total Score	Total Ranking	Prioritization Tier
					Initial Score	Detailed Results	Initial Score	Detailed Results	Initial Score	Detailed Results	Initial Score	Detailed Results	Initial Score	Detailed Results						
50	Sonoma	Rodgers Creeks Stormwater Detention	Sonoma County Water Agency	YES	6.7	14.0	1.7	2.0	8.0	2.0	6.0	3.0	8.0	4.0	30.3	25.0	4.0	59.3	1	A
52	Sonoma	Stormwater Detention on Multiuse Areas in Nathanson Creek	Sonoma County Water Agency	YES	5.6	15.0	2.5	2.0	8.0	2.0	2.0	1.0	7.0	6.0	25.1	26.0	4.0	55.1	2	A
58	Sonoma	Carriger Creek Stormwater Detention	Sonoma County Water Agency	YES	6.7	15.0	1.7	3.0	4.0	0.0	3.0	3.0	3.0	1.0	18.3	22.0	4.0	44.3	3	A
60	Sonoma	Sonoma Creek Stormwater Capture Project	North Bay Agriculture Alliance	YES	5.6	0.0	9.2	0.0	6.0	0.0	9.0	0.0	6.0	2.0	35.7	2.0	6.0	43.7	4	A
53	Sonoma	El Verano Area Stormwater Detention	Sonoma County Water Agency	YES	5.6	9.0	1.7	1.0	2.0	0.0	3.0	3.0	8.0	6.0	20.2	19.0	4.0	43.2	5	A
10	Sonoma	Circle Bar Ranch Groundwater Recharge	Sonoma Resource Conservation District	YES	6.7	9.0	4.2	1.0	4.0	2.0	4.0	7.0	3.0	0.0	21.8	19.0	2.0	42.8	6	A
8	Sonoma	Multi-Benefit Conservation Plan Implementation for Enhanced Water Quality and Quantity	Sonoma Resource Conservation District	YES	8.9	0.0	5.8	0.0	6.0	0.0	7.0	0.0	6.0	0.0	33.7	0.0	4.0	37.7	7	A
37	Sonoma	Lower Sonoma Creek Rainwater Catchment and Stormwater Infiltration Project	Sonoma Resource Conservation District	YES	4.4	8.0	3.3	3.0	4.0	2.0	4.0	4.0	1.0	0.0	16.8	17.0	2.0	35.8	8	A
14	Sonoma	Tolay Lake Restoration	Sonoma County Regional Parks	YES	7.8	0.0	0.0	0.0	0.0	0.0	7.0	3.0	6.0	7.0	20.8	10.0	4.0	34.8	9	A
40	Sonoma	First Street West Green Street and Flood Reduction Project	City of Sonoma	YES	6.7	8.0	1.7	0.0	6.0	2.0	4.0	0.0	1.0	0.0	19.3	10.0	4.0	33.3	10	A
39	Sonoma	Olsen Park Detention and Trash Capture	City of Sonoma	YES	6.7	8.0	1.7	0.0	6.0	2.0	1.0	0.0	1.0	2.0	16.3	12.0	4.0	32.3	11	B
27	Sonoma	Stormwater Management and Water Conservation along Rodgers Creek	Sonoma Ecology Center	YES	7.8	0.0	5.0	0.0	4.0	0.0	4.0	0.0	4.0	0.0	24.8	0.0	6.0	30.8	12	B
36	Sonoma	Upper Sonoma Creek Flood Management and Habitat Restoration	Sonoma Ecology Center	YES	7.8	0.0	5.8	0.0	8.0	0.0	3.0	0.0	4.0	0.0	28.6	0.0	2.0	30.6	13	B
33	Sonoma	Kenwood Marsh Restoration	Sonoma Ecology Center	YES	7.8	0.0	7.5	0.0	6.0	0.0	3.0	0.0	1.0	0.0	25.3	0.0	4.0	29.3	14	B
19	Sonoma	Middle & Lower Nathanson Creek Flood Management and Habitat Restoration	Sonoma Ecology Center	YES	6.7	0.0	0.0	0.0	6.0	0.0	4.0	0.0	4.0	0.0	20.7	0.0	6.0	26.7	15	B
29	Sonoma	Stormwater Management at Sonoma Valley School Campuses	Sonoma Ecology Center	YES	5.6	0.0	1.7	0.0	6.0	0.0	4.0	0.0	5.0	0.0	22.2	0.0	4.0	26.2	16	B
22	Sonoma	Stormwater Management and Habitat Enhancement at Maxwell Farms Regional Park	Sonoma Ecology Center	YES	5.6	0.0	2.5	0.0	6.0	0.0	3.0	0.0	4.0	0.0	21.1	0.0	2.0	23.1	17	B
28	Sonoma	Carriger Creek Stormwater Capture and Groundwater Recharge	Sonoma Ecology Center	YES	7.8	0.0	3.3	0.0	4.0	0.0	2.0	0.0	1.0	0.0	18.1	0.0	4.0	22.1	18	B
20	Both/Either	QWEL Rainwater Harvesting Training Module	Sonoma-Marin Saving Water Partnership	YES	3.3	0.0	7.5	0.0	4.0	0.0	0.0	0.0	7.0	0.0	21.8	0.0	0.0	21.8	19	C
30	Sonoma	Sonoma Creek Watershed Stream Restoration: Sonoma Developmental Center Reach	Sonoma Ecology Center	YES	7.8	0.0	1.7	0.0	4.0	0.0	2.0	0.0	3.0	0.0	18.4	0.0	2.0	20.4	20	C
25	Sonoma	Stormwater Management at Sonoma Valley Regional Park	Sonoma Ecology Center	YES	5.6	0.0	1.7	0.0	4.0	0.0	2.0	0.0	4.0	0.0	17.2	0.0	2.0	19.2	21	C
18	Sonoma	Stormwater Improvements to Roads and Trails in Sonoma Valley State Parks	Sonoma Ecology Center	YES	6.7	0.0	0.0	0.0	4.0	0.0	2.0	0.0	4.0	0.0	16.7	0.0	2.0	18.7	22	C
23	Sonoma	Creek Restoration and Spillway Replacement or Dam Modification at Larson Park	Sonoma Ecology Center	YES	6.7	0.0	1.7	0.0	0.0	0.0	4.0	0.0	4.0	0.0	16.3	0.0	2.0	18.3	23	C
41	Sonoma	Broadway and Leveroni Road Flood Reduction and Trash Capture Project	City of Sonoma	YES	5.6	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	13.6	0.0	4.0	17.6	24	C
17	Sonoma	Stormwater Capture & Groundwater Recharge in Upper Nathanson Creek	Sonoma Ecology Center	YES	5.6	0.0	1.7	0.0	6.0	0.0	2.0	0.0	0.0	0.0	15.2	0.0	2.0	17.2	25	C
35	Sonoma	Lower Watershed Flood Plain Restoration in Freshwater Streams	Sonoma Ecology Center	YES	2.2	0.0	0.0	0.0	6.0	0.0	3.0	0.0	4.0	0.0	15.2	0.0	2.0	17.2	25	C
26	Sonoma	Erosion Control and Riparian Restoration at Van Hoosear Wildflower Preserve	Sonoma Ecology Center	YES	4.4	0.0	0.0	0.0	4.0	0.0	3.0	0.0	3.0	0.0	14.4	0.0	2.0	16.4	27	C
47	Sonoma	Land Acquisition from willing seller in Lower Sonoma Creek	Sonoma Land Trust	YES	1.1	0.0	0.0	0.0	6.0	0.0	3.0	0.0	2.0	0.0	12.1	0.0	4.0	16.1	28	C
21	Sonoma	Sugarloaf State Park Erosion Reduction, Habitat Restoration, and Bridge Repair	Sonoma Ecology Center	YES	4.4	0.0	0.0	0.0	0.0	0.0	2.0	0.0	4.0	0.0	10.4	0.0	4.0	14.4	29	C
16	Both/Either	Erosion Control, Habitat Restoration, and Stormwater/Trash Capture along Roads in Sonoma County	Sonoma Ecology Center	YES	6.7	0.0	0.0	0.0	0.0	0.0	2.0	0.0	1.0	0.0	9.7	0.0	4.0	13.7	30	C
24	Sonoma	Restoration of Natural Hydrology and Salmonid Habitat at Alder Park	Sonoma Ecology Center	YES	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	3.0	0.0	6.0	0.0	2.0	8.0	31	C

6. IMPLEMENTATION STRATEGY AND SCHEDULE

SWRP Checklist Guidelines

- ☒ Plan identifies resources for Plan implementation, including: 1) projection of additional funding needs and sources for administration and implementation needs; and 2) schedule for arranging and securing Plan implementation financing.
- ☒ Plan projects and programs are identified to ensure the effective implementation of the storm water resource plan pursuant to this part and achieve multiple benefits.
- ☒ The Plan identifies the development of appropriate decision support tools and the data necessary to use the decision support tools.
- ☒ Plan describes implementation strategy, including:
  a. Timeline for submitting Plan into existing plans, as applicable;
  b. Specific actions by which Plan will be implemented;
  c. All entities responsible for project implementation;
  d. Description of community participation strategy;
  e. Procedures to track status of each project;
  f. Timelines for all active or planned projects;
  g. Procedures for ongoing review, updates, and adaptive management of the Plan; and
  h. A strategy and timeline for obtaining necessary federal, state, and local permits.
- ☒ Applicable IRWM Plan: The Plan will be submitted, upon development, to the applicable integrated regional water management group for incorporation into the IRWM Plan.
- ☒ Plan describes how implementation performance measures will be tracked.

This section summarizes implementation of the SWRP, including schedule, implementation strategy, and performance tracking.

6.1 Resources, Timeline and Actions for Project Implementation

The Southern Sonoma SWRP will be implemented through a series of actions over time by the watershed stakeholders. The implementation strategy features the project proponents as the primary responsible parties leading the implementation actions. Given the uncertainty of funding sources and the scope and authorities of various entities participating in project development, the entity responsible for implementation of specific projects may change and new partnerships may develop. Current identified projects are unfunded and further factors such as feasibility, funding and partnerships are important to determining viability of ultimate implementation. Depending on key benefits provided and community needs and priorities, some projects will rise to the top and be considered for funding while other projects may be modified over time or funded through other sources. Sonoma Water will continue to administer and lead the planning effort, monitor for updates, conduct outreach, and host the website in support of the watershed goals and objectives.

Table 39 describes implementation by project listing proponents, specific management actions, projects, and studies, ongoing or planned, by which the Plan will be implemented, an estimated timeline, and estimated costs for implementation of each project.

Costs identified below are preliminary estimates only. Many of the cost estimates are considered very preliminary based on concept level designs with some level of uncertainty dependent on a variety of factors. The cost estimates provided in Table 39 do not include operations and maintenance costs. However, operations and maintenance costs would be identified and provided by a project proponent when a project is selected for state funding. In addition to the estimated project costs listed below, proponents have identified potential sources for implementation funding, often times comprised of several fund types. Potential funding sources may include:

- California Water Resources Control Board Prop 1 Storm Water Grant Program
- California Water Resources Control Board 319(h) Program
- San Francisco Bay Restoration Authority Measure AA
- Municipal General Fund
- USDA Natural Resources Conservation Service Environmental Quality Incentives Program (EQIP)
- EPA San Francisco Bay Water Quality Improvement Fund
- Developer impact fees
- California Coastal Conservancy
- USFWS North American Wetlands Conservation Act Grant
- USFWS National Coastal Wetlands Conservation Grant
- Sonoma Water Flood Control Zone 2A
- Sonoma Water Flood Control Zone 3A
- Private Foundations, Other Private Sources
- CA Department of Food and Agriculture Healthy Soils Program
- US Bureau of Reclamation Sustain and Manage America's Resources for Tomorrow (WaterSMART)
- CA Department of Fish and Wildlife Proposition 1 Watershed Restoration and Fisheries Restoration Grant Programs
- University of California Planning and Research Funds
- Sonoma County Ag + Open Space Matching Grant Program
- Bay Area Air Quality Management District Grant
- California Natural Resources Agency Urban Greening Grant
- Bay Area Barns and Trails Grant

The timeline for implementation includes estimated 1-3 and 3-5 year timeframes for physical projects, as well as estimated 1 year and 2-5 year for programmatic timeframes. The implementation timeframes are estimates, as long-term implementation timelines are generally dependent on funding resources. A detailed project timeline would be developed at time of funding source identification and award.

Proponents for the projects listed in Table 39 selected from the following list to describe the anticipated scope of the project work. The actions listed were defined broadly for the purposes of providing an overview of the general steps each project will take to achieve implementation. Project proponents have identified one action or a combination of actions required to implement their project:

- *Engagement/Outreach/Education (Ed):* includes engaging community members, volunteer mobilization, public meetings, hosting workshops/events, public review
- *Environmental Review & Permitting (ER):* includes CEQA/NEPA, USACE, USFWS, SWRCB, County/City coordination and permitting
- *Planning (P):* feasibility, could include land acquisition or easement
- *Design (D):* modeling, preparation of drawings, specifications, and contract documents, design review
- *Construction (C):* creation or modification of physical features, installation of infrastructure, bioengineering
- *Restoration (R):* propagation, revegetation, physical or mechanical alterations to create or modify natural features
- *Monitoring (M):* sampling, project effectiveness tracking, reporting, compliance

6.1.1 Strategy for Obtaining Permits

Project proponents will be responsible for obtaining all required permits associated with project implementation. Environmental regulatory compliance is necessary to implement with documentation or approvals required in advance with some funding sources. Permitting may be considered an eligible expense as part of implementation and covered by some funding sources. At the time specific projects are to be considered for funding or approval, an environmental assessment and appropriate document(s) should be prepared by the project proponent to comply with California Environmental Quality Act (CEQA), National Environmental Policy Act (NEPA), and pursuant to local regulatory policies and permits. A strategy for obtaining project related permits should begin with a well-developed project design, early consultation and scoping of significant environmental issues with permitting agencies to ensure timely implementation. A streamlined permitting approach will be used whenever possible. Categorical Exemptions or a programmatic CEQA document similar to the Mitigated Negative Declaration may be used for CEQA compliance for many common projects implemented through the Sonoma Resource Conservation District's LandSmart Program.

Public engagement and early consultation with stakeholders is also key to determining feasible design and implementation. The permitting timeline is dependent on many factors including: public input, available funding, review timelines for permitting authorities and restrictions of construction based on season, weather, conditions and habitat sensitivities.

Projects that include substantial change or use of any material from a river, stream, or lake should avoid and minimize erosion, sediment transport, and hydromodification and fully mitigate environmental impacts resulting from the project, as required by Clean Water Act sections 401 and 404 and any other federal and state laws, regulations and permits. Project-specific impacts and required permits may include those provided in Table 40.

TABLE 39
RESOURCES, TIMELINE, AND ACTIONS FOR PROJECT IMPLEMENTATION

#	Proponent	Project Name	Cost Estimate	Timeline	Actions
1	City of Petaluma	Petaluma River Corona Reach Linear Overflow Channel	$2,500,000	3 to 5 years	Ed, ER, D, C, R, M
2	City of Petaluma	Washington Creek Enhancement	$1,800,000	3 to 5 years	Ed, ER, D, C, R, M
3	City of Petaluma	Kelly Creek Enhancements	$300,000	3 to 5 years	Ed, ER, D, C, R, M
4	City of Petaluma	Willow Brook Flood Detention Basin	$2,500,000	3 to 5 years	Ed, ER, D, C, R, M
42	City of Petaluma	Lichau Creek Flood Mitigation and Detention Basin	$1,800,000	3 to 5 years	Ed, ER, D, C, R, M
43	City of Petaluma	City of Petaluma trash capture device pilot project	$350,000	1 to 3 years	Ed, ER, D, C, R, M
62	City of Petaluma	Petaluma River Dredging and Beneficial Re-use of dredge material	$5,300,000	3 to 5 years	Ed, ER, D, C, R, M
39	City of Sonoma	Olsen Park Detention and Trash Capture	$3,050,000	1 to 3 years	Ed, ER, D, C, M
40	City of Sonoma	First Street West Green Street and Flood Reduction Project	$3,250,000	1 to 3 years	Ed, ER, D, C
41	City of Sonoma	Broadway and Leveroni Road Flood Reduction and Trash Capture Project	$1,130,000	1 to 3 years	Ed, ER, D, C, M
49	Daily Acts	Santa Rosa Junior College Rain Gardens	$5,000	1 year program	Ed, D, C
48	Daily Acts	Stormwater-Friendly Landscape Transformations at Petaluma Schools, Churches, Community Centers and other Public Sites	$97,500	3 to 5 years	Ed, D, C
55	Equine Environmental Management	Equine Water Stewardship	$180,000	2 to 5 year program	
57	Friends of the Petaluma River	Watershed Classroom - Pollution Monitoring & Education in the Petaluma Watershed	$ -		
59	Friends of the Petaluma River	Storm Water Capture & Re-Use at Steamer Landing Park	$ -		
61	Friends of the Petaluma River	Adopt A Creek Project	$ -		
60	North Bay Agriculture Alliance	Sonoma Creek Stormwater Capture Project	$10,000,000	3 to 5 years	ER, D, C, R, M
14	Sonoma County Regional Parks	Tolay Lake Restoration	$5,000,000	3 to 5 years	Ed, ER, D, C, R, M
50	Sonoma County Water Agency	Rodgers Creeks Stormwater Detention	$1,100,000	3 to 7 years	Ed, ER, D, C, R
52	Sonoma County Water Agency	Stormwater Detention on Multiuse Areas in Nathanson Creek	$3,800,000	3 to 7 years	Ed, ER, D, C, R
53	Sonoma County Water Agency	El Verano Area Stormwater Detention	$3,600,000	3 to 7 years	Ed, ER, D, C, R
56	Sonoma County Water Agency	Upper Lichau Creek Stormwater Detention	$7,300,000	3 to 7 years	ER, D, C, R
58	Sonoma County Water Agency	Carriger Creek Stormwater Detention	$3,500,000	3 to 7 years	Ed, ER, D, C, R
16	Sonoma Ecology Center	Erosion Control, Habitat Restoration, and Stormwater/Trash Capture along Roads in Sonoma County	$2,000,000	3 to 5 years	Ed, ER, D, C, R, M
17	Sonoma Ecology Center	Stormwater Capture & Groundwater Recharge in Upper Nathanson Creek	$2,000,000	3 to 5 years	Ed, ER, D, C, R, M
18	Sonoma Ecology Center	Stormwater Improvements to Roads and Trails in Sonoma Valley State Parks	$800,000	3 to 5 years	Ed, ER, D, C, R, M
19	Sonoma Ecology Center	Middle & Lower Nathanson Creek Flood Management and Habitat Restoration	$2,500,000	3 to 5 years	Ed, ER, D, C, R, M
21	Sonoma Ecology Center	Sugarloaf State Park Erosion Reduction, Habitat Restoration, and Bridge Repair	$800,000	3 to 5 years	Ed, ER, D, C, R, M
22	Sonoma Ecology Center	Stormwater Management & Habitat Enhancement at Maxwell Park	$800,000	3 to 5 years	Ed, ER, D, C, R, M
23	Sonoma Ecology Center	Creek Restoration and Spillway Replacement or Dam Modification at Larson Park	$2,500,000	3 to 5 years	Ed, ER, D, C, R, M
24	Sonoma Ecology Center	Restoration of Natural Hydrology and Salmonid Habitat at Alder Park	$800,000	1 to 3 years	Ed, ER, D, C, R, M

TABLE 39 (CONTINUED)
RESOURCES, TIMELINE AND ACTIONS FOR PROJECT IMPLEMENTATION

#	Proponent	Project Name	Cost Estimate	Timeline	Actions
25	Sonoma Ecology Center	Stormwater Management at Sonoma Valley Regional Park	$800,000	1 to 3 years	Ed, ER, D, C, R, M
26	Sonoma Ecology Center	Erosion Control and Riparian Restoration at Van Hoosear Wildflower Preserve	$800,000	1 to 3 years	Ed, ER, D, C, R, M
27	Sonoma Ecology Center	Stormwater Management and Water Conservation along Rodgers Creek	$800,000	1 to 3 years	Ed, ER, D, C, R, M
28	Sonoma Ecology Center	Carriger Creek Stormwater Capture and Groundwater Recharge	$1,000,000	3 to 5 years	Ed, ER, D, C, R, M
29	Sonoma Ecology Center	Stormwater Management at Sonoma Valley School Campuses	$1,000,000	3 to 5 years	Ed, ER, D, C, R, M
30	Sonoma Ecology Center	Sonoma Creek Watershed Stream Restoration: Sonoma Developmental Center Reach	$800,000	3 to 5 years	Ed, ER, D, C, R, M
33	Sonoma Ecology Center	Kenwood Marsh Restoration	$2,000,000	3 to 5 years	Ed, ER, D, C, R, M
35	Sonoma Ecology Center	Lower Watershed Flood Plain Restoration in Freshwater Streams	$2,000,000	3 to 5 years	Ed, ER, D, C, R, M
36	Sonoma Ecology Center	Upper Sonoma Creek Flood Management and Habitat Restoration	$1,000,000	3 to 5 years	Ed, ER, D, C, R, M
15	Sonoma Land Trust	Lower Petaluma River Valley Conservation Strategy	$150,000	1 to 3 years	Ed
44	Sonoma Land Trust	Cougar Mountain Creek Riparian Restoration	$425,000	3 to 5 years	ER, D, C, R
45	Sonoma Land Trust	Lakeville Creek Riparian Restoration	$1,100,000	3 to 5 years	ER, D, C, R
46	Sonoma Land Trust	Frog Creek Riparian Restoration	$350,000		ER, D, C, R
47	Sonoma Land Trust	Land Acquisition from willing seller in Lower Sonoma Creek		1 to 3 years	ER, D, C, R
5	Sonoma Resource Conservation District	Adobe Creek Floodplain Management and Sediment Study	$175,000	1 to 3 years	Ed, D, M
6	Sonoma Resource Conservation District	Lichau Creek Rainwater Catchment and Wildlife Pond	$200,000	1 to 3 years	D, ER, C, R
7	Sonoma Resource Conservation District	King Creek Wetland Development and Riparian Enhancement	$300,000	3 to 5 years	D, ER, C, R
8	Sonoma Resource Conservation District	Multi-Benefit Conservation Plan Implementation for Enhanced Water Quality and Quantity	$105,000	3 to 5 years	Ed, ER, D, C, R, M
9	Sonoma Resource Conservation District	Petaluma River Watershed Multi-Benefit Flood Alleviation, Groundwater Recharge, and Habitat Restoration Project	$1,000,000	1 to 3 years	Ed, ER, D, C, R, M
10	Sonoma Resource Conservation District	Circle Bar Ranch Groundwater Recharge	$325,000	1 to 3 years	Ed, ER, C, M
11	Sonoma Resource Conservation District	Increasing Groundwater Recharge on Rangelands	$75,000	1 to 3 years	D, R, M
12	Sonoma Resource Conservation District	Installing Vegetative Filter Strips to Clean and Infiltrate Water on Ranchlands	$50,000	1 to 3 years	D, R, M
13	Sonoma Resource Conservation District	Keyline Ploughing to Increase Groundwater Infiltration on Ranches	$30,000	1 to 3 years	D, R, M
31	Sonoma Resource Conservation District	Willow Brook Creek Groundwater Recharge	$1,300,000	3 to 5 years	ER, D, C, R
32	Sonoma Resource Conservation District	Sonoma Mountain Rainwater Storage and Forbearance of Groundwater Extraction	$350,000	3 to 5 years	ER, D, C
34	Sonoma Resource Conservation District	Upper Petaluma River Watershed Multi-Benefit Flood Alleviation, Groundwater Recharge, and Habitat Restoration Project	$850,000	3 to 5 years	Ed, ER, D, C, R, M
37	Sonoma Resource Conservation District	Lower Sonoma Creek Rainwater Catchment and Stormwater Infiltration Project	$180,000	3 to 5 years	ER, D, C
38	Sonoma Resource Conservation District	Sonoma Mountain Institute Rainwater Catchment Project	$250,000	3 to 5 years	ER, D, C
20	Sonoma-Marin Saving Water Partnership	QWEL Rainwater Harvesting Training Module	$30,000	1 year program	Ed

TABLE 40
PERMITTING REQUIREMENTS

Analyze your project by asking these questions below. Does Your Project:	City/County Planning Dept & CEQA Review	City/County Environmental Health Department	Water/ Irrigation Flood Control District	CA Department of Fish and Wildlife	State Water Resources Control Board Division of Water Quality/ Water rights	Regional Water Quality Control Board	National Marine Fisheries Service	U.S. Army Corps of Engineers	California Coastal Commission	National Environmental Policy Act	U.S. Fish and Wildlife Service*
Involve bank stabilization or erosion control?	●		●	●		●	○	●		○	○
Require the removal of trees or riparian vegetation?	●			●		●	○	○		○	○
Involve planting riparian vegetation?	●		●	●		●	○	○		○	
Affect native plants, wildlife or fisheries?	●			●		●	●	○		○	
Result in stormwater discharge into a creek?	●	●	●	●		●	○	○		○	○
Divert or obstruct the natural flow; or change the natural bed or bank of a creek?	●		●	●	●	●	○	●		○	○
Involve repair. Rehabilitation or replacement of any structure or fill adjacent to a creek?	●			●		●	○	○		○	○
Involve building any structure adjacent to a creek?	●	●		●		●	●	○	○	○	○
Involve fish and wildlife enhancement, attraction or harvesting devices and activities?	●			●		●		●		○	
Use materials from a streambed (including but not limited to boulders, rocks, gravel, sand and wood debris)?	●		●	●		●	○	●		○	○
Require the disposal or deposition of debris, waste or any material containing crumbled, flaked, or ground pavement with a possibility that such material could pass into the stream?	●		●	●		●	○	○		○	○
Involve the removal of any materials from a stream or add fill to the stream?	●		●	●		●	○	●		○	○
Involve grading or fill near the creek?	●		●	●		●	○	○		○	○
Involve a bridge or culvert?	●			●		●	○	●		○	
Involve utility pipe lines?	●	●		●		●		○		○	○
Involve a septic leach field near the creek?	●	●		●		●		○		○	
Require a water well near the creek?	●	●		●		●	○	○		○	○
Involve work within historic or existing coastal wetlands?	●			●		●		●	●	○	○
Remove water from creek for storage or direct use on non-riparian land?	●		●	●	●	●	○	○		○	○
Require that hazardous materials be generated and/or stored on site?	●	●		●		●		○		○	○
Involve a land disturbance of five acres or more?	●			●	●	●		○		○	
Involve a creek or stream with species listed as endangered or threatened?	●			●			●	○			○
Involve bank stabilization or erosion control?	●		●	●		●	○	●		○	○

TABLE 40 (CONTINUED)
PERMITTING REQUIREMENTS

Analyze your project by asking these questions below. Does Your Project:	City/County Planning Dept & CEQA Review	City/County Environmental Health Department	Water/ Irrigation Flood Control District	CA Department of Fish and Wildlife	State Water Resources Control Board Division of Water Quality/ Water rights	Regional Water Quality Control Board	National Marine Fisheries Service	U.S. Army Corps of Engineers	California Coastal Commission	National Environmental Policy Act	U.S. Fish and Wildlife Service*
Require the removal of trees or riparian vegetation?	●			●		●	○	○		○	○
Involve planting riparian vegetation?	●		●	●		●	○	○		○	
Affect native plants, wildlife or fisheries?	●			●		●	●	○		○	
Result in storm water discharge into a creek?	●	●	●	●		●	○	○		○	○
Divert or obstruct the natural flow; or change the natural bed or bank of a creek?	●		●	●	●	●	○	●		○	○
Involve repair. Rehabilitation or replacement of any structure or fill adjacent to a creek?	●			●		●	○	○		○	○
Involve building any structure adjacent to a creek?	●	●		●		●	●	○	○	○	○
Involve fish and wildlife enhancement, attraction or harvesting devices and activities?	●			●		●		●		○	
Use materials from a streambed (including but not limited to boulders, rocks, gravel, sand and wood debris)?	●		●	●		●	○	●		○	○
Require the disposal or deposition of debris, waste or any material containing crumbled, flaked, or ground pavement with a possibility that such material could pass into the stream?	●		●	●		●	○	○		○	○
Involve the removal of any materials from a stream or add fill to the stream?	●		●	●		●	○	●		○	○
Involve grading or fill near the creek?	●		●	●		●	○	○		○	○
Involve a bridge or culvert?	●			●		●	○	●		○	
Involve utility pipe lines?	●	●		●		●		○		○	○
Involve a septic leach field near the creek?	●	●		●		●		○		○	
Require a water well near the creek?	●	●		●		●	○	○		○	○
Involve work within historic or existing coastal wetlands?	●			●		●		●	●	○	○
Remove water from creek for storage or direct use on non-riparian land?	●		●	●	●	●	○	○		○	○
Require that hazardous materials be generated and/or stored on site?	●	●		●		●		○		○	○
Involve a land disturbance of five acres or more?	●			●	●	●		○		○	
Involve a creek or stream with species listed as endangered or threatened?	●			●			●	○			○

NOTES:

● = Action will most likely require regulatory compliance ○ = Action may require regulatory compliance *USFWS requires permits only when listed, threatened and/or endangered species may be affected

6.2 Adaptive Management

The Plan will be administered through adaptive management strategies. Public input, funding availability, project proponent scheduling and regulatory compliance drivers are all important factors influencing the timing for implementation, and will require proponents to adaptively manage and structure their implementation efforts.

Sonoma Water, in addition to many TAC members, is an active participant in the Bay Area Integrated Regional Water Management Program and member of the IRWM Coordinating Committee with a role in developing procedures to incorporate plans such as the SWRPs. Sonoma Water staff participated in a discussion at the February 29, 2016 meeting of BAIRWM in which the group proposed a procedure for incorporating SWRPs. The process outlined a basic two-step process for incorporation: Step 1- Review of Draft Plan by TAC, SWRCB and public and revise per comments, Step 2- Submit Final Plan and completed checklist to BAIRWM for incorporation (target date November 2018). Following incorporation, the Plan will be implemented through the execution of projects by their respective project proponents. Progress toward attaining the regional goals and objectives will be reviewed periodically and additional work will be completed on the Plan as needed through an adaptive management framework described below.

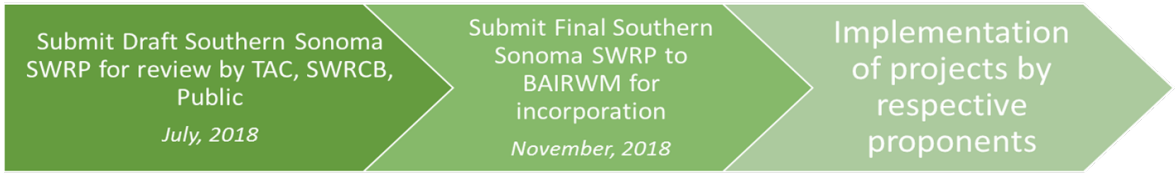


Figure 18 BAIRWM and SWRP Incorporation and Implementation Process Diagram

6.2.1 Plan Updates

Sonoma Water will continue to serve as administrator of the Plan, working with collaborative entities and stakeholders to update the Plan and coordinate with BAIRWM on incorporating successive updates. Sonoma Water will maintain the SWRP webpage, project submission form, quantification tools and oversee the update or revisions of the Plan. The Plan will be updated as needed and when feasible, at a frequency that is in concert with leveraging funding opportunities. Sonoma Water, in collaboration with partners, will monitor needs to update key information. At this time, it is anticipated that the Plan may be revised and updated every 5 or more years, possibly earlier, dependent on substantive changes to regulations, funding opportunities and other mandates. Sonoma Water and collaborating entities will continue to monitor the funding and regulatory landscape to best position the watershed stakeholders to raise funds to implement projects and manage storm water effectively.

A Plan update may include revisions and updates to the following: a) curves and metrics developed to assess and quantify project benefits, b) Best Management Practices (BMPs) that would meet watershed based goals for storm water management, c) updates to the water

quality compliance section reflective of new or amended regulations and targets, d) completing a watershed based performance assessment to understand how the projects implemented are meeting the cumulative goals listed in the performance assessment section and e) new data sources or other assessment tools. It is also anticipated that the project descriptions and listing of projects will be updated in the Plan. Once updated, the Plan would be re-submitted and incorporated under the over-arching BAIRWMP. Foreseen future Plan updates may also be needed in response to regulatory environment or changing watershed conditions which may include:

- Basin Plan Amendment: Because the Basin Plan is considered a master planning document for water quality in the Bay Area, the SFBRWQCB regularly considers updates to address new or changing water quality issues, and stakeholders are involved in this deliberation. This evaluation, called the Triennial Review, was initiated in the spring of 2018 with a public workshop and distributing a list of candidate Basin Planning projects. It is anticipated that a Plan update may be warranted to address any new amendments to the Basin Plan.
- Development and/or Adoption of TMDLs
- Natural Disaster
- Updates to land use planning documents, watershed and natural resources assessments and plans, and storm water and groundwater management policies (General Plans, Groundwater Sustainability Plans, Climate Action Plans)

A Plan update will require sufficient funding and resources to convene a TAC and to engage stakeholders involved in storm water management and planning within the region. Existing funding will allow Sonoma Water, with support from the collaborating entities, to complete the initial Plan in 2019, pursuant to the grant agreement. Future costs for plan updates may include a variety of sources including local funds, grant funds and cost sharing from stakeholders.

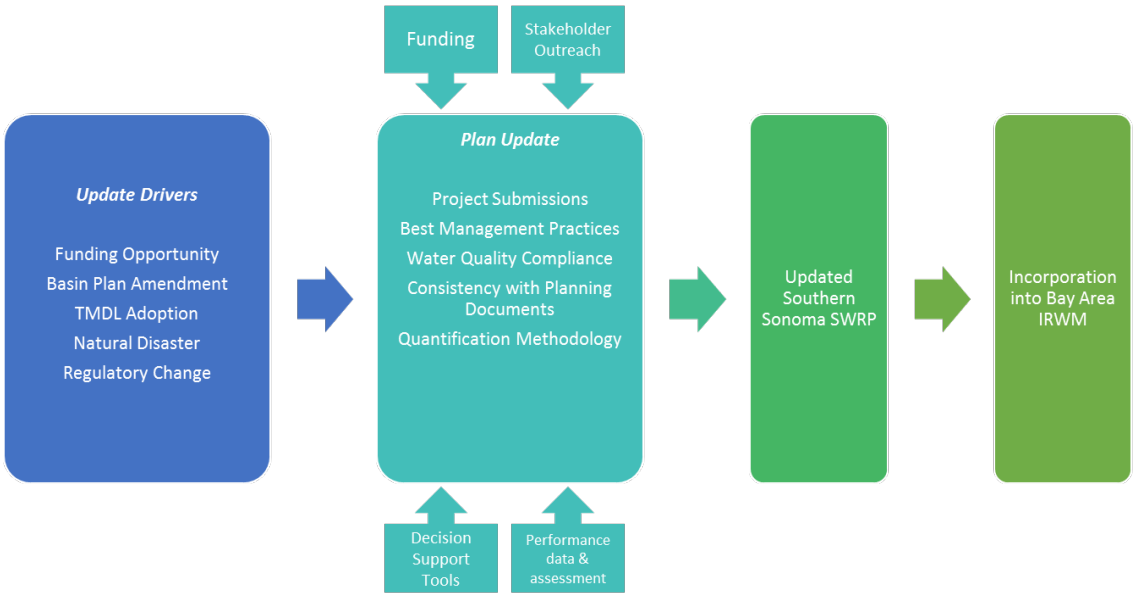


Figure 19 SWRP Funding and Plan Update Process Diagram

6.2.2 Project Submission Process

A public announcement notifying stakeholders of opportunity to submit new or revised projects for consideration in the Plan will be distributed publicly via Sonoma Water's weblink, newsletter and through TAC and stakeholder networks. Projects would be submitted using the input form linked to Sonoma Water's storm water resource plan webpage (www.scwa.ca.gov/SWRP). Project proponents will be expected to provide a project description, approximate location, contact information and identified partners, as well as project descriptive information pursuant to the phase two initial quantification inputs and phase three detailed quantification inputs. Proponents will be directed to follow the approved project submission process and to utilize the established methods to quantify benefits. The process, methodology and criteria is publicly available on the website. Proponents can utilize the linked GIS web application upon development to supply inputs to the phase two and phase three form sections. The projects will be reviewed, scored and ranked consistent with the weighting criteria established by the TAC at the formation of this Plan. The resulting list will be published as an updated appendix on the Sonoma Water website. A cumulative appendix of all project submissions, deletions and updates would be maintained.

A description of outreach mechanisms used during development of the Plan, and those that will be used during implementation, can be found in Section 7.

6.2.3 Implementation Performance Measures

It is anticipated that a watershed-based assessment to evaluate plan performance will be conducted in concert with Plan update frequency. Evaluation will be based on assessments performed by project proponents at the project level, surveys conducted, stakeholder input, and relevant data from monitoring and information management systems described below. During future project submission periods, an opportunity to provide project performance evaluations of existing projects will be made available as part of the plan implementation updates.

6.2.4 Monitoring and Data Management

No new local monitoring or data management mechanisms are being proposed for use for tracking during implementation of the Plan. Upon implementation, projects may require post-construction monitoring as part of permit requirements. There are existing California and San Francisco Bay Area based monitoring and project tracking programs listed in Table 41 that proponents will use to track progress and generate relevant, publicly accessible data that will support the performance assessment evaluation of progress made toward achieving the SWRP watershed based goals. The data sources utilized to develop quantification methods used during the phase 3 process (Section 5.4) are documented in the references section, and will be evaluated and updated periodically to reflect changes to relevant data within the planning area as it becomes available.

TABLE 41
DATA COLLECTION PROGRAMS

Managing Entity	Program
State Water Resources Control Board (SWRCB)	California Environmental Data Exchange Network (CEDEN)
State Water Resources Control Board (SWRCB)	Groundwater Ambient Monitoring and Assessment Program (GAMA)
State Water Resources Control Board (SWRCB)	Surface Water Ambient Monitoring Program (SWAMP)
California Resources Agency	California Environmental Resources Evaluation System (CERES)
State Water Resources Control Board (SWRCB)	Stormwater Multiple Application and Report Tracking System (SMARTS)
State and Regional Water Quality Control Boards	California Integrated Water Quality System Project (CIWQS)
San Francisco Estuary Institute	California EcoAtlas
San Francisco Estuary Institute	Bay Regional Monitoring Program

All monitoring results conducted in the watershed should be provided to the appropriate local, regional and/or state data collection systems applicable to corresponding individual-project funding and regulatory requirements. If the project includes a surface water or groundwater quality monitoring component, project proponents should integrate ambient data into the State Water Board's California Environmental the Data Exchange Network (CEDEN), Surface Water Ambient Monitoring Program (SWAMP), and Groundwater Ambient Monitoring and Assessment Program (GAMA).

The Project proponents will adapt project operations as needed per assessment of performance data results during individual project implementation. The project proponent should adjust as necessary and feasible to meet Plan objectives and project goals. This may include expanding or prioritizing outreach and education efforts, adjustment to project scope, or adapting project design to previously unknown constraints. Additional past and ongoing monitoring efforts are described below.

The City of Sonoma, City of Petaluma, County of Sonoma and Sonoma Valley Treatment Plant are regulated under either National Pollutant Discharge Elimination System Industrial General Permit or MS4 Permit which implements the federally-required storm water regulations in California for storm water associated with industrial activities and municipal separate storm sewer systems discharging to receiving waters. The City of Sonoma, City of Petaluma and County of Sonoma maintain robust monitoring programs related to receiving water and compile Annual Reports which are publicly available through the Stormwater Multiple Application and Report Tracking System (SMARTS) public access portal on the State Waterboard's website. Current monitoring data and comparable data collected previously for establishing the Sonoma Creek TMDLs and future Petaluma River TMDLs will provide a baseline against which the future beneficial water quality impacts of Plan implementation can be a measured. This comparison can be executed through the region-wide framework for assessing storm water program effectiveness outlined in the 2014 Program Effectiveness Assessment and Improvement Plan for

Marin, Napa, Solano, and Sonoma Counties, prepared by the Bay Area Stormwater Management Agencies Association (BASMAA) Phase II Committee.

In 2015, the City of Petaluma and the Marin County Stormwater Pollution Prevention Program (MCSTOPPP) collaborated on a two-year pesticide monitoring project. During water years 2016 and 2017, the City of Petaluma conducted pesticide monitoring at two locations in the Petaluma River during dry-season and storm-season conditions. Monitoring results were reported to CEDEN and filed to SMARTS. The City of Petaluma is also currently establishing a baseline trash generation rate through an On-Land Visual Trash Assessment protocol in order to show trash reduction in high priority areas over time. Staff have performed two visual assessments and will perform a third to establish baseline trash generation in high priority areas. The City will be doing regular visual monitoring to verify trash reduction in comparison to full capture systems. Compliance documents will be filed to SMARTS.

In the Sonoma Creek watershed, receiving water monitoring is being conducted by Sonoma County through a partnership with the City of Sonoma for priority pollutants consistent with the current TMDLs, namely pesticides and pathogens. The County of Sonoma, Sonoma Ecology Center, Sonoma County Transportation and Public Works, Sonoma County Regional Parks, City of Sonoma, Sonoma Water, and private landowners partnered for the *Clean Streams Project* in Southern Sonoma County to broaden existing public/private partnerships to reduce pollutant loading at high-priority sites in the Sonoma Creek and Petaluma River watersheds by implementing activities called for in TMDLs for sediment, pesticides, and pathogens. The City of Sonoma is also currently establishing a baseline trash generation rate through an On-Land Visual Trash Assessment protocol in order to show trash reduction in high priority areas over time. Staff has performed one visual assessments and will perform additional assessments to establish baseline trash generation in high priority areas. The City will be doing regular visual monitoring to verify trash reduction in comparison to full capture systems. Compliance documents will be filed to SMARTS.

The San Francisco Estuary Institute (SFEI) monitors a site at the mouth of the Petaluma River as part of the Regional Monitoring Program (RMP) for Water Quality in San Francisco Bay. The RMP is SFEI's largest program and an innovative collaborative effort between SFEI, the SFBRWQCB, and the regulated discharger community. This long-term, adaptive program provides information that regulators and decision makers need to manage the Bay effectively. Water, sediment, and bivalve tissue samples are collected from this location and are tested for a variety of constituents. Data for the RMP can be viewed at: https://cd3.sfei.org/.

The United States Geological Survey (USGS) maintains a gauging station on Sonoma Creek at Agua Caliente Road crossing, which can be accessed via the internet and allows the public to download the data at: https://waterdata.usgs.gov/ca/nwis/uv/?site_no=11458500&PARAmeter_cd=00065,00060. This station reports creek flow in cubic feet per second as well as creek depth. Additional precipitation and flow gauges have recently been deployed in the October, 2017 burn areas affecting the Sonoma Creek watershed. The information is publicly accessibly at: https://sonoma.onerain.com/home.php.

6.2.5 Decision Support Tools

During Plan development, a web-based GIS application hosted by Sonoma Water was populated with stakeholder supplied data and shared with the TAC to support analysis and inform decision making during project development. GIS layers included open space, non-taxed government parcels (public lands), disadvantaged communities, City and County storm drain structures, jurisdictional boundaries, soils, streams, LIDAR topography, and vegetation mapping. All of these layers exist on publicly hosted websites or are available upon request from the appropriate managing entity. Sonoma Water's webpage (www.scwa.ca.gov/SWRP) will link to public-facing GIS web applications that will enable project proponents to easily access the information needed to submit accurate phase two and three form information. These applications will include soil type, disadvantaged communities, watershed boundaries, streams, vegetation mapping, non-taxed parcels and open space.

In addition to the volume reduction and flood management curves found in Appendices D and E, existing hydrologic/hydraulic models for lower Sonoma Creek, City of Sonoma and Nathanson Creek, upper Petaluma River watershed, and City of Petaluma can be utilized to further define or refine project benefits and determine potential project locations.

Field investigations of site conditions (soil, water, habitat, etc.) are a fundamental evaluation tool to determine appropriate design for successful implementation. Project proponents will conduct field evaluations and assessments as needed as part of implementation and ongoing monitoring.

6.3 2018 Field Investigations to Determine Recharge Potential

As part of developing the SWRP, Sonoma Water led limited and focused surface and subsurface field investigations to evaluate groundwater recharge potential in the Petaluma River and Sonoma Creek Watershed. The field investigation sites were linked to proponent-identified project locations. Sonoma Water's scoping studies, developed for the Stormwater Management and Groundwater Recharge Initiative, recommended site specific assessments be performed at locations that appear feasible or optimal prior to planning and designing medium to large scale recharge enhancements projects.

Initially, the site locations where the proponent proposed to increase permeability and recharge groundwater as a project benefit were considered. The first step in the field investigation site selection process was to perform a literature review and desktop screening evaluation that considered pertinent hydrogeologic factors, including the project location relative to basin groundwater flow direction and occurrence, topographic slope, soil and aquifer permeability, and land use. Spatial datasets were provided directly by Sonoma Water or obtained from publicly available data sources. Sites were selected based on hydrogeologic factors, stated project description and benefits, willing participants, and access considerations. The field work plan included a two phased approach beginning with geophysical surveys performed on ground surface using electrical resistivity testing, followed by a second phase of work featuring

installation of sub-surface shallow borings performed to assess and confirm soil and groundwater conditions.

During Phase 1, surface field investigations were conducted at four locations (two in each watershed) where information collected from the desktop evaluation indicated the potential for effective recharge based storm water resource projects. During Phase 2, one site was selected in each watershed to conduct subsurface soil borings to confirm Phase 1 findings. This focused work was intended to enhance understanding of groundwater and surface water interactions to plan and provide for water supply reliability and manage surface and groundwater resources sustainably. Summaries of the field investigation findings for both the Petaluma River and Sonoma Creek watersheds can be found in Appendix F.

As a result of participation in this collaborative planning process and work of developing and sharing data and planning tools, the Sonoma RCD developed an approach to assist in conducting site assessments for determining potential for groundwater recharge. The approach (see Appendix G) is for future consideration and presents preliminary variables to investigate, and techniques available to assess a site for groundwater recharge potential, as well as to help identify sites that merit further investigation. It is intended to provide a low cost and iterative approach to assessing the suitability of a site, before making the decision to spend more significant funds on detailed field investigations, project design, and ultimately construction.

7. EDUCATION, OUTREACH, AND PUBLIC PARTICIPATION

7.1 Identification of Audiences

Sonoma Water identified and partnered with all primary entities involved in managing water and natural resources for the purposes of wide collaboration and involvement in the planning and public outreach process. Sonoma Water reached out to collaborating entities and existing stakeholder groups in the watershed communities to identify audiences and design outreach to include public participation, ensuring residents both rural and urban had a voice in the SWRP process. Stakeholders included non-governmental organizations (NGOs) with representation in the disadvantaged communities in both watersheds and include disadvantaged area communities (DACs) in Petaluma, El Verano, Boyes Hot Springs, and Agua Caliente. Information describing the Plan stakeholders, including the project team, collaborating entities participating in the Technical Advisory Committee, and disadvantaged and climate-vulnerable communities is provided below**.** Appendix A provides a complete list of specific audiences engaged.

SWRP Guidelines Checklist

- ☒ Outreach and Scoping: Community participation is provided for in Plan implementation.
- ☒ Plan describes public education and public participation opportunities to engage the public when considering major technical and policy issues related to the development and implementation.
- ☒ Plan describes mechanisms, processes, and milestones that have been or will be used to facilitate public participation and communication during development and implementation of the Plan.
- ☒ Plan describes mechanisms to engage communities in project design and implementation, including disadvantaged communities.
- ☒ Plan identifies specific audiences including local ratepayers, developers, locally regulated commercial and industrial stakeholders, nonprofit organizations, and the general public.
- ☒ Plan includes a schedule for initial public engagement and education.

7.1.1 Technical Advisory Committee

A Technical Advisory Committee (TAC) was formed to guide the development of the SWRP and to ensure successful implementation based on local conditions, needs and priorities. TAC membership consists of governmental and non-governmental organizations with responsibilities of storm water management or compliance or missions focused on natural resource management in either or both watersheds. The TAC composition represents the key stakeholder entities involved in managing storm water in both urban and rural areas. The TAC was formed early in the grant application process highlighting the members' history of collaboration and overlapping interests. The TAC's role included contributing existing data, maps, and written reports to inform the Plan development, providing guidance and input to the planning process,

methods, and conducting outreach efforts. Members also participated by submitting projects for consideration and reviewed and provided input for revisions of the administrative, public and draft final Plan versions. The TAC was comprised of the following organizations

TABLE 42
TECHNICAL ADVISORY COMMITTEE MEMBERS

Organization	Short Description
Sonoma Water	Sonoma Water was created as a special district in 1949 by the California Legislature to provide flood protection and water supply services. Since its inception, Sonoma Water's responsibilities have grown to provide over 600,000 residents with potable water, manage county and sanitation zones and districts serving 22,000 residences and businesses, maintain over 80 miles of creeks, distribute recycled water, and enhance fisheries populations within the Russian River. Sonoma Water served as the lead on development and management of the Southern Sonoma County SWRP.
City of Petaluma	The City of Petaluma is the second largest city in Sonoma County with a population of 60,540. Incorporated in 1858, the river, coupled with the arrival of the railroad in the 1870s, transformed the city into a thriving center of agricultural commerce for the region. Petaluma has the second-highest number of businesses of all cities in Sonoma County. The majority of workers in the City are employed in the service industry, followed by retail trade and construction.
Sonoma Ecology Center	Non-profit organization established in 1990, whose mission is to work with the community to enhance and preserve ecological health in Sonoma Valley. The SEC works on a broad range of programs, including education and outreach, sustainability, climate adaptation and watershed planning, creek mapping, creek restoration, and watershed organizing to help preserve and restore the natural areas and ecosystems of Sonoma County. The SEC has worked collaboratively with the Water Board, Sonoma RCD, and other partners over the years to promote watershed stewardship and protect habitats in the Sonoma Creek Watershed.
Sonoma County Regional Parks	Over 50 years, Sonoma County's Regional Parks system has grown to over 11,000 acres and 150 miles of trails in 56 parks, open spaces and marinas from Petaluma to Gualala and Sonoma to Bodega Bay. In the last 10 years, the parks system has doubled from 5,648 acres to 11,071 acres. The major public open space that Regional Parks manages within the Petaluma River and Sonoma Creek watersheds includes Helen Putnam, Tolay Lake, Hood Mountain, Sonoma Valley Regional Parks and Maxwell Farms.
Sonoma County Ag + Open Space	In 1990, Sonoma County residents created Sonoma County Ag + Open Space to permanently protect the greenbelts, scenic viewsheds, farms and ranches and natural areas of Sonoma County. As one of the first organizations in the country established to protect both agricultural and open space lands, Ag + Open Space has protected over 114,000 acres to benefit people and wildlife.
Sonoma Resource Conservation District	The Sonoma RCD's mission is to empower and partner with landowners and the community to address Sonoma County's most pressing natural resource concerns. For over 70 years, the RCD has provided science-based information and technical resources to assist landowners and managers in making the best possible management decisions about their land. Collaborating with a vast array of landowners and stakeholders, they deliver LandSmart® education, planning, and on-the-ground implementation programming throughout their district.
City of Sonoma	The City of Sonoma is the sixth largest city in Sonoma County with a population of 11,405. Over 56% of the City of Sonoma's employed population works in the service sector, which includes education, health care, tourism, and legal services. The second-largest sector is retail trade, followed by manufacturing. The City boasts an eight-acre plaza, the largest of its kind in California.
Sonoma Land Trust	A local, non-governmental, non-profit organization that preserves and protects land. They work closely with land owners, SCAPOSD, and an array of public agencies and government. They conserve scenic, natural, agricultural and open land through developing long-term land protection strategies, active stewardship, conservation easements, and provide educational opportunities. The SLT has protected more than 50,000 acres of land since their establishment in 1976.

TABLE 42 (CONTINUED)
TECHNICAL ADVISORY COMMITTEE MEMBERS

Organization	Short Description
Permit Sonoma, Sonoma County	Permit Sonoma is Sonoma County's consolidated land use planning and development permitting agency. Virtually any land development or construction that takes place in the unincorporated area of Sonoma County (outside the nine incorporated cities) is reviewed, permitted, and inspected by Permit Sonoma. Permit Sonoma also manages the County's storm water compliance obligations, well and sewer permitting.
Valley of the Moon Water District	VOMWD was formed as a County Water District in 1960 under Water Code Section 30000 et seq. for the primary purpose of providing a dependable supply of potable water in the Valley of the Moon. VOMWD's service area extends from the Trinity Oaks Subdivision, located north of the town of Glen Ellen, to the Temelec Subdivision located at the southern end of the Sonoma Valley, and encompasses a total area of approximately 7,545 acres. The District provides potable water to approximately 23,000 people through over 6,940 connections.
Lawrence Berkeley National Laboratories	Lawrence Berkeley National Laboratory addresses the world's most urgent scientific challenges by advancing sustainable energy, protecting human health, creating new materials, and revealing the origin and fate of the universe. Founded in 1931, Berkeley Lab's scientific expertise has been recognized with 13 Nobel Prizes. The University of California manages Berkeley Lab for the U.S. Department of Energy's Office of Science.
State Water Resources Control Board	The "California Water Boards" are state government departments that protect and enhance the quality of our state's waters for present and future generations. The California Water Boards are made up of the State Water Resources Control Board, along with the nine Regional Water Quality Control Boards. The State Water Board develops statewide policy and regulations for water quality control and allocates water rights.
San Francisco Bay Regional Water Quality Control Board	The SF Bay Regional Water Board jurisdiction covers the nine bay area counties and provides local implementation of policy and regulations, develop long-range plans for the basin, issue waste discharge permits and take enforcement actions against violators.

7.1.2 Disadvantaged and Climate-Vulnerable Communities

Petaluma River Watershed

There are four DAC census blocks within the watershed. Two tracts are located along the river at North McDowell Boulevard and are listed on the Department of Water Resources Disadvantaged Community Map (DWR 2017) as severely disadvantaged. Both tracts have a high social vulnerability ranking according to the Agency for Toxic Substances and Diseases Registry's Social Vulnerability Index (ATSDR 2017). Another tract is located across from the Sonoma-Marin Fairgrounds, and the fourth is located in the western part of the City, near Petaluma High School. Indicators include a large number of mobile homes or apartments, residents age 65 and up, and low median incomes. These vulnerability indicators suggest that this community's mobilization and response to disaster could be weakened and a sustained burden.

Sonoma Creek Watershed

The census block groups of El Verano, Boyes Hot Springs, and Agua Caliente are listed as DACs (DWR 2017). The census tracts in the Boyes Hot Springs and El Verano areas are also listed with high social vulnerability indices and low human development indices according to the Portrait of Sonoma County (Measure of America, 2014).

An identification and discussion of the climate hazards to vulnerable communities was reported in the Climate Ready Sonoma County: Climate Hazards and Vulnerabilities Assessment (Cornwall et al., 2014). Sonoma County is facing climate change hazards including bigger, more variable floods, more extreme heat events, longer and more frequent droughts, greater frequency and intensity of wildfires, fewer winter nights that freeze, and higher sea level and storm surge.

Communities vulnerable to these climate hazards are included in the planning boundaries for the southern Sonoma watersheds. Communities lacking air conditioning in their homes, having pre-existing asthma or other health conditions, living in neighborhoods with less open space and trees, lacking personal transportation to evacuate during emergencies or travel to air-conditioned buildings, or having language barriers to warnings and assistance messages are most at risk from harm from climate impacts (Cornwall et al., 2014). The 2013 California State Hazard Mitigation Plan ranks the County of Sonoma first and City of Petaluma tenth for highest repetitive flood loss. In addition, the County of Sonoma's 2017 Local Hazard Mitigation Plan further identifies Action Item #30 directing preparedness and outreach engagement to disadvantaged communities. Communities include those listed above and those in the bayland portion of the watersheds (such as Schellville in the Sonoma Creek watershed and Lakeville in the Petaluma River watershed) at risk to sea level rise and storm surges, as well as salt water intrusion into drinking water aquifers.

7.2 Public Outreach and Participation Strategy

Sonoma Water provided opportunities for community participation in Plan development and outreach during throughout plan development and project identification phases. Sonoma Water and its partners took an active role in gathering existing data, designing a transparent project evaluation procedure, and participating in the project prioritization process. During project implementation phases, project proponents will engage through the outreach mechanisms below, as well as additional or new mechanisms required by the funding source, to ensure the public and local stakeholders have an opportunity to learn about, contribute, and provide feedback on proposed project elements. Mechanisms that were used for engagement, outreach and education and a schedule for outreach conducted during Plan development are described below.

7.2.1 Website

Public participation and communication during development of the Plan was facilitated through use of a central website (www.scwa.ca.gov/SWRP) where project information, meeting notices, materials and grant deliverables were posted. The public comment period on the Draft Plan was noticed online, and the draft and final Plan will be available through the website.

The website will continue to function during Plan implementation as a conduit for resources on storm water management, Plan updates, and notices for public meetings. The website will provide a link to an online form used to capture and submit information on proposed new storm water projects.

7.2.2 Meetings

Plan-specific meetings and a variety of regularly-held water and natural resource meetings or forums provided numerous opportunities for participation, engagement, and education. Sonoma Water Flood Control Zone Advisory Committee meetings were publicly-noticed meetings. These meetings provided opportunities for citizens to learn about the State's Storm Water Grant Program, the Plan, receive project updates, and discuss flooding and storm water management issues. The Storm Water Resources Plan was a meeting agenda topic associated with several regional or watershed-based planning efforts including: Sonoma County Venture Conservation- Regional Conservation Partnership Program, Sonoma County Ag + Open Space Vital Lands Initiative, the Sonoma Valley Groundwater Basin Advisory Panel and the Upper Petaluma River Flood Control Project.

Technical Advisory Committee meetings were also open to the public and noticed online and via email. A public meeting on storm water planning was held on November 14, 2017. Notices for the public meeting were sent in English and Spanish to project partners and to those on an interested parties mailing list.

Sonoma Water and collaborating entities held numerous meetings with non-profit groups, ad-hoc working groups, and conducted outreach to many individual landowners to discuss the Plan, collect information, solicit input and develop project ideas.

7.2.3 Press Releases and Newsletters

Other forms of outreach and education included press releases, a frequently asked questions (FAQ) document, informational presentations and project updates, graphics and handouts of tables and maps involved in the planning process. Sonoma Water and Plan partners utilized their newsletters, local newspapers, and mailing lists to provide Plan updates, meeting notices, and project related information. The public comment period on the Draft Plan was also noticed via press release, online, newsletter and email.

A SWRP mailing list will be continuously maintained to ensure entities involved in storm water management and planning in both watersheds are provided notification and will have opportunity to submit projects and provide feedback during future Plan updates. Plan partners will be invited to post SWRP news and updates in their newsletters reaching a broad stakeholder audience and publicly available through websites.

7.2.4 Education and Outreach Programs

Sonoma Water's Water Education Program utilizes a multifaceted approach to teach students and teachers to appreciate the value of water as an important natural resource. Storm water, water conservation, natural resources and fisheries, as well as 'knowing where your water comes from' are main themes in curriculum. Programs are free and taught using inquiry-based, exploratory science aligned with the Next Generation Science Standards. Sonoma Water provides classroom visits, field trips, and curriculum materials for students located within Sonoma Water's service area and planning boundaries of the SWRP. In addition to the youth

education program, Sonoma Water hosts varied informational meetings, forums, and outreach tours to educate and inform the public on a variety of issues including: water supply, sanitation, flood protection and stream maintenance, storm water management, water conservation, groundwater management, fisheries, and natural resource conservation.

Sonoma Water, Valley of the Moon Water District, City of Petaluma and City of Sonoma maintain public webpages with information on storm water, pollution prevention, water conservation and provide helpful contacts and resources. Agency partners are active in storm water management and water conservation activities and outreach programs. One such program is the Sonoma Marin Water Saving Partnership where water management agencies work together in conducting outreach to consumers to conserve water.

The Sonoma Ecology Center and the Sonoma Resource Conservation District have developed landowner and homeowner storm water outreach material, including the NeWTS (Neighborhood Water Teams) Resource Guide and the Slow it, Spread it, Sink it, Store it Guide, for beneficial storm water management, in addition to plentiful online and print resources.

Daily Acts and the Friends of the Petaluma Watershed are NGOs actively engaged in community action and education. Education and outreach activities include: development of education materials, action campaigns, volunteer events, workshops, classroom programs, forums, and community wide events. Agencies and NGOs often partner and collaborate in engaging the community through a variety of activities and mixed media including: educational tours, land management demonstrations, water and natural resource forums/symposia, and restoration projects utilizing public volunteers. There are frequent opportunities through meetings, events, and websites and email to discuss Plan efforts and future implementation.

Several projects prioritized in the Plan are education and outreach-based programs. These projects, when implemented, will serve as a vital resource to the community by educating private landowners, land managers, public facilities, schools, and community organizations on practical and scalable storm water management practices.

7.2.5 Industry Collaboration and Outreach

Sonoma Water, Cities of Petaluma and Sonoma, and other SWRP stakeholders are active members in industry and government associations related to storm water management including: Association of California Water Agencies, Bay Area Stormwater Management Agencies Association, California Stormwater Quality Association, Bay Area Integrated Regional Monitoring Program, North Bay Watershed Association, North Bay Climate Adaptation Initiative, Bay Area Integrated Regional Water Management group, and ReNUWIt- Re Inventing the Nation’s Urban Water Infrastructure.

7.2.6 Disadvantaged and Climate-Vulnerable Community Outreach

Disadvantaged and climate vulnerable communities that are negatively impacted by runoff and flood related issues are addressed by flood management planning and project development by

the City of Petaluma and Sonoma Water. Environmental injustice affecting vulnerable communities was brought forward for inclusion in the work of the TAC.

TAC members conducted outreach in disadvantaged communities through in-person meetings, community meetings and newsletters. The County of Sonoma and the cities of Petaluma and Sonoma are actively engaged with economically disadvantaged and climate-vulnerable communities who are subject to repetitive flood loss and current flooding; these entities are working to address these issues through community engagement, providing education and working to secure resources for capital improvements and programming. The Sonoma Ecology Center engaged with several community groups in Boyes Hot Springs and Rogers Creek to plan storm water management projects that would benefit these communities. Mechanisms for outreach included in-person meetings, phone calls, and email exchanges with the Springs Community Alliance, La Luz Center, and Sonoma Valley Health Roundtable regarding Best Management Practices such as tree planting, urban greening, and storm water detention basins in the Springs area. Sonoma Ecology Center also met with representatives from the Creekside Village Homeowners Association about storm water management projects along Rogers Creek via telephone and email. The continued engagement of disadvantaged and climate-vulnerable communities was facilitated and tracked through the mechanisms listed above and through individual outreach to organizations serving these communities.

7.3 Schedule for Outreach and Engagement

The schedule for Outreach and Engagement included regular publicly-noticed meetings including Sonoma Water's Flood Control Zone Advisory Committee Meetings held in December 2016 and other meetings of the Sonoma Valley and Santa Rosa Plain Groundwater Basin Advisory Committee Meetings. These meetings provided opportunities for input. Presentations on the SWRP were made at the Flood Control Zone Advisory Committee Meetings held in December 2016 and other meetings of the Sonoma Valley and Santa Rosa Plain Groundwater Basin Advisory Committee Meetings. Updates on the Plan and opportunities for stakeholder involvement were also discussed at Zone 2A Flood Control Advisory Committee meeting on July 20, 2017.

During Plan development, a joint Kick Off meeting convening collaborators from the Russian River SWRP and Southern Sonoma SWRP was held on February 27, 2017 to introduce the planning efforts and provide an early look at objectives and timelines. This meeting served as TAC Meeting #1. Notices for TAC meetings were sent in advance to collaborators and posted online. The schedule for Southern Sonoma County SWRP TAC meetings was as listed below:

- TAC Meeting #2- July 26, 2017
- TAC Meeting #3- September 20, 2017
- TAC Meeting #4- January 17, 2018
- Additional TAC meetings held as needed

A public meeting was held on November 14, 2017 to gather input on the prioritization process and to provide an official call for projects to solicit opportunities from the public for consideration. The administrative draft review and comment period for the Plan began in May, 2018 with a planned 20-day review period. The Plan was then circulated for public review from August 20 to September 17, 2018, providing a 30-day review period. A summary of the public comments received and response can be found in Appendix H.

TABLE 43
SCHEDULE FOR OUTREACH AND ENGAGEMENT DURING PLAN DEVELOPMENT

	December	January	February	March	April	May	June	July	August	September	October	November	December	January 2018	February	March	April	May	June	July	August	September	October	November
Zone 2A Mtg.	■							■						■			■			■				
Zone 3A Mtg.	■													■										
TAC 1			■																					
TAC 2								■																
TAC 3										■														
TAC 4														■										
Public Meeting												■												
Admin Draft																		■	■					
Public Draft																					■	■		
Final SWRP																								■

8. REFERENCES

Agency for Toxic Substances and Diseases Registry (ATSDR). 2017. Social Vulnerability Index. Available at https://svi.cdc.gov/; accessed November 10, 2017.

Aquatic Science Center, 2010. Petaluma River Impairment Assessment for Nutrients, Sediment/Siltation, and Pathogens. Part 1: Existing Information and TMDL Comparison. Available at http://www.sfei.org/sites/default/files/biblio_files/Petaluma_IA_submitted_to_RWQCB_April_2010.pdf; accessed August 8, 2017.

BASMAA, 2014. BASMAA Post-Construction Manual: Design Guidance for Stormwater Treatment and Control for Projects in Marin, Sonoma, Napa, and Solano Counties. Available at http://basmaa.org/Board-and-Committees/Phase-II; accessed on July 25, 2017.

BMP Database, 2016. BMP Database 2016 Summary Statistics. Available at http://www.bmpdatabase.org/Docs/03-SW-1COh%20BMP%20Database%202016%20Summary%20Stats.pdf; accessed November 20, 2017.

California Department of Water Resources (DWR). 2017. Disadvantages Communities Mapping Tool. Available at https://gis.water.ca.gov/app/dacs/; accessed November 10, 2017.

City of Petaluma. 2015. City of Petaluma Urban Water Management Plan.

City of Sonoma. 2015. City of Sonoma Urban Water Management Plan.

Clean Estuary Partnership, 2004. How TMDLs are Adopted – the Basin Planning Process. Available at http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/mainpagegraphics/basin_planning_fs.pdf; accessed on July 5, 2017.

Cornwall, C., S. Moore, D. DiPietro, S. Veloz, L. Micheli, L. Casey, M. Mersich. 2014. Climate Ready Sonoma County: Climate Hazards and Vulnerabilities. Prepared as part of Climate Action 2020 by North Bay Climate Adaptation Initiative for Sonoma County Regional Climate Protection Authority. Santa Rosa, California. Available: http://www.sctainfo.org/pdf/Climate%20Ready_Hazards_Vulnerabilities.pdf.

Cornwall, C., G. Taylor, C. Walker. 2016. A Roadmap for Climate Resilience in Sonoma County. By Sonoma Ecology Center and the North Bay Climate Adaptation Initiative, for Sonoma County Water Agency. Sonoma Ecology Center, Sonoma, California.

Environmental Science Associates (ESA), 2017. Southern Sonoma Stormwater Resources Plan Modeling and Quantitative Methodology. Final Report. Prepared for Sonoma County Water Agency. September 2017.

EOA, 2012. Preliminary Baseline Trash Generation Rates for San Francisco Bay Area MS4s. Technical Memorandum.

EPA, 2007. Developing Your Stormwater Pollution Prevention Plan – A Guide for Construction Sites. Available at http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/; accessed on July 6, 2017.

EPA, 1999. Baylands Ecosystem Habitat Goals. A report of Habitat recommendations prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project.

Goals Project. 2015. Baylands and Climate Change: What We Can Do. Baylands Ecosystem Habitat Goals Science Update 2015 prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. California State Coastal Conservancy, Oakland, CA. p. v-vii, p.146-149. http://baylandsgoals.org/.

Measure of America. 2014. A Portrait of Sonoma County. Available at www.measureofamerica.org/sonoma/; accessed November 28, 2017.

Micheli E., L. Flint, S. Veloz, K. Johnson (Higgason), and N. Heller. 2016. Climate Ready North Bay Vulnerability Assessment Data Products: 1. North Bay Region Summary. A technical memorandum prepared by the Dwight Center for Conservation Science at Pepperwood, Santa Rosa, CA, for the California Coastal Conservancy and Regional Climate Protection Authority, 38 pp. http://climate.calcommons.org/crnb/home.

NOAA, 2017. NOAA Atlas 14 Point Precipitation Frequency Estimates: KS. Accessed at https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html. Downloaded on November 29, 2017.

North Marin Water District. 2015. North Marin Water District Urban Water Management Plan.

San Francisco Bay Regional Water Quality Control Board (SFRWQCB), 2005. Diazinon and Pesticide-Related Toxicity in Bay Area Urban Creeks – Water Quality Attainment Strategy and Total Maximum Daily Load (TMDL). Proposed Basin Plan Amendment and Staff Report. November 9, 2005.

SFRWQCB, 2006. California Regional Water Quality Control Board San Francisco Bay Region, Resolution R2-2006-0052. Available at http://www.swrcb.ca.gov/sanfranciscobay/board_decisions/adopted_orders/2006/R2-2006-0052.pdf; accessed August 8, 2017.

SFRWQCB, 2006b. Mercury in San Francisco Bay – Proposed Basin Plan Amendment and Staff Report for Revised Total Maximum Daily Loads (TMDL) and Proposed Mercury Water Quality Objectives. August 1, 2006. Available at http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/sfbaymercury/sr080906.pdf; accessed on August 24, 2017

SFRWQCB, 2007. San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan). Available at http://www.waterboards.ca.gov/water_issues/programs/tmdl/records/region_2/2008/ref2411.pdf; accessed on August 3, 2017.

SFRWQCB, 2008. Sonoma Creek Watershed Sediment TMDL and Habitat Enhancement Plan.

SFRWQCB, 2008. Total Maximum Daily Load for PCBs in San Francisco Bay – Final Staff Report for Proposed Basin Plan Amendment. February 13, 2008. Available at http://www.waterboards.ca.gov/ sanfranciscobay/water_issues/programs/TMDLs/ sfbaypcbs/PCBs%20TMDL%20Final%20Staff%20Report%20April2017.pdf; accessed August 24, 2017.

SFRWQCB, 2010. Final California 2010 Integrated Report (303(d) List/305(b) Report). Available at http://www.waterboards.ca.gov/water_issues/programs/tmdl/2010state_ir_reports/ 00692.shtml#6468; accessed August 21, 2017.

SFRWQCB, 2017a. San Francisco Region – Total Maximum Daily Loads (TMDLs) and the 303(d) List of Impaired Water Bodes. Available at http://www.waterboards.ca.gov/ sanfranciscobay/water_issues/programs/TMDLs/; accessed on July 5, 2017.

SFRWQCB, 2017b. San Francisco Region – What are TMDLs?. Available at http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/ whataretmdls.shtml; accessed on July 5, 2017.

SFRWQCB, 2017c. San Francisco Region Stormwater Programs and Permits – Construction Sites. Available at http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/ stormwater/construction.shtml; accessed on July 6, 2017.

SFRWQCB, 2017d. San Francisco Regional Water Quality Control Board – Order No. R2-2017-0033, General Waste Discharge Requirements for Vineyard Properties in the Napa River and Sonoma Creek Watersheds Available at http://www.waterboards.ca.gov/ sanfranciscobay/water_issues/programs/TMDLs/vineyard/final_docs/Vineyard%20 General%20WDRs%20-%207-17.pdf; accessed on August 21, 2017.

SFRWQCB. 2017e. San Francisco Regional Water Quality Control Board –Sonoma Creek Sediment TMDL. Available at http://www.waterboards.ca.gov/sanfranciscobay/water_ issues/programs/pTMDLs/sonomacrksedimenttmdl.shtml; accessed on July 6, 2017.

SFRWQCB, 2017f. San Francisco Regional Water Quality Control Board –Sonoma Creek Pathogens TMDL. Available at http://www.waterboards.ca.gov/sanfranciscobay/ water_issues/programs/TMDLs/sonomacrkpathogenstmdl.shtml; accessed on July 6, 2017.

SFRWQCB, 2017g. San Francisco Regional Water Quality Control Board –Sonoma Creek Nutrient TMDL. Available at http://www.waterboards.ca.gov/sanfranciscobay/water_issues/ programs/TMDLs/sonomacrknutrienttmdl.shtml; accessed July 6, 2017.

SFRWQCB, 2017h. San Francisco Regional Water Quality Control Board –Petaluma River Bacteria and Nutrients TMDL. Available at http://www.waterboards.ca.gov/sanfranciscobay/ water_issues/programs/TMDLs/petalumabacterianutrienttmdl.shtml; accessed July 6, 2017.

SFRWQCB, 2017i. San Francisco Regional Water Quality Control Board – Diazinon and Pesticide-Related Toxicity in Urban Creeks TMDL. Available at http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/urbancrksdiazinontmdl.shtml; accessed July 6, 2017.

SFRWQCB, 2017j. San Francisco Bay Mercury TMDL. Available at http://www.swrcb.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/sfbaymercurytmdl.shtml; accessed August 8, 2017.

SFRWQCB, 2017k. San Francisco Bay PCBs TMDL Project. Available at http://www.swrcb.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/sfbaypcbstmdl.shtml; accessed August 8, 2017.

SFRWQCB, 2017l. Renewal of Conditional Waiver of Waste Discharge Requirements for Grazing Operations in the Napa River and Sonoma Creek Watersheds. Available at https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/agriculture/grazing/napa_sonoma_grazing.html; accessed June 6, 2018.

SFRWQCB, 2018. Total Maximum Daily Load for Bacteria and Nutrient Impairment Analysis in Petaluma River. Draft Project Report. Available at https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/petalumabacterianutrienttmdl.html; accessed June 8, 2018.

San Francisco Estuary Institute, 2000. Contaminant Loads from Stormwater to Coastal Waters in the San Francisco Bay Region. September 2000.

San Francisco Estuary Institute and the Aquatic Science Center. 2018. Petaluma Valley Historical Hydrology and Ecology Study.

Schueler, T. and A. Youngk. 2015. Potential benefits of nutrient and sediment practices to reduce toxic contaminants in the Chesapeake Bay watershed: Part 1: removal of urban toxic contaminants. Final Report to the CBP Toxic Contaminants Work Group. Chesapeake Stormwater Network. Ellicott City, MD.

Sonoma County Economic Development Board (Sonoma County EDB). 2017. Petaluma City Profile Report.

Sonoma County EDB. 2018. Sonoma City Profile Report.

Sonoma County Regional Parks. 2017. Tolay Lake Regional Park Master Plan.

Sonoma County Water Agency (SCWA). 2003. Petaluma River Watershed Master Drainage Plan.

SCWA. 2007. Sonoma Valley Groundwater Management Plan.

SCWA. 2014. Sonoma Valley Groundwater Management Program Five-Year Review and Update.

SCWA. 2015. Sonoma County Water Agency Urban Water Management Plan.

SCWA. 2016. Sonoma Valley Groundwater Management Program 2015 Annual Report.

Sonoma Resource Conservation District (Sonoma RCD). 2013. Sonoma Creek Watershed Enhancement Plan.

Sonoma RCD. 2015. Petaluma River Watershed Enhancement Plan.

SWRCB, 2009. State Water Resources Control Board Resolution No. 2009-0076. Available at http://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2009/rs2009_0076.pdf; accessed August 8, 2017.

SWRCB, 2010. Category 5 Final 2010 California 303(d) List of Water Quality Limited Segments. Available at http://www.waterboards.ca.gov/water_issues/programs/tmdl/2010state_ir_reports/category5_report.shtml; accessed August 8, 2017.

SWRCB, 2012. Final California 2012 Integrated Report (303(d) List/305(b) Report). Available at http://www.waterboards.ca.gov/water_issues/programs/tmdl/2012state_ir_reports/00690.shtml#19845; accessed June 22, 2017.

SWRCB, 2013. Water Quality Order No. 2013-0001-DWQ, NPDES General Permit No. CAS000004. WDRs for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) (General Permit). Available at http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/phsii2012_5th/order_final.pdf; accessed August 8, 2017.

SWRCB, 2014. State Water Resources Control Board – Industrial General Permit 2014-0057-DWQ. Available at http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/industrial/2014indgenpermit/factsheet.pdf; accessed July 6, 2017.

SWRCB, 2015a. State Water Resources Control Board Resolution 2015-0019: Amendment to the Water Quality Control Plan for Ocean Waters to Control Trash and Part 1 Trash Provisions of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California. Available at http://www.swrcb.ca.gov/board_decisions/adopted_orders/resolutions/2015/rs2015_0019.pdf; accessed July 25, 2017.

SWRCB, 2015b. Storm Water Resource Plan Guidelines. December 15, 2015.

SWRCB, 2016. Draft California 2016 Integrated Report (303(d) List/305(b) Report). Available at http://www.waterboards.ca.gov/rwqcb2/water_issues/programs/TMDLs/2016_303d/00690.shtml; accessed August 8, 2017.

SWRCB, 2017a. State Water Resources Control Board – Phase II Municipal Separate Storm Sewer System (MS4) Program. Available at http://www.waterboards.ca.gov/water_issues/programs/stormwater/phase_ii_municipal.shtml; accessed July 6, 2017.

US Geological Survey (USGS), 2006. Geohydrologic Characterization, Water- Chemistry, and Ground-Water Flow Simulation Model of the Sonoma Valley Area, Sonoma County, California; USGS Scientific Investigations Report 2006-5092.

Valley of the Moon Water District (VOMWD). 2015. Valley of the Moon Water District Urban Water Management Plan.

Watershed Collaborative, 2018. Living in a Fire-Adapted Landscape: Priorities for Resiliency. A technical report prepared by the Watershed Collaborative Group chaired and coordinated by Sonoma County Ag + Open Space and Sonoma Resource Conservation District. Available at https://www.sonomaopenspace.org/watershed-collaborative/; accessed October 31, 2018.

Yee, D. and L.J. McKee. 2010. Task 3.5: Concentrations of PCBs and Hg in soils, sediments and water in the urbanized Bay Area: implications for best management. A technical report of the Watershed Program. SFEI Contribution 608. San Francisco Estuary Institute, Oakland CA 94621. 36.