Sonoma Valley Stormwater Management and Groundwater Recharge Scoping Study

Draft Issues Assessment

March 11, 2011

1. Introduction

The Sonoma County Water Agency (Water Agency) seeks to identify potential projects within the Sonoma Valley that can meet stormwater management and groundwater recharge goals. The Water Agency has contracted with ESA, PWA, Daniel B. Stephens & Associates, Parker Groundwater, and other subconsultants to develop these project concepts, vet them with Sonoma Valley stakeholders, and help identify potential funding sources.

This document is designed to elicit discussion and help to develop and articulate a common understanding of the project purpose and other objectives, issues, and strategies associated with the project.

2. Project Purpose

An immediate action of the Water Agency's 2010 Water Supply Strategies Action Plan is identification of projects within Water Agency flood control zones that reduce flooding and increase groundwater recharge. An important tool in identifying and improving water resource management in the Sonoma Valley is the 2007 Groundwater Management Plan (GMP). The GMP identifies stormwater recharge as a key action towards achieving groundwater sustainability. Other key actions identified in the GMP include groundwater banking, increased use of recycled water and conservation and other demand-reduction measures. The Sonoma Valley GMP goal – groundwater sustainability – cannot be reached without implementation of each of these actions.

Key Project Purpose:

Providing flood hazard reduction and groundwater benefits within the Sonoma Creek watershed.

The goal of the Sonoma Valley Stormwater Management and Groundwater Recharge Scoping Study is to develop one or more stormwater management/groundwater recharge projects that address the Key Project Purpose: reducing flood hazards and increasing opportunities for groundwater recharge within the Sonoma Creek watershed.

A project may consist of either a single facility or multiple "elements" that function physically as stand-alone projects but collectively address core project objectives. For example, a single facility option might be a retention basin for stormwater that reduces the size of a flood peak while enhancing groundwater recharge. A multiple-element project might include a project to create a designated high flow bypass area for a creek, together with an educational and incentive program to encourage retrofitting of residences for onsite stormwater infiltration.

Project Objectives

Core project objectives are proposed to include **both**:

1. Flood hazard reduction - improve **management of stormwater** that contributes, directly or indirectly, to reduced flood hazards.
    1. Includes reduction in flood hazards resulting from any magnitude flood event, whether a rare, large event or a small, frequent event.
    2. Includes measures that shift incompatible uses (e.g., a residence that is not flood-proofed) out of the floodplain or dedicate floodplain to flood-compatible uses, such as parks, agricultural fields, other forms of open space, or even parking lots.
    3. Includes measures that reduce anticipated future flood hazards, such as converting lands at increased risk from sea level rise to tidal marsh, so as to preclude potential flood damage and to help protect adjacent land uses.
2. Groundwater recharge - increase beneficial **recharge of groundwater**, whether or not that recharged groundwater is directly accessible as water supply.
    1. Includes passive recharge, such as retention ponds designed for infiltration.
    2. Includes Low Impact Development (LID) measures that promote infiltration, such as rain gardens to retain runoff at the source.
    3. Includes groundwater recharge – whether or not that recharge quantity is directly tracked as supply (“banked”).
    4. Includes any groundwater recharge that can directly or indirectly increase or protect accessible groundwater supplies.

Core Project Objectives

1. Flood hazard reduction - Improve management of stormwater that contributes, directly or indirectly, to reduced flood hazards.
2. Groundwater recharge - increase beneficial recharge of groundwater, whether or not that recharged groundwater is directly accessible as water supply.

These core objectives are supported by a number of supporting project objectives, which may or may not be achieved by every project. Supporting project objectives include:

1. Water quality – Improve quality of surface water and/or groundwater supplies.
2. Water supply – Increase or improve water supply availability, reliability, and flexibility for domestic, municipal, industrial and agricultural use and for the environment.
3. System sustainability – Support energy and water efficiency and climate change resiliency of water management systems and developed supplies, as well as the ability of stream systems to be maintained by natural processes.

4. Ecosystem – Improve ecosystem function and/or habitat enhancement, especially for special status species.
5. Agricultural land – Preserve agricultural land uses.
6. Open space – Preserve and/or enhance open space.
7. Community benefits – Create and/or enhance recreation, public access, education, etc.

Sonoma Creek at Glen Ellen, following the peak of the 2005-2006 flood event.
Image from the Sonoma Valley Historical Ecology Archive. Elaine Nealley, photographer.

3. Problem Description

To provide a context for this project, the following section describes the problems related to flood hazards and groundwater in the Sonoma Valley. Our goal is to develop one or more stormwater management/groundwater recharge projects to offset these problems.

3.1 Flood hazards

Sonoma Creek has experienced significant morphological changes typical of streams in the San Francisco Bay Area following land use modifications and population increases in the 19th and 20th centuries. Grazing and development in the upper watershed reduce the capacity for soils to infiltrate moisture and result in increased runoff to stream channels. Levees and infrastructure adjacent to the stream channel reduce connectivity with the adjacent floodplain and concentrate flows within the channel. The result is an increase in runoff and sediment delivered from the upper watershed to the lower watershed over time.

In addition to sediment, storm water runoff also delivers other pollutants, providing a strong linkage between water quality and floods. Because Sonoma Creek is formally recognized as impaired by nutrients, pathogens, and sediment, water quality considerations are an important part of determining the watershed's runoff management strategy, especially for smaller flood events. The "slow it, spread it, sink it" or a "low-impact development" (LID) approach is increasingly being reflected in both regulatory constraints and funding requirements or incentives;, however, this approach has not historically been a part of how the storm water system was developed in the Sonoma Valley. In fact, the traditional strategy for storm water management sent runoff as quickly and efficiently as possible to receiving waters. This strategy typically increased flood peaks while virtually eliminating the opportunity to treat diffuse water quality problems at the source. Thus, measures to address flood hazards may address water quality concerns as well.

Flooding in the Sonoma Creek watershed for which economic damages have been reported is largely concentrated in three areas: near the town of Kenwood, within the City of Sonoma and downstream of Schellville. Each of these three flood hazard areas is discussed below. Additional areas are also subject to flooding (e.g., in Boyes Springs, El Verano, Glen Ellen, etc.).

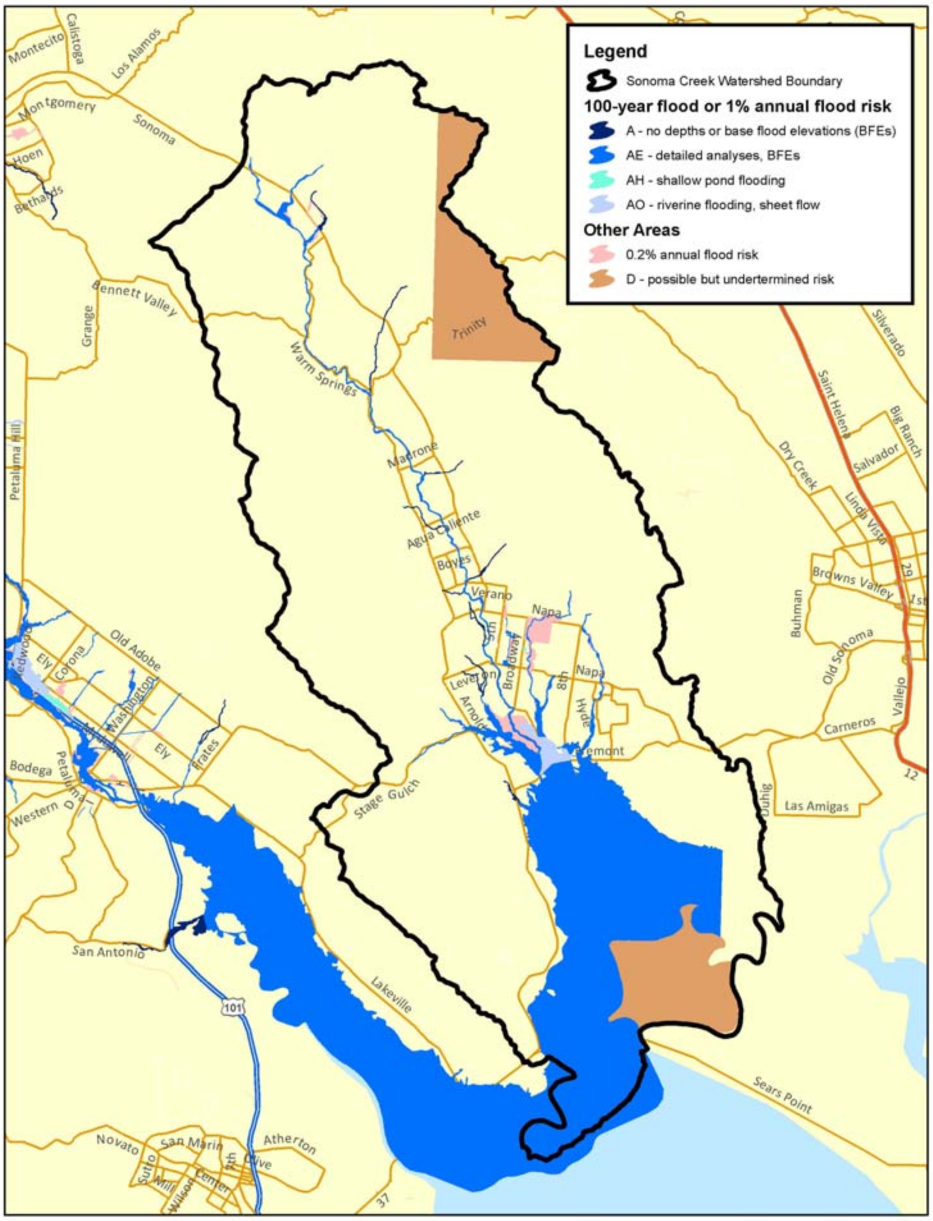
Sonoma Creek near Kenwood

Frequent flooding occurs on Sonoma Creek just upstream from the town of Kenwood. This area is located on the alluvial fan formed by Sonoma Creek as it flows from the Mayacamas Mountains to the Sonoma Valley floor. During floods, all of the alluvial fan surface may be subject to flooding and channels may move across its surface due to active processes of erosion and deposition. Because of the potential of catastrophic change in stream channel form and position that can occur during a single flood, alluvial fans present particular challenges to floodplain managers, regulators, and residents.

In the vicinity of Kenwood, the principal flood problems in the main channel are caused by inadequate channel capacity to carry large flows from short-duration, high-intensity storms. Flood problems are accentuated by residential development along the channels. There are several distributary channels (channels carrying flow away from the main channel) in the area that may become active during floods. The size of a given flood usually determines which overflow channels are active, but land use practices have caused many of the main distributaries and overflow channels to change course. Historically, flood flows from nearby tributaries—which have now been connected directly to the mainstream of Sonoma

Creek through a series of large ditches—probably combined into various overflow and distributary channels, eventually merging into the broad wetlands of the Kenwood Marsh (Laurel Collins, personal communication).

The effect of development on flooding is complex. Recent floods, such as the New Year's Eve flood of 2005-2006, resulted in flooding of distributary channels and overflow channels upstream of the Highway 12 crossing of Sonoma Creek. This flooding probably helped reduce the flood peak and associated impacts in Sonoma Creek itself.



Current FEMA Flood insurance regulatory floodplain mapping

City of Sonoma
The City of Sonoma is built upon the alluvial fan deposited by Nathanson Creek, Arroyo Seco, and Fryer Creek. Through years of flooding and sediment deposition, the banks of Nathanson Creek at the northern end of the city have formed natural levees. Floodplains adjacent to streams with natural levees gently slope away from the stream channel, resulting in banks that are higher than in surrounding development. As a result, when these channels overtop their banks, they can inundate a large area.

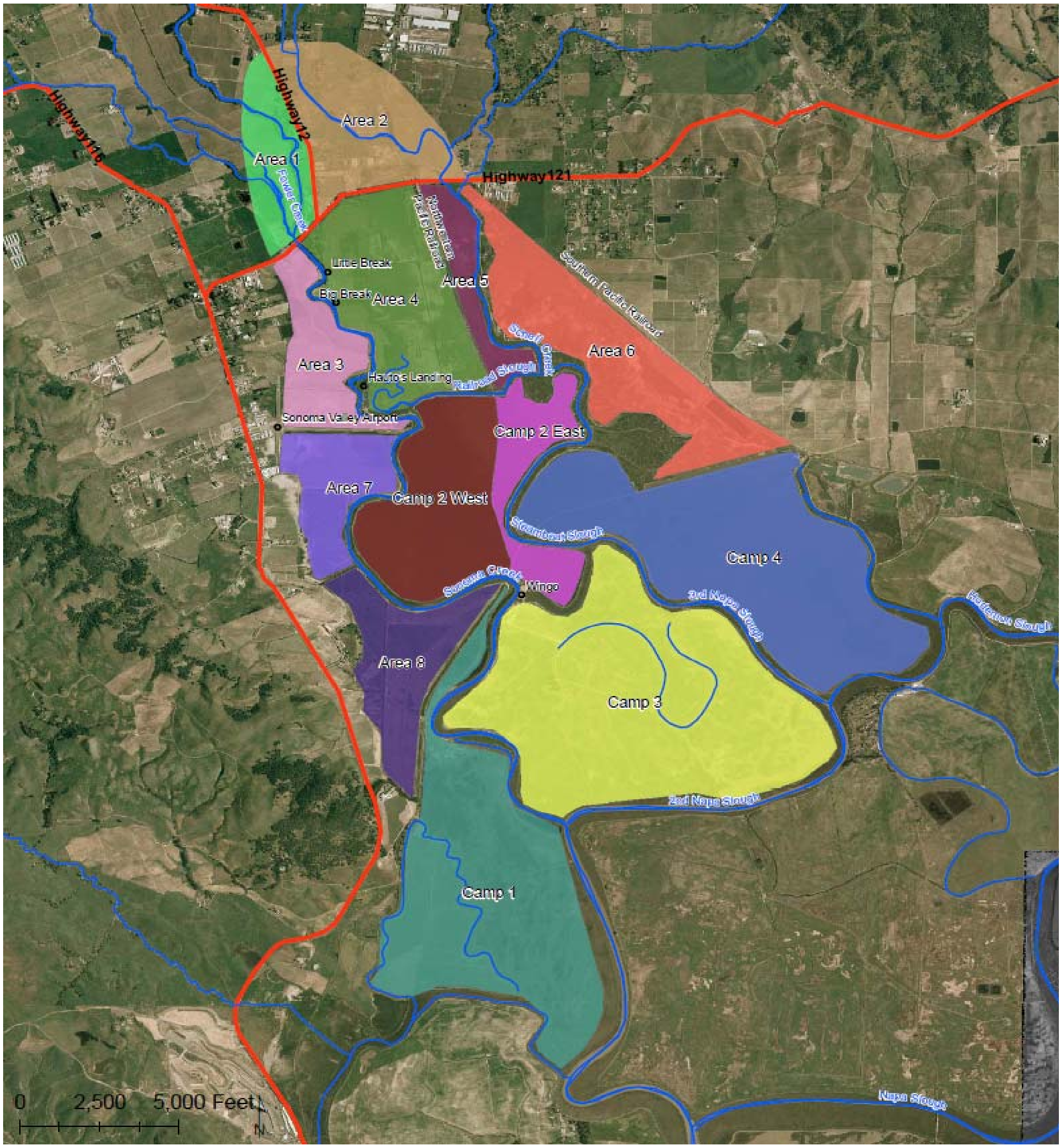
Principal causes of flooding in the City of Sonoma are perched channel conditions, encroachment of development onto floodplains, and inadequately-sized storm drainage infrastructure such as bridges and culverts. According to Flood Emergency Management Agency (FEMA) mapping, Nathanson Creek is able to contain the 100-year flood with minor overbank flooding in some locations. However, due to its perched conditions above adjacent lands, significant flooding can occur during larger storms. Flooding in the Fryer Creek watershed occurs more frequently than in the Nathanson Creek watershed and is primarily driven by undersized storm drainage infrastructure.

Sonoma Creek near Schellville
The most extensive flooding in the watershed occurs at the furthest downstream reach of Sonoma Creek, between the confluence of Sonoma Creek and Schell Creek during flood flows (just upstream of Highway 121) and San Pablo Bay.

Flood Level	**Impacts** *(see figure on the following page for location information)*
+ / - 2-yr	Sonoma Creek begins to overtop its levees at low spots.
	Schell Creek overtops its banks upstream of Highway 121.
	Flows overtopping the right bank bypass the creek's large meander and flow overland south to the highway.
	Downstream of Highway 121, Schell Creek overtops its right and left banks upstream of the tide gates.
10-yr	CA Department of Fish & Game property known as Camp 2 may begin to flood from levee overtopping at its northeast corner.
	Area south of the airport and north of the agricultural property west of Sonoma Creek known as Camp 1 also floods from the overtopping of Sonoma Creek levees.
25-yr	Out-of-bank flows from Sonoma, Schell, and Fowler Creeks are comingled upstream of Highway 121.
	Deeper flood waters in Camp 2 due to additional overbank flow locations along Sonoma Creek and Steamboat Slough.
100-yr	Additional flood locations include the area north of the airport and the agricultural property east of Sonoma Creek known as Camp 4.

In the vicinity of the Highway 121 crossing, Sonoma Creek transitions from being fluvially-dominated to tidally-dominated and the slope of the channel decreases dramatically as the creek nears San Pablo Bay. Historically, much of the area downstream of Highway 121 was marshland, bounded roughly by the railroad line to the east and the Sonoma Valley Airport to the West. Between Highway 121 and Railroad Slough, the marshlands were bisected by the Sonoma Creek alluvial fan, and the creek channel was perched somewhat above the surrounding lands. During higher runoff events, the historic marshlands were regularly inundated by tidal waters from the Bay as well as floodwaters from the upper watershed. The marshes were drained in the late 1800s, distributary channels were combined and ditched, and levees, or local elevated areas that border a stream channel, were built to contain flood waters and prevent tidal inundation (USACE, 1963).

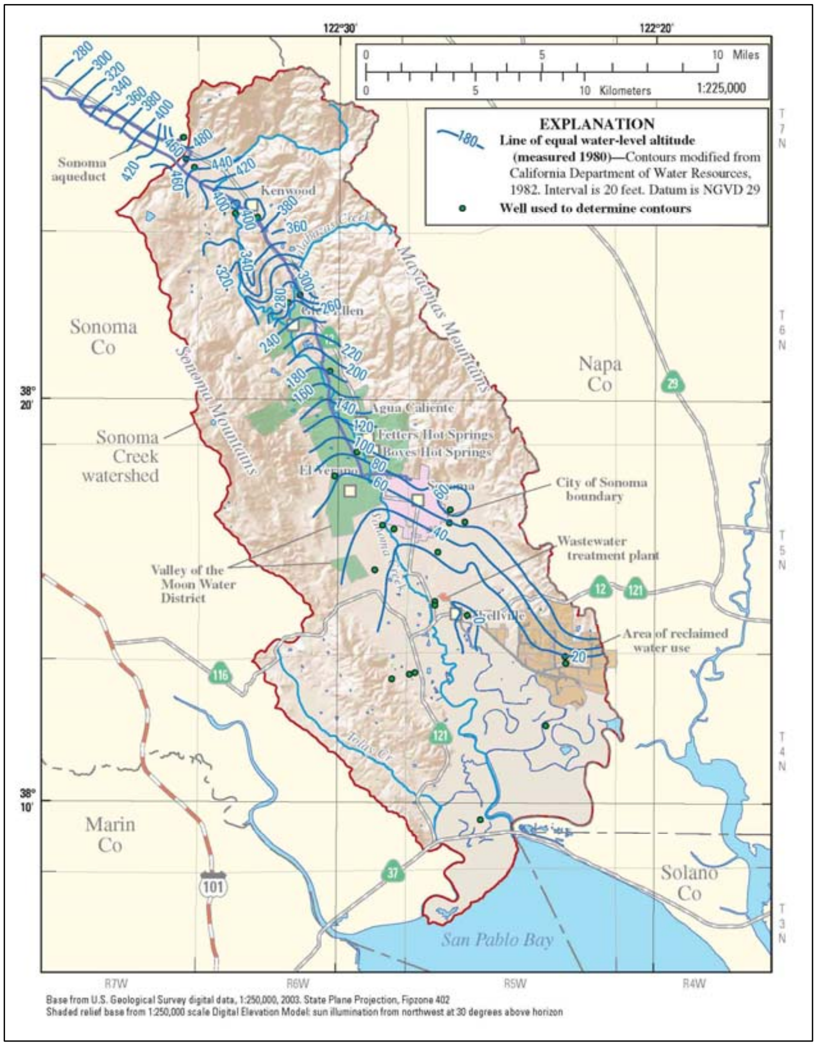
Relatively frequent runoff events from the Sonoma Creek watershed can cause out-of-bank flooding from Sonoma and Schell Creeks in the Schellville area.



Schellville/Lower Sonoma Creek Subareas

Groundwater Problems

The primary groundwater problems for the Sonoma Valley include declining groundwater levels, groundwater quality concerns including intrusion of saline water in the southern part of the valley, and upwelling of thermal groundwater.



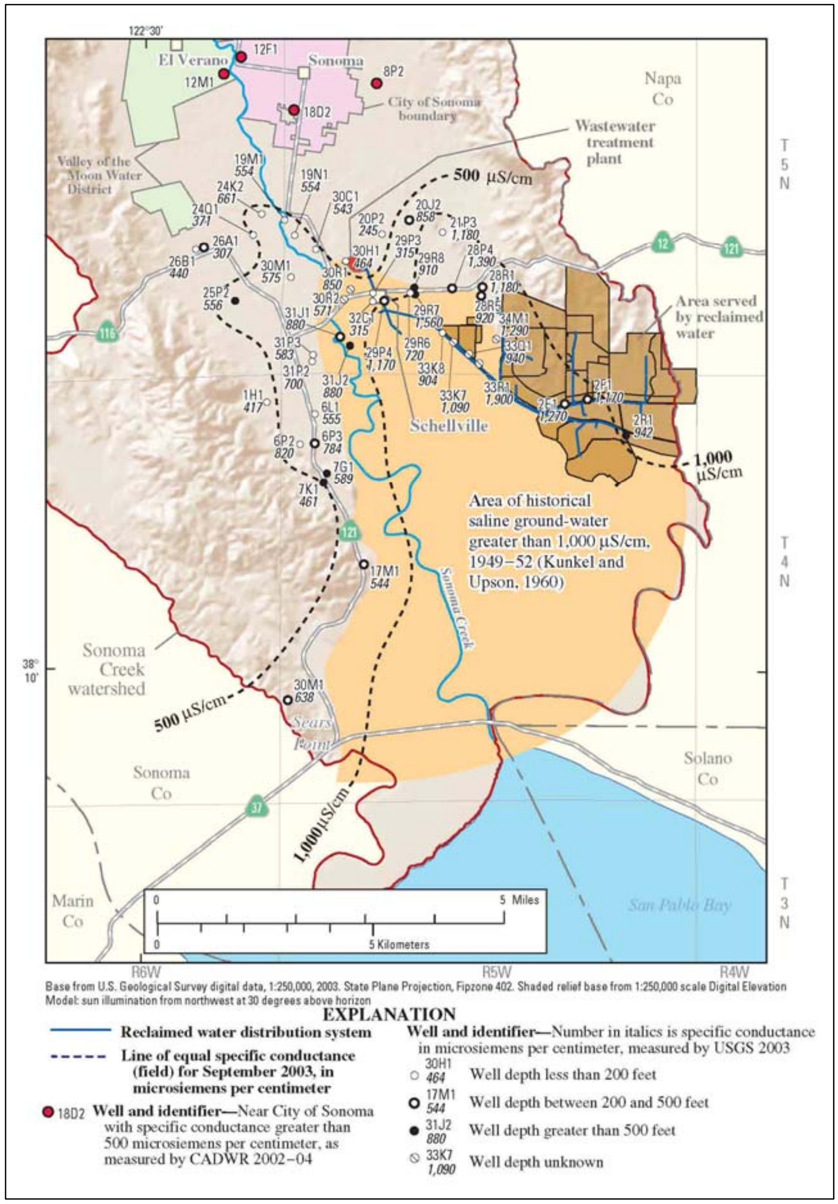
Rapid growth and increased demand on groundwater resources have led to declining water levels.

Over the past 30 years, Sonoma Valley has experienced rapid population growth and land-use changes. There has been a significant increase in irrigated agriculture, predominantly vineyards, which rely primarily on groundwater. Groundwater levels have declined in some portions of the Sonoma Valley, especially in the Sonoma, El Verano, and the Carriger Creek areas and can be attributed to increased localized groundwater withdrawals. Cones of depression have recently developed in areas southeast of the City of Sonoma and southwest of El Verano. Domestic, agricultural and urban water use is projected to increase, placing further demands on the current groundwater supply that will likely result in lower groundwater levels in the future. These declines in groundwater level may result in increased extraction costs, possible well deepening or replacements costs, possible groundwater quality degradation including salinity intrusion, potential land subsidence, decreases in streamflow, and environmental damage.

When evaluating areas for aquifer recharge, potential groundwater constituents of concern include nitrate, arsenic, boron, chloride, chromium, fluoride, iron, lead, and manganese. Wells in the northern half of Sonoma Valley are disproportionally more likely to have water with values equal to or in excess of standards and advisory levels for these compounds. The public health goal for chromium was recently decreased and is likely to result in a reduced maximum contaminant level (MCL) in drinking water.

Data collected in 2003 suggests that saline groundwater in the southern part of the Sonoma Valley has shifted since 1949–1952. . The northern edge of the saline area may have advanced as much as one mile north of Highway 121. This apparent movement of saline ground water may be in response to groundwater pumping in the lower basin and the resulting depression of hydraulic heads southeast of the City of Sonoma.

A “warm water belt” (water greater than 20°C) extends between Los Guilicos in the northwest to Boyes Hot Springs in the southeast and also includes Fetter’s Hot Springs and Agua Caliente. The Eastside fault on the eastern side of the Sonoma Valley is believed to be the western boundary of the main geothermal reservoir. The source and mechanism of the movement of thermal water in the Sonoma Valley may be the upwelling of the most mineralized and the hottest thermal waters along faults or fractures extending from depth to near land surface. Water quality issues are often associated with thermal water, which contains higher concentrations of dissolved minerals than nonthermal waters. Thermal water often contains elevated concentrations of trace elements such as arsenic, boron, chromium, fluoride, and lithium in concentrations that exceed drinking-water standards and that can damage irrigated crops .



Saline groundwater in the southern part of the Sonoma Valley appears to have shifted since 1949–1952.

4. Issues

Issues to be confronted when developing projects that meet the objectives range from technical to informational to economic, political, legal, social, institutional, or some combination. Below is a brief identification of issues, based on our current understanding.

1. Stormwater technical issues
    a. Selecting an appropriate analysis methodology, given limited information
    b. Analysis strategy, given limited time and budget
    c. Reconciling sometimes conflicting goals: reduced flooding and increased recharge
2. Stormwater goal issues
    a. Appropriate size of events to focus on
    b. Flow reduction targets – how to set
3. Stormwater information gaps
    a. Topography and hydrography
    b. Flood hazard locations
    c. Valuation of flood hazard reduction benefits
    d. Hydraulic data and evaluation tools
4. Hydrogeology/groundwater recharge technical issues
    a. Variable geology and permeability (faults, folds, volcanics)
    b. Variable depth to water and storage space available
    c. Water quality issues (nitrate, boron, arsenic, manganese, fluoride, chloride and chromium)
    d. Finding recharge methods appropriate for stormwater and local hydrogeology
    e. Finding recharge methods and locations that do not create or exacerbate issues (slope instability, salinization, mobilization of naturally occurring contaminants, etc.)
5. Hydrogeology/groundwater recharge information gaps
    a. Limited long term water level and water quality data
    b. Current monitoring network consists largely of production wells (instead of dedicated monitoring wells)
    c. Limited construction and geologic information of wells in monitoring network
    d. Pumping data is currently limited to municipal supply wells and does not include domestic and agricultural wells
6. Stakeholder concerns
    a. Effective communication with the public, including affected communities.
    b. Accounting for water rights considerations.

   c. Regulatory constraints and considerations *(see Regulatory Agencies box on the following page for a list of agencies with a potential interest)*.

   d. Spatial and stakeholder distribution of project benefits and impacts.

   e. Achieving buy-in from a diverse set of stakeholders.

   f. Getting agreement on who implements and who manages a project longer term.

7. Funding and cost considerations

   a. Making the most of diverse potential funding sources with differing priorities and requirements.

   b. Reconciling who benefits with who pays.

   c. Addressing the need for a local cost share.

   d. Addressing the need to finance ongoing project operations and maintenance activities.

   e. Uncertainty in the valuation of project costs and benefits.

8. Local Issues

   a. Land use change requirements for project implementation.

   b. Incidental economic and land use impacts.

Hwy 12 at the Hwy 121 intersection, after the 2005-2006 flood event on Sonoma Creek. Image downloaded from the Sonoma Ecology Center website. Richard Dale, photographer.

Regulatory Agencies – A Partial List

USACE (US Army Corps of Engineers):

Jurisdictional wetlands; Sections 106 110 – cultural resources

USFWS (US Fish and Wildlife Service):

Listed Species in riparian, baylands, and upland environments; Biological Opinions; mitigation requirements and costs

FEMA (Federal Emergency Management Agency):

Floodplains, floodways; insurance issues

CDFG (CA Department of Fish and Game):

State listings and concurrence with Biological Opinions; 1601 Streambed Alteration Agreements; 1602 Stream Crossing Permits in riparian areas

SWRCB/RWQCB (State Water Resources Control Board/Regional Water Quality Control Board):

Water rights, water quality; local water agencies' discharge permit requirements

BCDC (Bay Conservation and Development Commission):

Baylands management

State Lands Commission:

Ownership, rights of way – Commission requirements

Local:

Engineering – Ownership and rights of way, construction requirements
Planning – Conformity with plans and ordinances
Parks and Open Space – rights of way, species issues, public access

Strategies

We envision that the current effort to develop projects to accomplish the core objectives will adopt many or all of the following strategies. Doing so will help to guide the development of project solution set with good potential to have the mix of funding potential and community support required to be successful:

Strategy 1: Develop a portfolio. Develop a portfolio of individual, technically-effective project elements that individually address one or more core or supporting project objectives. Use this menu of elements to develop combinations that can be used to configure a project depending on the priorities and scoring mechanism of the funding source. This would create a resource into the future that could be adapted to funding sources beyond those that are currently identified.

Strategy 2: Build around core and high priority objectives. Rather than trying to look broadly at many possibilities, focus on core and high priority project objectives and formulate one or more project concepts that accomplish them. Use lower priority goals only to help refine the project components.

Strategy 3: Identify the likely do-ers and dollars. Focus on the entities most likely to take the lead in a type of project, the most promising sources of grant money, and opportunities for local cost-share as a way of determining the most desirable initial building blocks of a project.

Strategy 4: Build a foundation on political strength. Focus first on project with elements that have strong political support. We assume that increased political support will also generally reflect larger economic valuation of benefits.

Strategy 5: Start the ball rolling. Rather than only trying to address large problems with large solutions, focus on developing guidance materials, incentives, assistance programs, or demonstration projects that will trigger further action and a larger cumulative effect.

Strategy 6: Inspire with a vision. Create a vision of a single large, multi-part project that will appeal to many. Seek to pursue funding in smaller steps as available and appropriate. This approach may encourage multiple opportunities for private and public entities to take on implementing parts of the vision.

Strategy 7: Include elements of multiple scales, types, and locations. Identify a set of project elements that span a range of scales and types, focused in different parts of the Sonoma Valley, to create a strong mix of supporters and a range of scales of demonstration projects.

We will consider each of these strategies prior to establishing our approach to developing conceptual project alternatives.

5. Project Types

There are a wide range of types of projects that can contribute to meeting the Key Project Purpose and core objectives. These types of projects include the following:

Flood hazard reduction

- Create centralized surface water detention/retention
- Increase channel conveyance
- Replace or modify undersized drainage infrastructure
- Develop bypass conveyance
- Develop features to facilitate drainage out of ponding areas
- Floodproof/elevate development
- Relocate development
- Create or expand flood easements
- Purchase lands subject to flooding
- Construct or repair levees/flood walls
- Remove undesirable flow blockages (e.g., *arundo donax*, unpermitted fences, etc.)
- Develop an improved flood warning system
- Undertake watershed management to reduce sediment erosion and delivery to waterways
- Develop and implement sediment management program in depositional reaches

Groundwater recharge

- Implement or facilitate dispersed surface water detention (e.g., LID measures, rainwater harvesting systems)
- Develop centralized surface water detention/retention (e.g., off-channel reservoir)
- Implement or facilitate dispersed passive groundwater infiltration (e.g., LID measures)
- Develop centralized passive groundwater infiltration (e.g., infiltration gallery, siphon, creek daylighting)

Prioritization of objectives and development of screening criteria will likely reduce the range of potential project types as this scoping study progresses. Flood hazard reduction and groundwater recharge can be compatible or competing project goals. Generally, most groundwater recharge activities are conducive to flood hazard reduction because those activities are designed to relocate surface water to aquifer storage. Some project types are quite compatible; for example, detaining flood waters in a reservoir could accomplish the dual goal of minimizing flood hazards and providing a mechanism for groundwater recharge. Other flood hazard reduction activities may have outcomes that conflict with the objective of increasing groundwater recharge. For example, increasing channel conveyance may move surface water more quickly to downstream receiving bodies, which will leave less time for groundwater recharge. As another example, any action to reduce overbank flood flows that are currently helping to recharge groundwater has the potential to reduce overall recharge.

To avoid potential conflicts between the two core objectives, we plan to prioritize investigation into project types with the best potential to meet one or both core objectives. We will exclude project types that are potentially at conflict with one objective from our investigation unless there appears to be good cause: significant potential benefits accruing to one objective and zero or only minor costs with regard to the other objective.

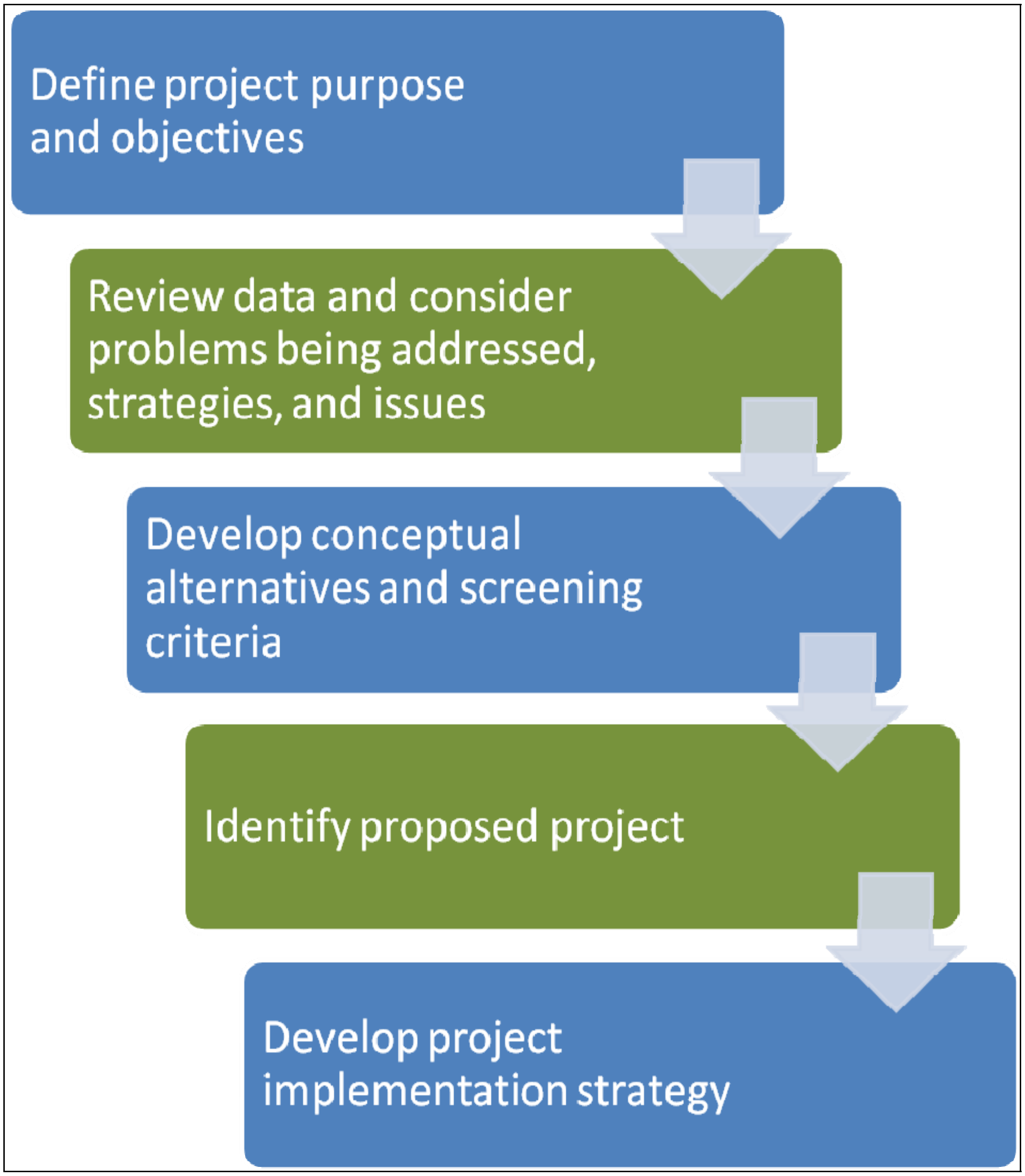
Flood Hazard Project Types	**General Compatibility with Groundwater Recharge Projects**
Create centralized surface water detention/retention	●
Increase channel conveyance	◆
Replace or modify undersized drainage infrastructure	● / ◆
Develop bypass conveyance	◆
Develop features to facilitate drainage out of ponding areas	●
Floodproof/elevate development	▲
Relocate development	▲
Create or expand flood easements	▲
Purchase of lands subject to flooding	▲
Construct or repair Levees/flood walls	● / ◆
Remove undesirable blockages (e.g., *arundo donax*, unpermitted fences, etc.)	▲
Develop an improved flood warning system	▲
Undertake watershed management to reduce sediment erosion and delivery to waterways	▲
Develop and implement sediment management program in depositional reaches	▲

Notes:

● Project types complement and enhance each other
▲ Project types are compatible
◆ Project types have potentially conflicting goals

6. Next Steps

With input from Sonoma Valley stakeholders, the Water Agency will develop a project that achieves the project purpose and satisfies the core objectives. The process being undertaken is illustrated in the flowchart below:



Current project development process

After receiving input from the stakeholders of the Sonoma Valley, the Water Agency will develop conceptual project alternatives for further consideration by the stakeholders. Project concepts will be screened and prioritized. One or more proposed projects will be identified for further consideration, including development of needed additional feasibility studies and a funding strategy.