# Marin County
# Watershed Management Plan
# Administrative Draft

**April 2004**


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# Introduction

The primary purpose of the Marin County Watershed Management Plan is to guide County staff, resource managers and policy makers, and community organizations to protect and where needed restore the beauty and natural function of Marin County's watersheds. The plan is intended to be a practical tool with specific recommendations on practices to improve and sustain a healthy, productive environment.

This plan focuses on the drainages within the Inland Rural and Coastal Recreation planning corridors, the area known as west Marin. Although most of the plan's recommendations are applicable for the entire County, the areas that drain into San Francisco Bay will be specifically addressed by the North Bay Watershed Stewardship Plan being prepared by the North Bay Watershed Association.

The Marin County Watershed Management Plan is intended to support the policies and programs developed during the updates of the Marin Countywide Plan and Local Coastal Program and to encourage implementation of the goals and recommendations of the community-based planning documents developed for Tomales Bay, Redwood Creek, Walker Creek, Stemple Creek, and others.

The plan consists of the following pieces:

- **Chapter 1** provides the context for the recommendations that form the heart of the plan. It defines a watershed, describes watershed management, and presents seven guiding principles to give overarching guidance for land use activities in Marin County watersheds.

- **Chapter 2** describes the watersheds of western Marin County, briefly summarizes current planning and restoration efforts, and identifies major issues in each watershed.

- **Chapter 3** presents objectives for implementing the guiding principles along with specific recommendations to achieve each objective. These objectives and recommendations have been developed within the context of supporting healthy watershed function. Some are taken directly from watershed plans that have undergone a public participation and approval process. Others are presented here for the first time.

- **Chapter 4** explains different types of monitoring used in watershed management and describes the elements of a scientifically sound monitoring plan.

- **Chapter 5** describes a framework to guide community groups and public resource managers in creating plans for individual watersheds.

- **Chapter 6** recommends priority actions, additional studies, and policies for Marin County, other public entities, and private-public partnerships to undertake as next steps.

  Acronyms used in this plan are provided after the Introduction. A **glossary** and a **list of references** cited follow Chapter 6.

- **Appendix A** describes each of the major watersheds covered in this plan. It identifies special habitats and species, describes past and current planning and management work, lists important issues, and identifies priority needs for each watershed.

- **Appendix B** is a collection of practices and references for implementing many of the recommendations identified in Chapter 4.

- **Appendix C** summarizes the regulations and permits pertaining to watershed restoration projects.

- **Appendix D** lists the species of concern identified through the California Natural Diversity Database for Marin County.

- **Appendix E** consists of the "Framework for Watershed Stewardship" taken from the Tomales Bay Watershed Stewardship Plan (TBWC, 2003). More than half of western Marin County drains into Tomales Bay. Appendix E contains the goals, objectives, and action plan developed by the Tomales Bay Watershed Council as part of a three-year, multi-stakeholder effort.

## Acronyms Used in This Plan

| | |
|---|---|
| ACOE | U.S. Army Corps of Engineers |
| ARS | Agricultural Research Service |
| BASMAA | Bay Area Stormwater Management Agency Association |
| BCDC | San Francisco Bay Conservation & Development Commission |
| BLTAC | Bolinas Lagoon Technical Advisory Committee |
| BMP | Best Management Practice |
| CAFF | Community Alliance with Family Farmers |
| CDFG | California Department of Fish and Game |
| CEQA | California Environmental Quality Act |
| CNDDB | California Natural Diversity Data Base |
| CNPS | California Native Plant Society |
| CSCC | California State Coastal Conservancy |
| DHS | California Department of Health Services |
| DPR | California Department of Parks and Recreation |
| EA | Environmental Assessment |
| EHS | Marin County Environmental Health Services |
| EPA | U.S. Environmental Protection Agency |
| EQIP | Environmental Quality Incentives Program |
| ESU | Evolutionarily Significant Unit |
| FishNet 4C | Fishery Network of the Central California Coastal Counties |
| GIS | Geographical Information System |
| GGNRA | Golden Gate National Recreation Area |
| Gold Ridge RCD | Gold Ridge Resource Conservation District |
| JARPA | Joint Aquatic Resources Permit Application |
| LMER | Land Margin Ecosystem Research |
| MALT | Marin Agricultural Land Trust |
| MCCDA | Marin County Community Development Agency |
| MCOSD | Marin County Open Space District |
| MCSTOPPP | Marin County Stormwater Pollution Prevention Program |
| MMWD | Marin Municipal Water District |
| MOU | Memorandum of Understanding |
| Marin RCD | Marin Resource Conservation District |
| NCWAP | North Coast Watershed Assessment Program |
| NCRWQCB | North Coast Regional Water Quality Control Board |

| | |
|---|---|
| NMWD | North Marin Water District |
| NOAA | National Oceanic and Atmospheric Administration |
| NOAA Fisheries | National Marine Fisheries Service, a part of NOAA |
| NPS | National Park Service |
| NRC | National Research Council |
| NRCS | Natural Resources Conservation Service |
| OWOW | EPA Office of Wetlands, Oceans, and Watersheds |
| PCI | Prunuske Chatham, Inc. |
| PL | Public Law |
| PRBO | Point Reyes Bird Observatory |
| PRNS | Point Reyes National Seashore |
| PWA | Pacific Watershed Associates |
| RCD | Resource Conservation District |
| RWQCB | Regional Water Quality Control Board |
| SCA | Stream Conservation Areas |
| SFBRWQCB | San Francisco Bay Regional Water Quality Control Board |
| SFZC | San Francisco Zen Center |
| SOD | Sudden Oak Death |
| STRAW | Students and Teachers Restoring a Watershed |
| SWRCB | State Water Resources Control Board |
| SWPPP | Stormwater Pollution Prevention Plan |
| TBA | Tomales Bay Association |
| TBAG | Tomales Bay Agriculture Group |
| TBI | The Bay Institute |
| TBSTAC | Tomales Bay Shellfish Technical Advisory Committee |
| TBWC | Tomales Bay Watershed Council |
| TMDL | Total Maximum Daily Load |
| UCCE | University of California Cooperative Extension |
| USDA | U.S. Department of Agriculture |
| USFWS | U.S. Fish and Wildlife Service |

# Chapter 1. Guiding Principles

A watershed is all of the land that drains into a given stream or river. It can be as small as the few acres that feed a seasonal creek, or it can encompass nearly half a nation, as does the Mississippi River watershed. In Marin County, the major watersheds are bisected by streams that enter San Pablo and San Francisco Bays to the east and south, and Tomales Bay, the Pacific Ocean, and Bodega Bay to the west (Figure 1).

Watersheds are an intricate and fine-tuned expression of the interaction between the climate, the earth itself, and the local plant and animal communities. They can be read like stories. Century-old gullies in western Marin County are remnants of the era when coastal prairies were plowed and rain poured off the hills instead of soaking into sod-protected soil. Alluvial soils in the valley floors of eastern Marin County were deposited by the slow wandering of creeks across their floodplains before they were confined by streets and backyards.

Watersheds move and store water, carve stream channels, carry sediment from the mountains to the beaches, provide year-round habitat for some wildlife species, and meet critical needs of others during annual migrations. Watersheds also provide people with the basic materials we need to sustain our communities—food and water, building supplies, places to call home.

A change in one watershed element affects the shape and function of the entirety. Together, small impacts can add up to major changes. One new roof, for example, may not make much difference, but a subdivision full of pavement and buildings can speed up the delivery of rainfall into the neighboring stream and ultimately lead to severe bank erosion, flooding, and habitat loss if it is not thoughtfully designed. Watershed management is the art and science of adjusting human activities so that they can co-exist with, and even support, natural systems. It calls for imagination, openness, and cooperation—imagination to be able to see complex and often delayed connections, openness to adapting policies and practices as new scientific information becomes available, and cooperation because no one person has all of the skills needed to understand or manage a watershed. The task requires well-informed and actively participating watershed residents, collaboration between a wide range of scientists, and public servants who are resolved to leave behind a healthy, productive environment.

As the demands on remaining natural resources continue to grow, management from a watershed perspective becomes urgent. It is no longer a luxury to consider the long-term repercussions of our actions; it is a necessity. The County's economy, quality of life, and its role of providing some of the most beautiful and biologically rich landscapes on the West Coast depend on integrative, scientifically-based management.

The following principles form the foundation for integrating the basics of watershed management into all activities that affect land and water use in Marin County. Chapter 3 gives specific recommendations for implementing the guiding principles.

## Watershed Guiding Principles

**Everything is connected.**
All elements of a watershed—the hydrologic cycle, the biotic community, human activities, and the land itself—are connected through a complex web of relationships. Changes in one part affect the health and function of the whole watershed.

**Scientific understanding underlies effective watershed management.**
The more we understand about watershed function and relationships, the better we will be able to protect natural processes. Sound management choices need to be based on up-to-date, interdisciplinary science coupled with ongoing assessment.

**Long-term watershed management requires continual adaptation and modification.**
Monitoring is vital to understanding and continually improving the success of management and restoration actions. Monitoring also allows us to observe and document trends in the health of our watersheds over time.

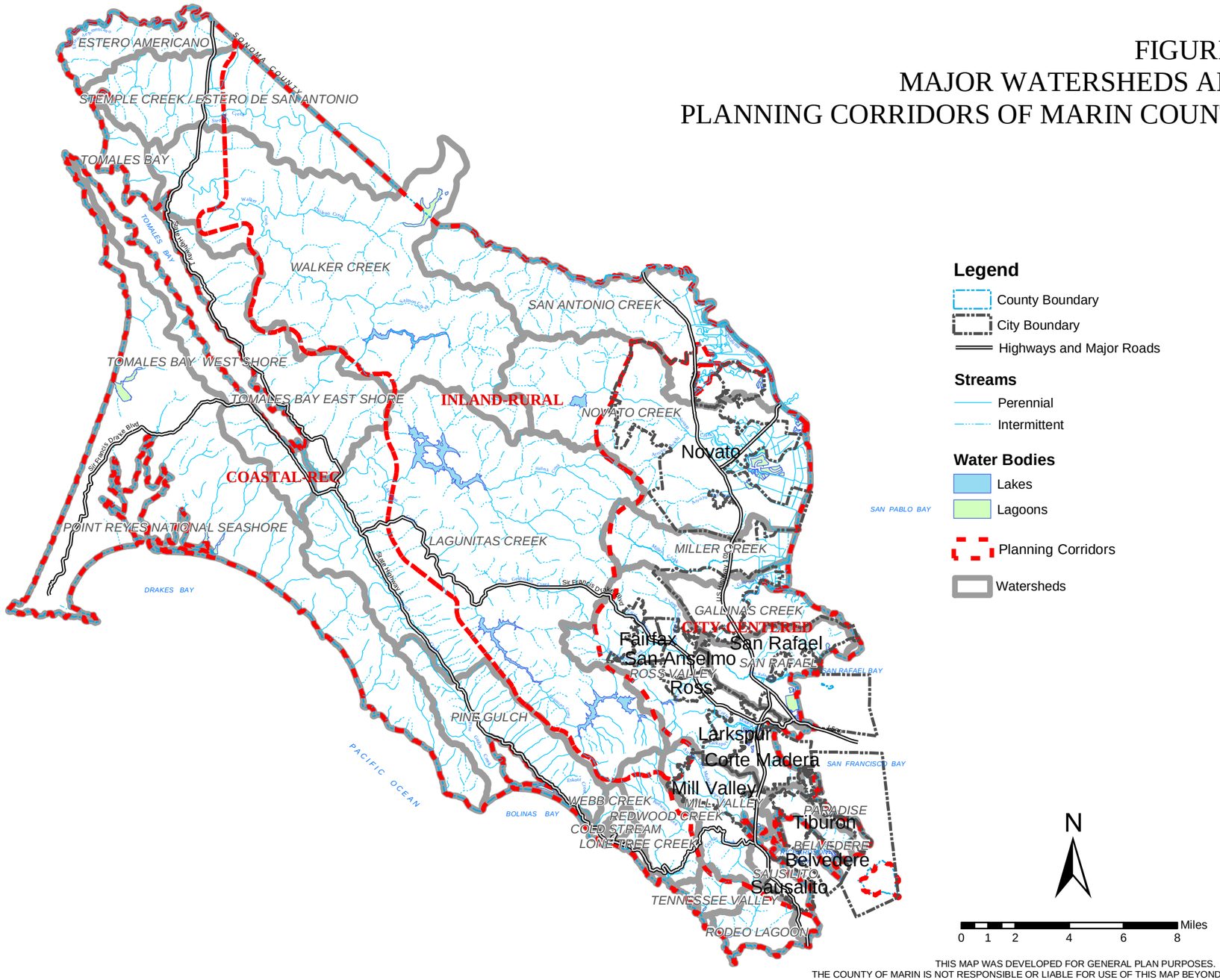
**Everyone has an important role.**
With over half of Marin County in private ownership, the leadership and committed participation of the people who live and work in each watershed is essential for effective planning, restoration, and ongoing management.

**Collaboration shares skills and resources.**
Watershed management requires a vast range of skills, from community organizing to designing water quality monitoring programs to sizing culverts. Interagency coordination and partnerships with local watershed residents bring multiple perspectives and durability into watershed efforts.

**Education creates the future.**
Education builds enduring connections between people of all ages and their watersheds. Being able to see ourselves as much a part of our local ecosystems as live oaks or salmon provides a deep and compelling sense of stewardship.

**Protection and restoration are key to preserving biodiversity.**
Zoning, land protection programs, and land use policies can help protect natural resources and balance human needs with healthy watersheds. Restoration can extend, connect, and enhance natural habitats.

# FIGURE 1
# MAJOR WATERSHEDS AND PLANNING CORRIDORS OF MARIN COUNTY




SOURCE: PRUNUSKE CHATHAM, INC.
MARIN COUNTY COMMUNITY DEVELOPMENT AGENCY

# Chapter 2. Watersheds of Western Marin County

## Physical Setting

This section of the plan focuses on western Marin County—on the lands that are found within the Inland Rural and Coastal Recreational environmental planning corridors (Figure 1). With the exception of the Stafford Lake drainage, these watersheds drain into Bodega Bay, Tomales Bay, Bolinas Lagoon, and directly into the Pacific Ocean. Appendix A describes the individual watersheds in greater detail.

Marin County is renowned for its beauty and biological diversity. The Tomales Bay watershed alone has nearly 900 species of plants and 490 species of birds (TBWC, 2003). With almost half of western Marin County publicly managed for resource protection, this area of small rural communities, grazing cattle, and vast stretches of undeveloped land stands in sharp contrast to the busy eastern part of the County. Its proximity to the San Francisco Bay area helps draw millions of visitors each year (MCCDA, 2003).

## Geology and Climate

The dominant geological feature of western Marin County is the San Andreas Fault, which separates the Pacific and North American tectonic plates. Tomales Bay is a submerged valley directly over the fault. On the west side, the bedrock consists of granitic rocks and overlying sedimentary rocks (MCCDA, 2002b). On the east side, the parent material is composed of Franciscan Formation rock, an assemblage of sandstone, shale, chert, and submarine basaltic volcanic rock (Wahrhaftig and Wagner, 1972). Areas of serpentine rock occur in the Franciscan Formation, particularly in the upper Lagunitas Creek watershed. In the top corner of the County in the Stemple Creek and Estero Americano watersheds, the Franciscan rocks are overlain by the Wilson Hill Formation.

The parent rock determines the type of soil that develops over it and affects characteristics such as landslide potential, erosion potential, and availability of groundwater. Soils in the Franciscan Formation are particularly susceptible to landslides. Most have a high erosion potential. They hold very little groundwater and make poor candidates for water supply wells. Many Wilson Hill Formation soils are also highly erodible and subject to deep gullying, although they appear to have a lower landslide potential than Franciscan soils (Wahrhaftig and Wagner, 1972). The soils west of the San Andreas Fault zone are very weathered and create the beaches, dunes, and steep topography of Point Reyes. The Marin County Soil Survey (SCS, 1985), available at the Petaluma Office of the USDA Natural Resources Conservation Service (NRCS), gives detailed soil maps for the entire County and provides excellent information on the characteristics, problems, and best uses of individual soil types.

Because of soil composition, steep slopes, and heavy winter storms, landslides are common in Marin County soils. After the January 4, 1982, storm, 4,600 debris flows were mapped within the County (Ellen, et al., 1988). These events not only have a profound economic and safety impact, they are a significant force in shaping the landscape.

Marin County has a mild Mediterranean climate with long dry summers and rainy winters. Rainfall averages from 30 to 61 inches per year (Fischer, et al., 1996). Coastal fog is common, especially in late summer when it provides an important source of precipitation.

## Plant and Animal Communities

Marin County has a rich diversity of habitat types. The Marin County Community Development Agency (MCCDA) maintains detailed Geographical Information System (GIS) maps of habitat types based on surveys conducted by the U.S. Forest Service and the California Department of Forestry.

Marin's extensive shoreline with its many bays and lagoons creates the topography and tidal circulation needed to support dune habitat, mud flats, and both salt and freshwater marshes. Eelgrass beds, which provide nursery habitat for many species including Pacific herring and Dungeness crab, grow submerged in Marin bays and lagoons.

The rolling grasslands of the west County are the foundation of Marin's dairy and livestock industry, but they also provide vital habitat for many wild herbivores and their predators. Badgers, deer, elk, pond turtles, songbirds, golden eagles, and many other hawks are among the species that depend on grassland habitat for at least part of their life cycles. Although introduced grasses and forbs dominate most Marin grasslands, native grasses and wild flowers still flourish in many areas. Point Reyes and the Dillon Beach area have extensive areas dominated by native grassland plants.

Interspersed with the grasslands and closely hugging the slopes are the oak woodlands. Coast live oak is the dominant plant in this community growing along with bay laurel, California buckeye, madrone, and a host of understory plants. Sudden Oak Death (SOD), a fungus-like disease, is a serious threat to this habitat. (See Appendix B for more information on SOD.)

The Douglas fir-redwood forest is another major forest habitat in the west County. Extensively harvested in the 1800s and into the early 1900s, these forests have been significantly altered, and most are riddled with networks of old logging roads. Stands of old growth redwoods remain, notably in Roy's Redwoods in San Geronimo Valley and Muir Woods. In Samuel P. Taylor State Park, mainstem Lagunitas Creek flows through a spectacular stand of second-growth redwoods—their tall, straight trunks hinting at the stature of the pre-harvest trees.

Riparian forests line many Marin County streams. In the upper tributaries, these forests often consist of coast live oak and bay laurel. In the watersheds south of Walker Creek and east of Tomales Bay, redwoods are a common riparian tree as slopes begin to flatten. Nearer the coast or throughout some grassland streams, alders and willows are the primary constituents of the riparian forest. However, not all riparian plants are trees. Grasses, sedges and rushes, and many shrubs are important components of riparian systems. In California, over 225 species of birds, mammals, reptiles, and amphibians depend upon riparian habitat (Riparian Habitat Joint Venture, 2000). It provides an essential link from upland habitats to food and water sources. The shade, soil stabilization, and organic matter it provides are key ingredients to healthy stream systems.

Other Marin County habitats include the Bishop pine forests of Point Reyes, dense thickets of coastal scrub in undisturbed slopes along the coast, and chaparral on Mt. Tamalpais and the Carson Ridge area. Another feature of the rural Marin landscape is the lines of eucalyptus trees planted as windbreaks in the early and mid 1900s.

With its varied habitats and large areas of protected land, Marin County has 52 plants and 41 animals identified as special status species[1] by the California Natural Diversity Database (CNDDB) (CDFG, 2003)—an exceptionally high number given the County's relatively small size (Figure 2). Appendix D lists these species. Lagunitas Creek alone is a major force in wild coho salmon production, annually producing 500 to 800 of California's estimated total population of 5,000 spawning adult fish. Table 1 shows the number of coho redds (spawning nests where the salmon deposit their eggs in the stream) in the Lagunitas Creek system since the early 1980s. Figure 3 identifies the Marin streams with steelhead trout and coho salmon.

Point Reyes National Seashore (PRNS) supports nearly 15% of California's plant species, 30% of the world's marine mammal species, and 45% of the North American bird species (MCCDA, 2003). An estimated 20,000 shorebirds and 25,000 waterbirds winter in or along Tomales Bay (TBWC, 2003). In the spring of 2003, many people observed the first black bear in Marin County in 134 years (Schlesinger, 2003a, 2003b).

[1] Special status species are taxa listed as endangered or threatened by the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NOAA Fisheries), or California Department of Fish and Game (CDFG); taxa designated as candidates for listing; or any species of concern or local concern by USFWS, NOAA Fisheries, and/or CDFG. In addition, the California Native Plant Society (CNPS) has compiled a list of plant species that it considers to be rare, threatened, or endangered. These plants must be included for consideration during project evaluation in order to comply with the California Environmental Quality Act (CEQA) Guidelines concerning special status species.

**Table 1.**
**Total Coho Redds in Lagunitas Creek Watershed, 1995-2003**

| Years | Lagunitas Creek mainstem[1] | San Geronimo Creek[2] (mainstem + tributaries[3]) | Devil's Gulch[4] (+ Cheda Creek[5]) | Olema Creek mainstem[6] (+ tribs[7]) | Total Redds |
|---|---|---|---|---|---|
| 1995/96 | 70 | 6 | 10 | No Data | 86 |
| 1996/97 | 98 | 115 | 42 | No Data | 255 |
| 1997/98 | 80 | 107 + 14 | 46 | 126 + 7 | 380 |
| 1998/99 | 92 | 46 + 14 | 31 | 42 + 1 | 226 |
| 1999/00 | 139 | 58 + 3 | 3 | 10 + 17 | 230 |
| 2000/01 | 119 | 56 + 18 | 11 | 86 + 48 | 338 |
| 2001/02 | 79 | 102 + 43 | 59 + 3 | 58 + 31 | 375 |
| 2002/03 | 71 | 39 + 22 | 24 + 2 | 5 + 12 | 175 |

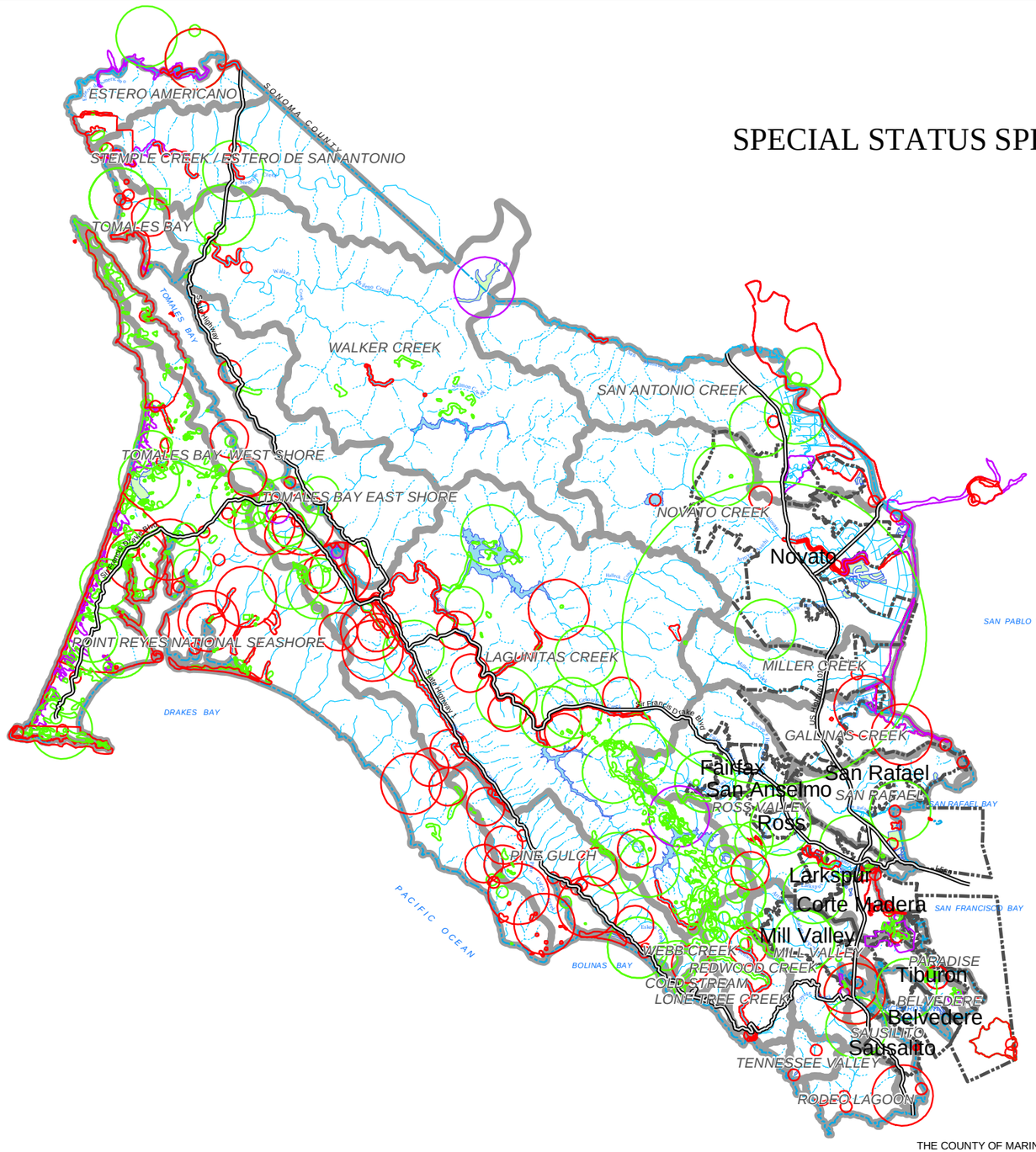
1 Lagunitas Creek is surveyed from Tocaloma to Peters Dam.
2 San Geronimo Creek is surveyed from its mouth to its confluence with Woodacre Creek.
3 San Geronimo tributaries include Arroyo Road Creek, Larsen Creek, Evans Canyon, Woodacre Creek, San Geronimo Creek above Woodacre Creek, and Cheda Creek.
4 Devil's Gulch is surveyed from its mouth to an impassable cascade roughly two miles upstream by MMWD.
5 Cheda Creek is surveyed from its mouth, 1.5 km upstream by the NPS.
6 Olema Creek is surveyed from the Bear Valley Road Bridge to its confluence with Randall Gulch by the NPS

*Source: Marin Municipal Water District and PRNS*

## Past and Current Land Use

For thousands of years, indigenous people lived along Marin streams and in coastal areas. Over 120 Coast Miwok village sites are known on Point Reyes alone (PRNS, 2003). By the early 1880s, the land had been parceled into ranchos through the Mexican land grant system. After the Bear Flag revolt in 1846 and the discovery of gold in 1848, American settlers poured into the area and established a thriving agricultural economy. In 1850, Marin County was among the ten leading cattle counties in the state with 6,981 head. By 1862, it was fourth in the state for producing potatoes. From 1862 until about 1910, Marin County led the state in dairy production, primarily through butter shipped into San Francisco. Wheat, barley, and sheep were also important products (UCCE, 1995). Since the first eastern oysters were planted in Tomales Bay in 1875 (TBWC, 2003), mariculture continues to be an important contributor to the local economy.

# FIGURE 2
# SPECIAL STATUS SPECIES OF MARIN COUNTY




**Legend**

- County Boundary
- City Boundary
- Highways and Major Roads

**Streams**

- Perennial
- Intermittent

**Water Bodies**

- Lakes
- Lagoons

**Special-Status Species Occurrences**

- Plant
- Animal
- Terrestrial Communities

- Watersheds

Mapped locations vary from accurate areas to areas that extend several miles and include potential habitat.

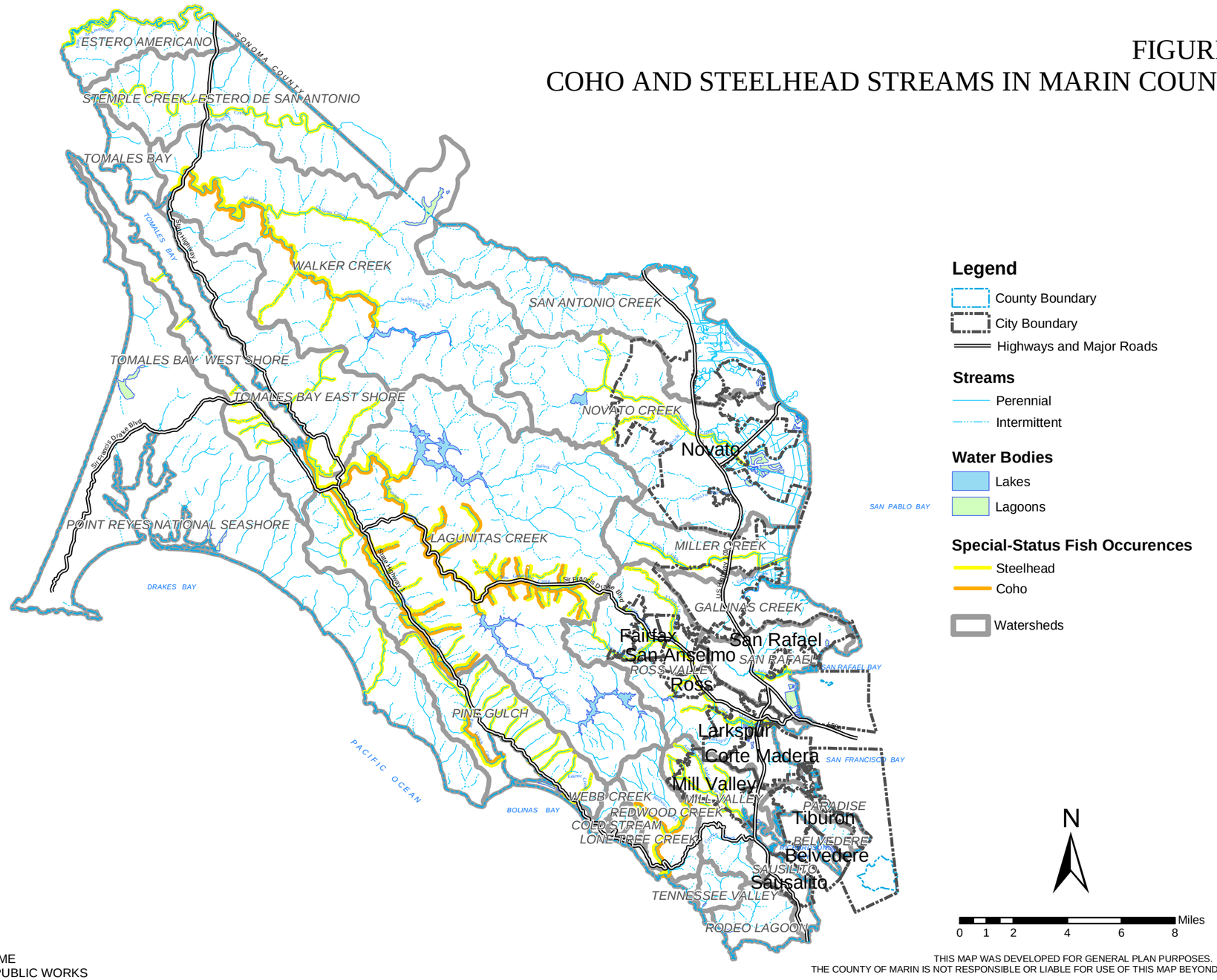
N

0 1 2 4 6 8 Miles

SOURCE: PRUNUSKE CHATHAM, INC.
MODIFIED FROM CALIFORNIA DEPARTMENT OF FISH & GAME
CALIFORNIA NATURAL DIVERSITY DATA BASE
ADDITIONAL INFORMATION AVAILABLE AT www.dfg.ca.gov

The California Natural Diversity Data Base (CNDDB) is a digital inventory of the locations of the state's rare, threatened and sensitive plants, animals and natural communities that is continually refined and updated. CNDDB provides information on locations, condition, dates of observation, accuracy of sightings and comments regarding habitat associations, threats, population sizes, and state and federal listings, and more. CNDDB is a positive sighting database available at the time of the request and should not be regarded as complete data on the elements or areas being considered.

# FIGURE 3
# COHO AND STEELHEAD STREAMS IN MARIN COUNTY




SOURCE: PRUNUSKE CHATHAM, INC.
BILL COX, CALIFORNIA DEPARTMENT OF FISH AND GAME
JOHN O'CONNER, SPAWN AND MARIN COUNTY DEPARTMENT OF PUBLIC WORKS

Today, animal agriculture still dominates western Marin. Of the 133,444 acres of land used for agriculture in the County in 2000, 94 acres were planted to vineyards, 177 were farmed for vegetables and other crops, 6,065 acres grew livestock feed crops such as hay and silage, and the remaining 127,128 acres consisted of pasture for livestock grazing (MCCDA, 2003). Beef production and dairies account for most of the livestock production, with sheep dwindling in number over the last 40 years. A strong trend in Marin County agriculture is the growth in value-added products and agricultural diversification (MCCDA, 2003). The increased production of organic vegetables and milk, local cheeses, and grass-fed beef demonstrate this trend. The Marin Agricultural Land Trust (MALT) holds agricultural conservation easements on 32,000 acres of land on 47 farms (MALT, 2003). Figure 4 shows current MALT easements.

Close to shipping and San Francisco, Marin County's forests provided a ready supply of redwood and Douglas fir beginning in the 1850s. Samuel P. Taylor built the West's first paper mill on Lagunitas Creek in 1856 (UCCE, 1995). The last significant commercial logging in the County occurred in the early 1960s in the Olema Creek and the Pine Gulch Creek watersheds.

Mercury mining left a lasting impact on western Marin County, especially at the Gambonini mine in the Walker Creek watershed. The mine was closed in 1970, but the severe January 1982 storm demolished stabilization measures and released a huge amount of mercury-laden sediment into Walker Creek. During the much milder storm season of 1997-98, 1,300 tons of mercury-rich suspended sediments and an undetermined amount of bedload were washed from the mine site (Whyte and Kirchner, 2000). Sediment samples collected 3 miles downstream from the mine and at the mouth of Walker Creek where it enters Tomales Bay contain high concentrations of mercury (Smelser and Whyte, 2001). Declared a Superfund site in 1998, the area has been stabilized through a joint effort between the federal Environmental Protection Agency (EPA) and the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB).

With nearly 110,000 acres in parklands and another 50,000 protected by water districts and open space easements, Marin County has more protected public land than any of the nine Bay Area counties (Figure 5). Approximately 500 miles of trails access this land. Tourism and recreation have become a major industry, bringing $500 million per year into western Marin County (MCCDA, 2003).

## Common Watershed Issues

Table 3 summarizes recent planning and restoration activity, major issues, and priority needs for watersheds in western Marin County. Although each watershed has its own unique challenges, the following issues and needs are held in common by many areas. Chapter 3 provides recommendations for addressing these issues.

## Water Quality

Section 303(d) of the federal Clean Water Act requires that states identify water bodies that do not meet water quality standards. Nine Marin streams and Tomales Bay are on the 303(d) list. Others, while not listed, are nonetheless impacted by excessive sedimentation or other problems. The SFBRWQCB has begun or scheduled the development of Total Maximum Daily Loads (TMDLs) for all of the watersheds on the 303(d) list. TMDLs identify sources of pollutants and specify actions to address them. Public participation is very important in setting effective and achievable TMDLs and attainment strategies. (See Table 2, below.)

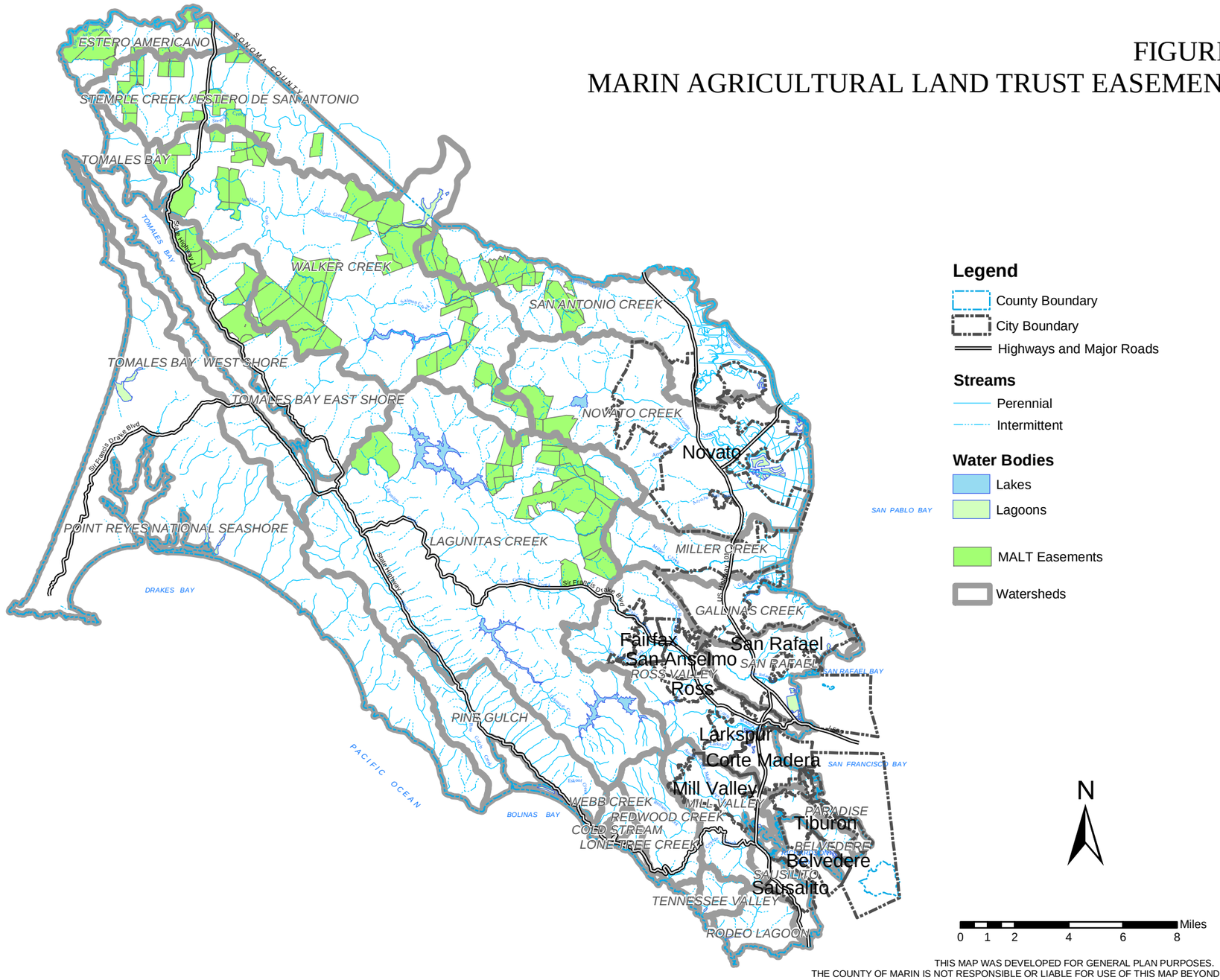
**Table 2. TMDL Development Schedule for Marin Watershed Management Areas**

| Waterbody | Stressor(s) | Basin Plan Amendment | Comments |
|---|---|---|---|
| All San Francisco Bay Segments | Mercury | 2002 | TMDL Report due April 2000. TMDL and Implementation Plan due June 2001. |
| | Exotic Species | Unknown | TMDL Report due April 2002. No further work is scheduled at this time due to AB 703 constraints. |
| | Copper | 2004 | TMDL Report due June 2002. TMDL and Implementation Plan due June 2003. |
| | PCBs | 2004 | TMDL Report due June 2002. TMDL and Implementation Plan due June 2003. |
| | Nickel | 2004 | TMDL Report due June 2002. TMDL and Implementation Plan due June 2003. |
| | Diazinon | 2006 | TMDL Report due June 2004. TMDL and Implementation Plan due June 2005. |
| | Selenium | 2010 | TMDL Report due June 2008. TMDL and Implementation Plan due June 2009. |
| | Dioxin line compounds including Furans | Unknown | U.S. EPA currently developing strategy. |
| | Chlordane, DDT, Diedrin | Unknown | U.S. EPA currently developing strategy. |
| Urban Creeks | Diazinon | 2004 | TMDL Report due June 2002. TMDL and Implementation Plan due June 2003. |
| Walker Creek/ Tomales Bay | Metals (Mercury) | 2005 | TMDL Report due June 2003. TMDL and Implementation Plan due June 2004. |
| | Siltation, Nutrients | 2007 | TMDL Report due June 2005. TMDL and Implementation Plan due June 2006. |
| Lagunitas Creek | Nutrients, Pathogens, Siltation | 2007 | TMDL Report due June 2005. TMDL and Implementation Plan due June 2006. |
| Richardson Bay | Pathogens | 2008 | TMDL Report due June 2006. TMDL and Implementation Plan due June 2007. |

*Source: EOA, Inc.*

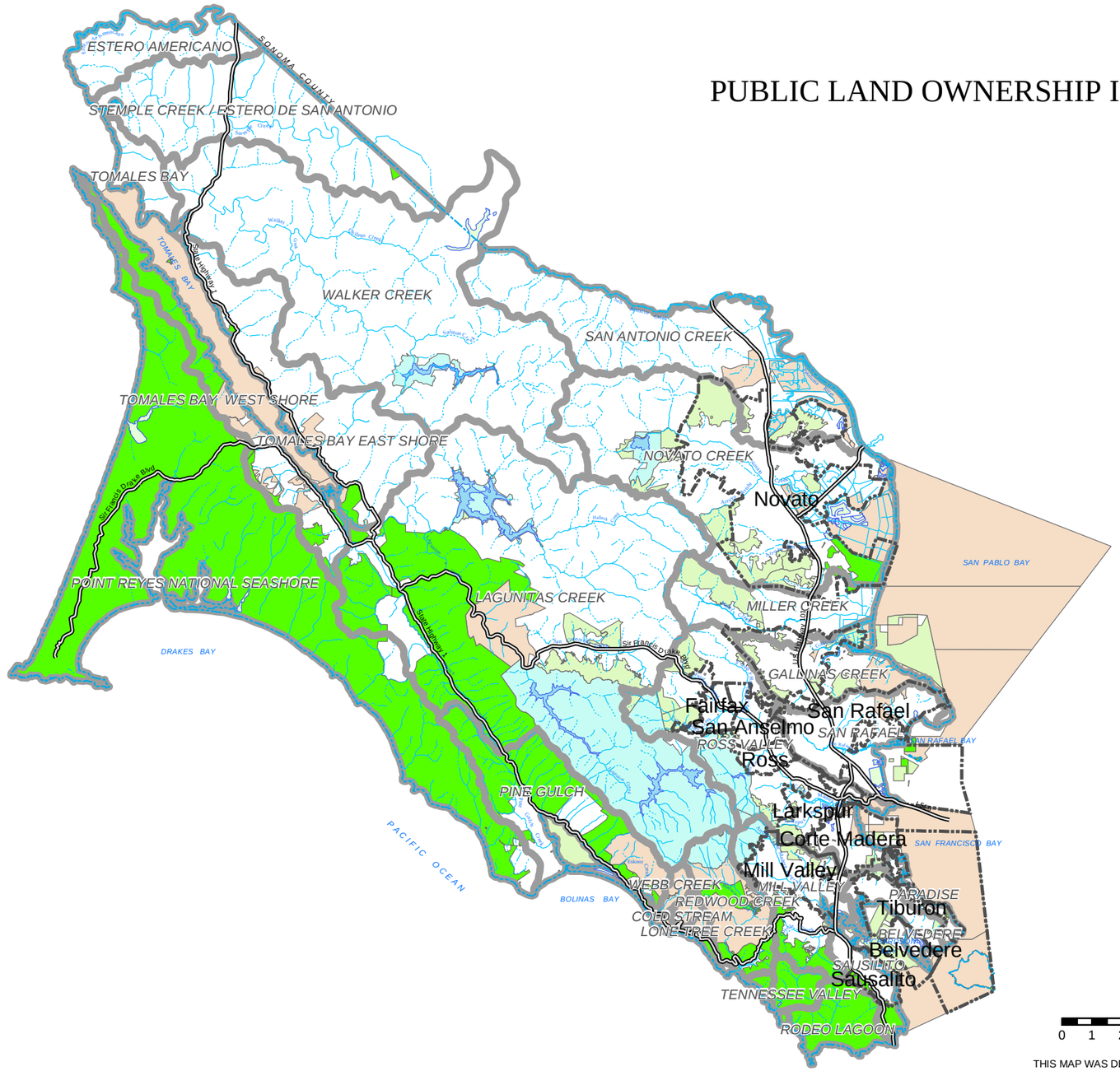
The following water quality issues are particularly important to western Marin County watersheds:

# FIGURE 4
# MARIN AGRICULTURAL LAND TRUST EASEMENTS




SOURCE: PRUNUSKE CHATHAM, INC.
MARIN COUNTY COMMUNITY DEVELOPMENT AGENCY

# FIGURE 5
# PUBLIC LAND OWNERSHIP IN MARIN COUNTY

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MARIN COUNTY COMMUNITY DEVELOPMENT AGENCY

**Degradation of aquatic habitat.** Poor water quality has an immediate impact on aquatic wildlife. Coho salmon and steelhead have been of special concern in many west County watersheds because of the dramatic decline in their populations during the 1970s and 1980s. Sedimentation of spawning gravels and rearing pools has been identified as a population constraint throughout the greater Tomales Bay watershed, Bolinas Lagoon, and Redwood Creek. High water temperatures from loss of riparian habitat are a concern in parts of the Walker Creek watershed. Elevated levels of nutrients and pathogens have been identified as issues in Tomales Bay and its tributaries, as well as in Stemple Creek and the Estero Americano. Mercury from the Walker Creek watershed impacts aquatic habitat in Walker Creek and in Tomales Bay.

**Clean domestic water.** The Lagunitas Creek and Stafford Lake watersheds supply most of Marin County's domestic water. Controlling the amount of sediment entering the storage reservoirs is important to maintaining their capacity. North Marin Water District (NMWD) is working on a cooperative program with watershed landowners to reduce the possibility of microbial contamination from agricultural operations in the watershed.

**Sub-standard septic systems.** Inadequate septic systems along Tomales Bay and in the San Geronimo Valley have been identified as possible sources of pathogens to Lagunitas Creek and Tomales Bay. Efforts are underway by Marin County to assist rural landowners in developing small-scale, neighborhood treatment facilities along the east shore of Tomales Bay.

**Agricultural impacts on water quality.** Water quality concerns from Marin's farms and ranches include sedimentation, mostly from ranch roads and historic farming practices that opened the soil to gullying, pathogens and nutrients from animal waste, and degradation of riparian habitat leading to increased surface water temperatures. The Marin RCD, UC Cooperative Extension (UCCE), NRCS, and, more recently, the Tomales Bay Agricultural Group (TBAG) have been working diligently with farmers and ranchers to address these impacts through education, monitoring, and implementation projects that eliminate or reduce sources of pollutants.

**Habitat Loss and Fragmentation.** Fragmentation is the breaking of large areas of habitat, such as an oak woodland or a riparian forest, into smaller pieces. Many wildlife species cannot adapt to this change because of increased vulnerability to predation and a reduction in the size of the home range they need to complete their entire life cycles. Restoration of continuous riparian habitat has been a major goal in many west County watersheds. Additional work is needed to identify important terrestrial

and wetland habitats throughout the County, as well as opportunities to protect and reconnect them.

**Barriers to Fish Passage.** Anadromous fish passage is an important issue in the Bolinas Lagoon and Lagunitas Creek drainages. Barriers can block adult access to spawning areas and the migration of young fish back to the ocean. Often these barriers occur at culverts and road crossings. A draft study commissioned by Marin County Department of Public Works identified barriers to anadromous fish passage throughout the County (Taylor, 2003).

**Water Quantity.** The amount of stream flow is a critical factor in maintaining the viability of aquatic habitat. It impacts water quality, the movement of sediment through the streambed, and the basic functions of many organisms including salmonid fish and the insects that support them. The Marin Municipal Water District (MMWD) reservoirs now capture about 40% of the freshwater that historically flowed into Tomales Bay (TBWC, 2003). State Water Resource Control Board Order 95-17 set flow limits from Kent Reservoir, but concern remains about long-term effects on Lagunitas Creek and Tomales Bay as well as additional impacts as new, small water impoundments are developed. Balancing the needs of residential and agricultural use with healthy aquatic habitat has also been an important issue in the Bolinas Lagoon watershed.

**Invasive Exotic Species.** Many watershed plans and resource managers identify invasive non-native plant and animal species as a major threat to native habitats and watershed function. Problem species include gorse, broom, goat grass, star and distaff thistle, domestic cats, starlings, and nearly 100 exotic marine invertebrates. A coordinated program between agencies, land managers, and private landowners is vital to controlling these threats.

**Regulatory Permit Simplification.** Agricultural operators have long expressed their frustration with the difficult and time-consuming process of securing multiple permits for many regular maintenance or improvement activities, such as removing sediment from a stock pond, repairing a headcut in a pasture gully, or building a barn. Such actions can require consultation and/or permits from the Army Corps of Engineers (ACOE), NOAA Marine Fisheries, or USFWS if endangered species are present, CDFG, the Regional Water Quality Control Board (RWQCB), and Marin County. If the project is in the Coastal Zone, additional review by the Coastal Commission is often required. Marin Resource Conservation District (Marin RCD) has been working with Sustainable Conservation, a non-profit organization, and state, federal, and local

agencies to simplify this process for many standard conservation practices.

**Agricultural Viability.** Although agriculture continues to be an important part of the Marin economy, a recent survey of Marin County farmers and ranchers indicated that only 37% considered their overall operation profitable (UCCE, 2003). High land values in Marin County have contributed to the cost of agricultural production, often exceeding the revenues it generates (MCCDA, 2003). Support with agricultural permitting, product diversification, marketing assistance, and easements that protect agricultural use are among the tools available to support the agricultural industry in Marin County.

**Monitoring.** Monitoring is a key need for all watershed management programs. Baseline monitoring establishes the starting conditions, and trend monitoring tracks how restoration activities and changes in management are affecting these conditions over time. Effectiveness monitoring documents whether or not specific practices are achieving desired goals. Monitoring is a fundamental component of adaptive management, the process of refining objectives and implementation strategies over time to improve overall success. Chapter 5 describes the basic elements of a scientific watershed monitoring program.

In the past twenty years, state and federal watershed grant programs have focused on planning and implementation. Funding for monitoring has been difficult to obtain, primarily because it does not fit into the 2 to 3-year timeframe of most non-profit or agency grants. Specific west County needs include baseline and trend monitoring of water quality, fish, and other sensitive species populations, as well as effectiveness monitoring of completed restoration efforts.

**Watershed Assessments.** Assessment is the first logical step for developing a sound watershed plan. Often, however, urgent problems and community concerns drive implementation projects to occur before assessments are undertaken. Assessment is defined by California's North Coast Watershed Assessment Program (NCWAP) as a process that characterizes current watershed conditions on a coarse scale using an interdisciplinary approach to collect and analyze information. Assessments identify issues and help focus the planning and restoration process. Although a great deal of assessment work has been done on several west County watersheds, Stemple Creek is the only one with a completed comprehensive watershed assessment (Marin RCD and Southern Sonoma County RCD, 2002). Many of the smaller watersheds have virtually no known assessment information. Table 3 and Appendix A identify specific assessment needs for each watershed.

**Outreach and Education.** Getting effective information to homeowners, land managers, and agricultural operators about conservation practices, septic systems maintenance, invasive species, and other issues is a critical need throughout the County. Park and public open space visitors also need information on what they can do to protect the resources they have come to enjoy. The education and outreach component of watershed management offers fine opportunities for coordination between watershed groups and for cost-effective agency support of local efforts.

**Agency and Private Landowner Coordination.** Marin County watersheds range from those that are completely owned by one public entity, such as most of the small drainages on Point Reyes, to those that are almost entirely in private ownership, such as the Stemple and Walker Creek watersheds. Most, however, have a mélange of landowners—public park agencies, water districts, school districts, private residents. Several watersheds, including Redwood Creek, Bolinas Lagoon, and the greater Tomales Bay watersheds, have councils or similar working groups that bring together multiple public agencies, watershed residents, and community groups. Others, such as Lagunitas Creek, have less formal coordinating mechanisms. Forums for effective agency coordination are needed in every watershed with multiple- agency management.

**Support of Ongoing Community Watershed Efforts.** Most of the west County watersheds have some level of community-based planning or restoration occurring. Some are well-established and coordinated; others are more opportunistic and limited in their scope, springing to life in response to new concerns or funding. Groups such as TBAG or the Marin RCD operate in many watersheds. Community efforts are essential to achieving and maintaining watershed health. Public agencies and elected representatives can help sustain these efforts by providing funding and letters of support, participating in meetings and restoration activities, and helping with outreach and technical advice.

**Table 3 Summary of Planning and Restoration Efforts, Issues, and Needs in Western Marin County Watersheds**

| Watershed | Recent Planning and Restoration Efforts | Important Issues | Priority Needs |
|---|---|---|---|
| Estero Americano | Enhancement Plan with focus on erosion control completed in 1987. Gold Ridge RCD undertaking erosion control, habitat protection and water quality improvement projects with private landowners. | • Water quality: nutrients and sediment.<br>• Agricultural viability.<br>• Invasive non-native plants.<br>• Estero function. | • Ongoing funding for landowners to implement habitat restoration and water quality improvement projects.<br>• Effectiveness monitoring and maintenance of completed projects.<br>• Regulatory permit simplification and assistance. |
| Stemple Creek | Enhancement Plan completed in 1994. Draft Watershed Project Plan and Environmental Assessment and Historical Sediment Study completed in 2002. Steering Committee in place to advice NRCS. Marin RCD and Southern Sonoma County RCD. Restoration projects underway with private landowners. | • Water quality: nutrients, sediment, leachate from Sonoma County landfill.<br>• Groundwater quality.<br>• Habitat restoration.<br>• Estero function.<br>• Agricultural viability. | • Support for the PL566 application for federal cost shares for water quality improvement projects.<br>• Ongoing funding to implement habitat restoration and water quality improvement projects.<br>• Effectiveness monitoring and maintenance of completed projects.<br>• Further investigation and monitoring to determine if the Estero is filling with sediment, or if scouring is occurring.<br>• Monitoring of groundwater quality.<br>• Regulatory permit simplification<br>• Development of a Safe Harbor program. |
| Tomales Bay: Walker Creek | Walker Creek Watershed Enhancement Plan completed in 2001. Tomales Bay Watershed Stewardship Plan completed in 2003. Marin RCD sponsors occasional community watershed meetings. Restoration projects underway. | • Water quality: sediment, mercury, nutrients, pathogens and high temperature<br>• Riparian habitat restoration.<br>• Range management.<br>• Agricultural viability. | • Ongoing funding to implement and manage habitat restoration and water quality improvement projects.<br>• Effectiveness monitoring and maintenance of completed projects.<br>• Regulatory permit simplification<br>• Limiting factor analysis for coho salmon and steelhead. Monitoring of habitat and populations. |

| Watershed | Recent Planning and Restoration Efforts | Important Issues | Priority Needs |
|---|---|---|---|
| | | • Landowner participation.<br>• Invasive non-native plants.<br>• Recovery of salmonid populations. | • Fluvial geomorphic analysis to guide restoration efforts.<br>• Monitoring program for sediment, water temperature and other water quality indicators. Continuing monitoring of neotropical songbird use of restored riparian corridors.<br>• Support of outreach and education efforts.<br>• Regularly updated GIS mapping of restored riparian habitat.<br>• Development of practical and effective TMDLs and attainment strategies.<br>• Control of invasive exotic plants. |
| Tomales Bay: small east and west shore tributaries | Tomales Bay Watershed Stewardship Plan completed in 2003. TBAG (Tomales Bay Agricultural Group) and many local organizations, including the Inverness Foundation, Tomales Bay Association, the Environmental Action Committee and the East Shore Planning Group, have undertaken planning, education and restoration projects. | • Water quality: pathogens and sediment<br>• Habitat protection and restoration<br>• Improvement of septic systems<br>• Outreach and education, especially for tourists visiting Tomales Bay<br>• Agricultural viability<br>• Visitor impacts | • Habitat mapping and assessment.<br>• Ongoing funding to implement and manage habitat restoration and water quality improvement projects.<br>• Improvement of septic systems. Coordinated outreach program on septic system maintenance and repair.<br>• Control of invasive exotic plants, especially gorse.<br>• Support the efforts of the Tomales Bay Watershed Council to provide community based-planning and coordination.<br>• Regulatory permit simplification<br>• Development of practical and effective TMDLs and attainment strategies.<br>• Outreach to rural residential landowners on good stewardship practices. |

| Watershed | Recent Planning and Restoration Efforts | Important Issues | Priority Needs |
|---|---|---|---|
| Tomales Bay: Lagunitas Creek | Tomales Bay Watershed Stewardship Plan completed in 2003. Salmonid and sediment studies completed by MMWD and PRNS in the 1980s and 1990s. State Water Board Order WR 95-17 set flow and temperature requirements. Lagunitas Creek Sediment and Riparian Management Plan completed for upper watershed in 1997. Monitoring, restoration and planning efforts underway. Strong community involvement from various groups including local schools, SPAWN and Trout Unlimited. | • Water quality: sediment, nutrients and pathogens<br>• Streamflows<br>• Health of aquatic habitat<br>• Fish passage<br>• Domestic water supply<br>• Agency and community coordination<br>• Community participation | • Development of restoration priorities based on limiting factors analysis for salmonids and freshwater shrimp<br>• Ongoing funding to implement erosion control and habitat improvement projects.<br>• Effectiveness monitoring and maintenance of completed projects.<br>• Coordinated water quality and quantity monitoring program involving state, federal, County and private landowners.<br>• Outreach to rural residential landowners on good stewardship practices.<br>• Development of a comprehensive habitat management plan for the Olema watershed.<br>• Development of practical and effective TMDLs and attainment strategies<br>• Septic system evaluation and improvement.<br>• Development of a watershed forum to facilitate coordinated planning, monitoring and implementation.<br>• Implementation of the multi-agency MOU for maintenance and management of unpaved roads.<br>• Restoration of natural hydrologic processes at the Giacomini Ranch at the mouth of Lagunitas Creek<br>• Implement restoration recommendations based on fish passage evaluation. |

| Watershed | Recent Planning and Restoration Efforts | Important Issues | Priority Needs |
|---|---|---|---|
| Stafford Lake | North Marin Water District is currently working with local landowners to reduce microbial contamination of Stafford Lake. | • Domestic water supply<br>• Habitat restoration | • Development and implementation of a landowner-supported plan to protect water quality in Stafford Lake. |
| Bolinas Lagoon | Bolinas Lagoon Management Plan revised in 1996. Historical perspective and sediment budget completed in 2001. Fisheries assessment of tributaries conducted from 1995-2000. The Bolinas Lagoon Technical Advisory Committee established in 1974. NPS coho and steelhead population monitoring since 1997. Many agencies and community-based organizations are active in planning, monitoring and restoration projects. | • Habitat restoration<br>• Viability of Easkoot Creek salmonid habitat<br>• Flood control<br>• Streamflow and water supply for agricultural and domestic use.<br>• Lagoon sedimentation | • Monitoring program for water quality, flow and fish habitat.<br>• Water management plan to protect aquatic life and provide water for residential and agricultural use.<br>• Investigation of low dissolved oxygen in Easkoot Creek<br>• Aquatic habitat restoration and enhancement.<br>• Feasibility assessment for long term riparian and channel improvements in Stinson and McKinnon Gulches.<br>• Education for private landowners along Easkoot Creek about protecting stream habitat.<br>• Control and replacement of invasive, exotic plants.<br>• Implement restoration recommendations based on fish passage evaluation. |
| Webb Creek (Steep Ravine) | No known planning or restoration efforts specific to this watershed. | • No data available. | • General assessment. |
| Lone Tree Creek and Cold Stream Creek | No known planning or restoration efforts specific to this watershed. | • Large landslide at Highway 1. | • General assessment. |

| Watershed | Recent Planning and Restoration Efforts | Important Issues | Priority Needs |
|---|---|---|---|
| Redwood Creek and Big Lagoon | Redwood Creek Watershed Vision (NPS, 2003) created by public and private landowners and resource managers. Sediment source assessment and prevention plan completed in 2002. Sediment budget and restoration plan for Big Lagoon underway. Comprehensive Transportation Management Plan also currently underway to develop options to reduce visitor impacts. | • Habitat loss and subsequent decline in aquatic species.<br>• Invasive non-native plants<br>• Change in vegetation and increased risk of fire from alterations in historic fire regime.<br>• Impacts on natural resources, traffic and neighboring communities from visitors and related facilities.<br>• Balancing multiple uses of trails and parks.<br>• Sedimentation of creek channels and Big Lagoon.<br>• Recurring flooding on Pacific Way. | • Continuing support of and implementation of the Vision Project by the watershed stakeholders.<br>• Comprehensive watershed assessment.<br>• Development and implementation of an adaptive management program.<br>• Restoration of salmonid habitat in Redwood Creek.<br>• Restoration of functional, self-sustaining wetland, aquatic and riparian habitat at Big Lagoon.<br>• Erosion control<br>• Removal and replacement of invasive, exotic plants.<br>• Implementation of measures to reduce visitor and traffic impacts on resources.<br>• Continued support for and expansion of public education activities. |
| Tennessee Creek and Rodeo Creek | No known planning or restoration efforts specific to this watershed. | • Invasive, non-native plants.<br>• Water quality: sedimentation. | • General assessment<br>• Identification of cause of recent fish kills in Rodeo Lagoon. |