CONSOLIDATED PROPOSAL FOR COASTAL NONPOINT SOURCE PROJECTS

(GRANT AGREEMENT NO. 04-155-552-2)

FINAL PROJECT REPORT

Prepared by
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Friends of Corte Madera Creek Watershed
Friends of Novato Creek
Southern Sonoma County Resource Conservation District
Sonoma Ecology Center

In partnership with
North Bay Watershed Association

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A. PROJECT SUMMARY

This section provides an overview of the Consolidated Concept Proposal for Nonpoint Source Projects, Greater San Pablo Bay Area (CCPNSP), a description of the project's purpose, scope and goals, a summary of the project elements and list of partners involved in project implementation. Additional detail, as well as a description of activities completed and techniques used in implementing each project element, is provided in Section C of this report.

The overarching goal of the CCPNSP was to protect and restore coastal waters and near-shore habitats in the North Bay region. Eight separate work efforts targeted erosion sites and sediment sources, urban storm water runoff and nonpoint source pollution, in-stream aquatic and wetland habitat improvements, and education and outreach to communities whose actions affect water quality and fisheries.

The CCPNSP was completed through a partnership between five North Bay Watershed Association (NBWA) member agencies: Friends of Corte Madera Creek Watershed (FCMCW), Friends of Novato Creek (FNC), Southern Sonoma County Resource Conservation District (SSCRCD), Marin Municipal Water District (MMWD), and Sonoma Ecology Center (SEC).

Eight individual project elements comprised the CCPNSP:

1. San Anselmo Creek Park: Riprap Removal and Restoration
2. Novato Creek Watershed Citizen's Water Quality Monitoring Program
3. Petaluma Watershed Restoration and Outreach
4. Redwood Creek Watershed Sediment Control on Marin Municipal Water District Lands
5. Erosion Inventory and Sediment Control Recommendations for Jack London State Historic Park Watershed
6. Watershed Stewardship Assist Landowners
7. Sonoma Creek Channel Reach Rehabilitation to Support TMDL Implementation
8. Sonoma Creek Water Quality Monitoring: Suspended Sediment, BMI, and Summer Stream Flow

The project included restoration and fish passage, watershed stewardship and partnership, and direct TMDL implementation. Individual project elements included on-the-ground construction and restoration work to improve water quality, decrease sediment input and enhance habitat for salmonids (San Anselmo Creek Park: Riprap Removal and Restoration, Petaluma Watershed Restoration and Outreach, Redwood Creek Watershed Sediment Control); monitoring in order to assess and compile baseline watershed conditions and evaluate project implementation success (Novato Creek Watershed Citizen's Water Quality Monitoring Program, Sonoma Creek Water Quality Monitoring: Suspended Sediment, Benthic Macroinvertebrates, and Summer Stream Flow); data manipulation in order to create a prioritized sediment source database

(Erosion Inventory and Sediment Control Recommendations for Jack London State Historic Park Watershed); outreach and education in order to encourage implementation of BMP's and improve land management practices (Watershed Stewardship Assistance for Landowners); and activities in preparation for TMDL implementation (Channel Reach Rehabilitation to Support TMDL Implementation in Sonoma Creek). Implementation of these project elements helped to fill information gaps and facilitate effective actions to reduce nonpoint source pollution and restore native fish and wildlife habitat throughout the project area watersheds.

The primary efforts funded by this grant include:

- Restoration activities in a section of San Anselmo Creek, including construction of a riprap revetment, installing riparian vegetation, removing invasive species, and enlarging the channel cross-section;
- Construction of 16 road-related sediment reduction projects on MMWD lands in the Redwood Creek watershed;
- Development of a comprehensive citizen water quality and biological monitoring program;
- Hydrologic modeling and some restoration of San Antonio Creek through revegetation and bank stabilization;
- Erosion inventory and sediment control recommendations for Jack London State Historic Park watershed to identify, characterize, quantify and prioritize sediment sources;
- Assistance and guidance to private landowners regarding BMP's and land management practices;
- Production of a conceptual rehabilitation plan and stakeholder commitments in preparation for implementation phases of the Sonoma Creek Sediment TMDL;
- Water quality monitoring in Sonoma Creek.

B. PROJECT LOCATION

This project spans the broader North Bay region, with the eight project elements located in Marin and southern Sonoma Counties. The work, which ranged from planning and design to education and implementation, took place in urbanized and agricultural areas, on suburban properties and parks, and on state and national parkland in several watersheds and sub-watersheds of the North Bay region including: Redwood Creek, Corte Madera Creek, Novato Creek, San

Antonio Creek, Petaluma River, and Sonoma Creek. Summary information for each of these watersheds is provided below.

Redwood Creek Watershed

The Redwood Creek Watershed is a seven-mile area extending from the west peak of Mt. Tamalpais, through Muir Woods National Monument, to the mouth of the creek at Muir Beach. The creek is one of four major creeks in Marin County with remnant populations of both coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Oncorhynchus mykiss*). However, recovery of salmonid populations in the stream is being hampered by streambed conditions due to excessive load of fine sediments entering the stream via road related inputs or stream crossing failures. Project element #4 (Redwood Creek Watershed Sediment Control on Marin Municipal Water District Lands) addressed the problem by conducting erosion control and prevention activities at ten high priority sites.

Corte Madera Creek Watershed

The Corte Madera Creek Watershed covers about 28 square miles and drains into tidal marsh bordering the northern San Francisco Bay. The Corte Madera Creek and its tributaries are among the few streams in the San Francisco Bay that retain runs of endangered steelhead trout. However, as identified in a fishery study conducted by A.A. Rich and Associates (e.g. *Fishery Resources Conditions of the Corte Madera Creek Watershed, Marin County, California*, November 2000), there is a declining trend in the steelhead population migrating up the watershed. Limiting factors identified included a lack of stream flows and high water temperatures. Project #1 (San Anselmo Creek Park: Riprap Removal and Restoration, San Anselmo, Marin County) is intended to improve riparian and aquatic habitat conditions by providing canopy to increase the amount of shade and thereby lower water temperatures.

Novato Creek Watershed

Novato Creek, a 44 square-mile drainage, flows year round, but the Novato Creek Dam alters the creek flows since it only spills for about a month's time between January and February. The dam catches all upstream sediment load (after Stafford Lake, an upstream reservoir belonging to the North Marin Water District), thus depleting the sediment supply downstream and causing further erosion through scouring. The upper reaches of the watershed are the primary sources of summer flows and ecologically beneficial gravels. The Novato Flood Control Project, a channelized section of the creek downstream, was built in 1987-90 and functions as a sediment trap; and has required dredging three times since construction. Novato Creek is on the watch list for excessive sediment deposition, and if erosion control activities in the upper watershed are not carried out, the creek could be added to the 303(d) list for impairment due to sedimentation. The goal of project #2 (Novato Creek Watershed Citizen's Water Quality Monitoring Program) was to further develop a comprehensive citizen water quality and biological monitoring program utilizing a rigorous sampling design, in order to assess conditions in the Novato Creek watershed.

Petaluma River Watershed

The Petaluma River, occupying a 146 square mile watershed, was historically a tidewater slough fed seasonally by smaller freshwater creeks. The lower channel has been deepened and widened, and is dredged for navigation. The riverine system supports a variety of marine, estuarine, and freshwater fish species. There is limited information about the current and historic numbers of steelhead in the watershed, but they have been observed in several of the tributaries. Restoration work performed in the upper watershed could improve its capacity to support steelhead. Water quality concerns in the Petaluma River include low levels of dissolved oxygen, and elevated levels of fecal coliform bacteria and nutrients. Sediment from erosion in the upland areas comes from natural and human sources; soils are highly erodable, and the increasing presence of rural ranchettes and small roads is a significant cause of erosion in the area. The *Petaluma Watershed Enhancement Plan*, prepared by the Southern Sonoma County Resource Conservation District (SSCRCD) and a citizen's Advisory Committee in July of 1999 with funding from the State Water Resources Control Board (SWRCB), serves as a guide for future watershed enhancement efforts in the Petaluma watershed.

San Antonio Creek Watershed

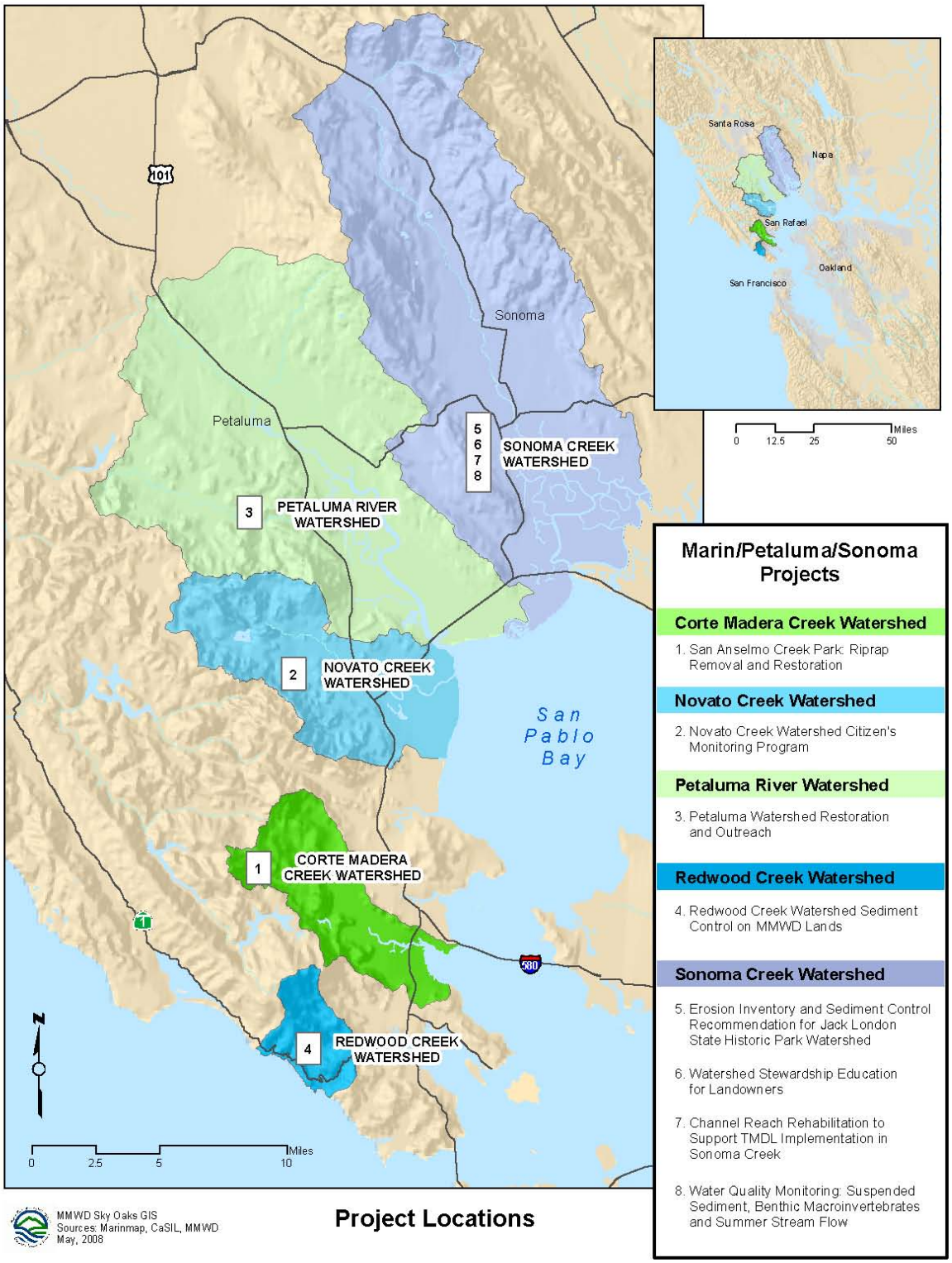
San Antonio Creek is a tributary to the Petaluma River which is listed as an impaired water body due to sedimentation and high nutrient levels. The creek drains a 36.5 square mile sub-watershed that makes up approximately 25% of the entire Petaluma River watershed. The channel terminates in a salt marsh before entering the Petaluma River. The surrounding land use has been agricultural since the early 1800s. The majority of the watershed is now characterized by European annual grasses with scattered oak woodlands and narrow bands of riparian forest. The riparian corridor is utilized by a wide variety of wildlife. Although limited information is available about the historic runs of steelhead in San Antonio Creek, this sub-watershed may have had the largest fishery in the Petaluma River watershed. Temperatures in the summer range higher than optimal for steelhead, and the upper sub-watershed contributes a large amount of sediment to the lower reaches, primarily from severe stream bank erosion. Project #3 (Petaluma Watershed Restoration and Outreach) will increase the length of contiguous riparian corridor to improve salmonid habitat. It will also increase bank stabilization by implementing biotechnical engineering practices along portions of the creek.

The San Antonio Creek Watershed is the largest sub-watershed in the Petaluma River Watershed. San Antonio Creek also sustains continued massive soil erosion affecting water quality and loss of habitat. This sub-watershed has the highest priority for restoration, and consistent with the goals and objectives developed in the *Petaluma River Watershed Enhancement Plan.* The Petaluma River is listed on the State Water Resource Control Board 303(d) list for impairments that include diazinon, nutrients, pathogens, and sedimentation. San Antonio Creek, which drains into the Petaluma River, is listed separately as impaired for diazinon. The majority of landowners along San Antonio Creek

involved in the planning process are ranchers and farmers who care about the health of the watershed. They are interested in participating and contributing to the process of enhancing the watershed and sustaining agriculture.

Sonoma Creek Watershed

The Sonoma Creek watershed covers 170 square miles and drains into the Sonoma Baylands, a complex system of tidal sloughs and seasonal wetlands. As identified in the Basin Plan, the Sonoma Creek watershed supports beneficial uses for cold and freshwater habitat, fish migration, fish spawning, wildlife habitat, and preservation of rare and endangered species (p. 2-23, Basin Plan, RWQCB, 1995). Excessive sedimentation has filled sloughs causing a degradation of wetland habitats and changing the hydrology and geomorphology of the Baylands. As a result, the watershed has been listed as impaired for sediment, as well as pathogens and nutrients (303(d) list, RWQCB July 2003). In order to ascertain the cause of sedimentation, a Sediment Source Analysis Study was recommended in a report developed by the U.S. Army Corps of Engineers (U.S. ACOE), the San Francisco Estuary Institute and Sonoma Ecology Center (*Summary of Existing Information in the Watershed of Sonoma Valley in Relation to the Sonoma Creek Watershed Restoration Study and Recommendation on How to Proceed*, December 2000). Projects #5 (Erosion Inventory and Sediment Control Recommendations for Jack London State Historic Park Watershed) and #6 (Watershed Stewardship Assistance for Landowners) helped to reduce sediment loading to salmonid streams in the watershed. Projects #7 (Channel Reach Rehabilitation to Support TMDL Implementation in Sonoma Creek) and #8 (Sonoma Creek Water Quality Monitoring: Suspended Sediment, Benthic Macroinvertebrates, and Summer Stream Flow) took steps needed to implement the watershed's upcoming TMDL.



Project Locations

C. PROJECT PERFORMANCE

PROJECT ELEMENT ONE:
SAN ANSELMO CREEK PARK: RIPRAP REMOVAL AND RESTORATION

Project Planning and Implementation

The San Anselmo Creek Park project was implemented in an approximately 90-foot long reach on the north bank of San Anselmo Creek within Creek Park, a public park owned and managed by the Town of San Anselmo. The project included removal of invasive non-native vegetation, removal of riprap above the mean high water mark, installation of a 15-foot long section of brush layering, planting upstream and downstream of the brush layering, and construction of a fence along the top of the bank to protect plants. The purposes of the project are to improve water quality and enhance steelhead habitat by removing invasive non-native plants and providing native riparian vegetation, slightly reduce the risk of flooding by enlarging the channel cross-section, and provide a highly visible demonstration project.

Partners in the original project included the Town of San Anselmo, the Marin County Stormwater Pollution Prevention Program (MCSTOPPP), and the North Bay Watershed Association. After the initial construction occurred, the San Francisco Bay Regional Water Quality Control Board (RWQCB) and Ross Valley Sanitary District (RVSD) provided additional funding to extend the habitat enhancement both upstream and downstream of the original project reach. The Marin Conservation Corps did most of the planting during both phases and took an active role in planning the expanded work.

The location map of the project area (Appendix 2.1.1) shows Creek Park, where the management measures were implemented:

1. Removal of non-native vegetation in the initial project area, a reach along the east bank of the creek approximately 90 feet long at its longest. This area is shown in Appendix 2.1.1.
2. Installation of a turbid-water basin to keep soil and construction materials out of the creek during removal of riprap and installation of the brush layering. This was located down slope from the brush layering.
3. Removal of some riprap above the mean high water mark. As shown on Sheet 2 of the Design in Appendix 2.1.1, the original plan called for removal of riprap for a distance of approximately 30 feet at the lowest elevation. Because of the multi-year delays in evaluating proposals and negotiating contracts and the reduced awards provided, there was only enough funding to remove approximately two-thirds of what had been planned. This is marked in the As-built Drawing in Appendix 2.1.1.
4. Installation of brush layering, using a combination of locally gathered willow and dogwood stakes.

5. Installation of container plants in December 2006 and January 2007 (see Table 1, below). Downstream of the riprap and above the brush layering, native grass seed was sowed at a rate of 60/lbs per acre in December 2006.
6. Installation and maintenance of drip irrigation system. The drip irrigation system needed frequent maintenance because teenagers slid down the planted hill, in the process damaging the plants and irrigation system. To reduce that, the Town and Friends decided to install a fence to discourage access to the hill.
7. Weeding.
8. Removal of additional non-natives upstream and downstream of the original project area and installation of container plants in December 2007 (see Table 1, below).
9. Installation of a fence to protect planting on the bank.

Table 1: Planting in Creek Park

		Number of Plants Installed			
Container Species	**Dec 2006[1]**	**Jan 2007[2]**	**Dec 2007[1]**	**Total**	
Acer macrophyllum	big-leaf maple	4			4
Aesculcus californica	buckeye	1			1
Calamagrostis nutkaensis	reed grass		6	10	16
Carex barbarae	whiteroot sedge	5		43	48
Ceonothus "Skylark"	Skylark ceonothus			5	5
Cornus sericea	dogwood		5	10	15
Corylus cornuta	California hazelnut			4	4
Festuca rubra	California red fescue			15	15
Heteromeles arbutfolia	toyon	16		4	20
Holodiscus discolor	oceanspray			10	10
Juncus patens	blue rush	5	10	11	20
Lonicera hispicula var. *vacillans*	vine honeysuckle	5			5
Mimulus auranticus	sticky monkeyflower			10	10
Polystichum munitum	western sword fern	2			2
Rosa californica	California rose	3			3
Rubus parviflorus	thimbleberry	2			2
Sympnocarpus albus var. *laevigatus*	snowberry	6			6
Woodwardia fimbriata	giant chain fern	5			5
	Total	**54**	**21**	**122**	**197**

Notes:
1. Funded by Proposition 13
2. Funded by SFBRWQCB and RVSD

Project Performance

This section presents a discussion of the items listed in the Project Assessment and Evaluation Plan (PAEP), including a discussion documenting the benefits provided by the project and successes. Shortcomings are discussed separately, below.

Goal 1: Install biotechnical project as designed

Tasks: Riprap removal, invasive plant removal, plantings
Output Indicators: Riprap removal, invasive plant removal, plantings
Outcome Indicators (Performance Monitoring Metric): Design plans and photos
Measurement Tools and Methods: Comparison of pre-construction design, as-built design and pre- and post-construction photos
Target: Conformance to design
Discussion: Work designed and supervised by Prunuske Chatham Inc. (riprap removal, installation of brush layering, and planting in riprap beneath the stage) was limited by a smaller-than-requested allocation and long delays that increased the cost of the work. Approximately 70% of the riprap removal/brush layering and about 30% of the planting in the riprap was accomplished. Numerous varieties of invasive non-natives (including Himalayan blackberries, *Vinca major*, *Arundo donax*, French broom, fennel, Cape ivy, English ivy, wild onions, and an abundance of non-native annual grasses) were removed in weeding on five different occasions. The Marin Conservation Corps (MCC) did pre-construction clearing of the original project area; weeding was done by the MCC before each planting session, and Town of San Anselmo DPW staff and volunteers from Friends of Corte Madera Creek Watershed (FCMCW) weeded in fall 2007. MCC crews removed non-native plants in the expanded planting area.
In December 2006, 54 plants were installed and native grass seeds sowed. With additional funding we planted 143 more plants. The original design, as-built drawing for the brush layering, and photos are provided in Appendix 2.1.1 and 2.1.2.
The Proposition 13 budget funded about 95% of the scaled-back riprap removal and planting; later Proposition 13 funding provided a new fence to protect the planting and steep bank from damage by children sliding on the bank and was used to purchase more plants and irrigation supplies. Outside funding from the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) and Ross Valley Sanitary District (RVSD) paid for about 5% of the original construction and for MCC crews to do the additional planting and installation of the irrigation system. It was not feasible to expand the riprap removal after the fact. Within the constraints of the budget, the target was met.

Goal 2: Improve riparian zone quality

Tasks: Riprap removal, invasive plant removal, plantings
Output Indicators: Riprap removal, invasive plant removal, plantings
Outcome Indicators (Performance Monitoring Metric): % vegetation bank coverage; % reduction in hardscape
Measurement Tools and Methods: From photographs, calculate areas of

vegetation coverage and hardscape before construction and annually after construction
Target: 50% vegetated bank coverage; 100% native plant species; 50% reduction in hardscape
Discussion: Within the original project area, hardscape downsteam of the stage has been reduced from 700 square feet to 450 square feet, for a bank that is 65% vegetated. Under the stage, 150 square feet of riprap remain in place; it has been planted to the extent there were pockets in the riprap available for planting. At present the reduction in hardscape is minor and two of the *Woodwardia fimbriata* have died; if the remaining plants become well established and grow, they will begin to cover the riprap and the amount of visible hardscape will decrease. We do not anticipate major replanting in the riprap because there is limited funding available and it is not work that can be easily done by casual volunteers.

Goal 3: Determine survival of installed riparian vegetation
Tasks: Annual inspection of restored area for period of three years
Output Indicators: Document survival of each vegetation class and recommend replanting as needed
Outcome Indicators (Performance Monitoring Metric): per cent total survival
Measurement Tools and Methods: 100 per cent survey of installed plants annually
Target: 85 per cent total survival
Discussion: Table 2, below, shows the survival after one year of plants installed in December 2006, the original planting. Many of the toyons were very small when planted, which contributed to their low survival (19 per cent). Also, the Town of San Anselmo asked that the planted area at the top of bank be reduced in size, so most of the survivors were transplanted, further reducing survival. Toyons were replaced in December 2007. The only other species with less than 100 per cent survival was the giant chain fern, which was planted in an area that appears too sunny for it to flourish.

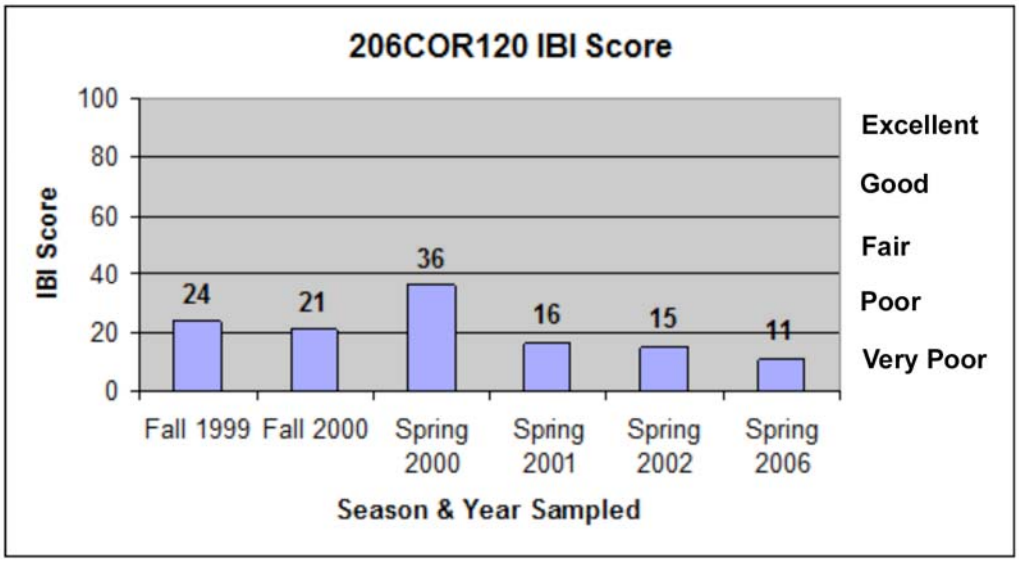
Table 2: Survival of plants installed in December 2006

		Number of Plants		
Container Species		**Planted Dec 2006**	**Surviving Jan 2008**	**Per Cent Surviving**
Acer macrophyllum	big-leaf maple	4	4	100
Aesculcus californica	buckeye 1	1	100	
Carex barbarae	whiteroot sedge	5	5	100
Heteromeles arbutfolia	toyon 16	3	19	
Juncus patens	blue rush 5	5	100	
Lonicera hispicula var. *vacillans*	vine honeysuckle	5	5	100
Polystichum munitum	western sword fern	2	2	100
Rosa californica	California rose	3	3	100
Rubus parviflorus	thimbleberry	2	2	100
Sympnocarpus albus var. *laevigatus*	snowberry	6	6	100
Woodwardia fimbriata	giant chain fern	5	3	60
	Total 54	**39**		

Goal 4: Maintain bank stability
Tasks: Riprap removal, invasive plant removal, plantings, and fencing at top of bank
Output Indicators: N/A
Outcome Indicators (Performance Monitoring Metric): No bank retreat in treated area
Measurement Tools and Methods: Annual inspection of erosion pins
Target: No increased erosion or less than one inch per year
Discussion: Erosion pins are not feasible in the brush layering. However, no apparent erosion has occurred in the area treated and planted in 2006 and January 2007. The upstream area planted in December 2007 suffered some erosion in the near-flood conditions on Friday, January 25, 2008. As of this writing, the water was still too high to assess the full extent of the damage, but it appears that some of the dogwoods planted very low on the bank were washed out. A more complete damage assessment will have to wait until the water is lower.

Goal 5: Improve in-stream water quality
Tasks: Conduct macro-invertebrate sampling at the restoration site
Output Indicators: Compare results to baseline conditions gathered from the streambed adjacent to the bank to be restored
Outcome Indicators (Performance Monitoring Metric): Species richness; per cent EPT
Measurement Tools and Methods: CA DFG Bio-assessment protocol
Target: maintain EPT and species richness
Discussion: The BMI sampling done in 1999 – 2006 show rather poor baseline condition at the site near the project (see Figure 1, below), with Index of Biological Integrity (IBI) scores ranging from 11 in fall 2006 to 36 in spring 2000. The average IBI score for that period was 20.5. The taxa list for 2006 is in Table 3; for 2007, Table 4, both of which are presented on pages 13 – 15 of this report.

Figure 1: BMI sampling data for Site 206COR120



Source: CDFG and MCSTOPPP

MCSTOPPP hired CDFG to analyze all of the data gathered to see if any conclusions can be drawn from the data that could inform land use decisions. That report has not been released as of January 2008. Results will be included in the first annual report after CDFG provides the information. We expect that will include all data for the site, from 1999 – 2007. Continued testing will depend on the conclusions of the analysis. If CDFG determines that there is no particular use to be made of the results of BMI sampling, then it will be discontinued.

MCSTOPPP no longer conducts monitoring at this site. In the past, they did periodic BMI sampling there, but they have not decided whether to continue, since it isn't clear that it helps inform management actions. However, further sampling may be conducted in late September 2008, with funding from Friends of Corte Madera Creek Watershed.

Goal 6: Demonstrate project success to the community
Tasks: Prepare annual reports documenting construction and monitoring activities
Output Indicators: N/A
Outcome Indicators (Performance Monitoring Metric): N/A
Measurement Tools and Methods: Submit annual reports to Grants Manager, MCSTOPPP, Town of San Anselmo and other interested parties
Target: Knowledge and acceptance of project success by the community.
Discussion: This is the first complete report, describing the project approximately one year after the initial treatment. It will be distributed to the parties listed above. The community has been preoccupied with dealing with the impacts of the damaging flood on 12/31/05, so this project has not attracted much attention. Several people have complimented us on the work when we have been on the site, but one critic was very vocal in his criticism of the removal of non-native shrubs.

Table 3: Taxa list for 2006 sampling at Site 206COR120 (San Anselmo Creek at Creek Park)

Phylum	Subphylum	Class	Order	Family	Subfamily	Tribe	Taxon	Tol Val	FFG	Distinct	
Arthropoda											
	Hexapoda										
		Insecta									
			Diptera								
				Chironomidae				6	CG	D	248
				Simuliidae							
							Simulium sp.	6	CF	D	16
				Tipulidae							
							Tipula sp.	4	OM	D	--
			Ephemeroptera								
				Baetidae							
							Baetis sp.	5	CG	D	10
			Odonata								
				Coenagrionidae							
							Argia sp.	7	P	D	1
			Plecoptera								
				Chloroperlidae				1	P	N/D	-
							Suwallia sp.	1	P	D	1
				Hydroptilidae							
							Hydroptila sp.	6	PH	D	4
	Chelicerata										
		Arachnida									
			Trombidiformes								
				Lebertiidae							
							Lebertia sp.	8	P	D	5
				Sperchontidae							
							Sperchon sp.	8	P	D	2
				Torrenticolidae							
							Testudacarus sp.	5	P	D	1
							Torrenticola sp.	5	P	D	1
Annelida											
	Clitellata										
		Oligochaeta						5	CG	D	196
Platyhelminthes											
		Turbellaria						4	P	D	2
											487
							Total Organisms Recovered				487
							Extra Organisms				63
							QC Organisms				3
							Total Picked (includes extras + QC)				553
							Grids Processed				0.25
							Total Grids Possible				12
							Abundance (#/ sample)				24042

Source: CDFG and MCSTOPP

Table 4: Taxa list for 2007 sampling at Site 206COR120 (San Anselmo Creek at Creek Park)

Phylum Subphylum Class Order Family Subfamily Tribe Taxon	Life Stage	Tol Val	FFG	Distinct	
Arthropoda					
Hexapoda					
Insecta					
Coleoptera					
Elmidae					
Narpus sp.	Adults	4	CG	D	2
Narpus sp.	Larvae	4	CG	D	3
Diptera					
Chironomidae		6	CG	D	241
Simuliidae					
Simulium sp.		6	CF	D	12
Tipulidae					
Tipula sp.		4	OM	D	1
Ephemeroptera					
Baetidae					
Baetis sp.		5	CG	D	10
Hemiptera					
Gerridae		--	P	D	1
Trichoptera					
Brachycentridae					
Amiocentrus aspilus		3	CG	D	1
Hydropsychidae					
Hydropsyche sp.		4	CF	D	58
Hydroptilidae					
Hydroptila sp.		6	PH	D	14
Lepidostomatidae					
Lepidostoma sp.		1	SH	D	1
Leptoceridae					
Mystacides sp.		4	OM	D	1
Crustacea					
Malacostraca					
Amphipoda					
Gammaridae					
Gammarus sp.		6	CG	D	93
Isopoda					
Asellidae					
Caecidotea sp.		8	CG	D	3
Ostracoda		8	CG	D	1
			Subtotal		442

continued

Table 4: Taxa list for 2007 sampling at Site 206COR120 (San Anselmo Creek at Creek Park) (*concluded*)

Phylum / Subphylum / Class / Order / Family / Subfamily / Tribe / Taxon	Life Stage	Tol Val	FFG	Distinct	
Arthropoda (continued)					
Chelicerata					
Arachnida					
Acari		5	PA	D	12
Trombidiformes					
Hygrobatidae					
Atractides sp.		8	P	D	2
Lebertiidae					
Lebertia sp.		8	P	D	16
Sperchontidae					
Sperchon sp.		8	P	D	9
Annelida					
Clitellata					
Oligochaeta		5	CG	D	64
Coelenterata					
Hydrozoa					
Hydroida					
Hydridae					
Hydra sp.		5	P	D	10
Mollusca					
Gastropoda					
Basommatophora					
Physidae					
Physa sp.		8	SC	D	8
Nemertea					
Enopla					
Hoplonemertea					
Tertastemmatidae					
Prostoma sp.		8	P	D	23
Platyhelminthes					
Turbellaria		4	P	D	28
Total					614

Abundance Calculations	
Total Grids	5
Grids Picked	3
Organisms ID	614
Extras	22
QC Organisms	3
Organisms ID + Extras + QC	636
Total Organisms per Sample	1060

Source: CDFG and MCSTOPPP

Goal 7: Irrigate plants to increase summer survival rate
Tasks: Install irrigation
Output Indicators: A temporary drip irrigation system
Outcome Indicators (Performance Monitoring Metric): Performance of irrigation system; plant survival
Measurement Tools and Methods: Plants will be watered through summer months for 3 years; plant survival monitoring
Target: 85 percent survival through the summer; adequately functioning irrigation system
Discussion: The irrigation system was installed and worked effectively with one exception. Children playing on the hill tore out a number of the hoses and instead of repairing it, the Town maintenance staff turned off the system. We noticed it 10 days later and repaired it. In spite of the interruption of water supply, survival was adequate except for giant chain ferns planted in the riprap under the deck. This area is probably too sunny for these plants. Many of the very small toyons died during the winter, before it was time to start the irrigation and several more died when they were mowed or transplanted.

Shortcomings

The major shortcoming is that the proposed project could not be fully implemented because of limited funding. Another shortcoming is that the Town's Department of Public Works staff is not familiar with maintaining native habitats. It would be a tremendous benefit to have a program to fund crews to conduct routine maintenance of habitat restoration projects on public lands. Although we have worked diligently to dig out the roots of invasive plants, it will take a consistent effort to control the persistent ones, such as *A. donax*, fennel, and Himalayan blackberry, found in the project area. And the seeds of French broom remain viable for decades, so until the area is too densely vegetated and shady for those seeds to germinate, the site will take regular weeding.

Lessons Learned

Friends of Corte Madera Creek Watershed has said that they have learned under no circumstances to participate in a bundled project where final payment is delayed until all projects are completed. The original Proposition 13 allocation was spent in October 2006 and the 10% withholding (over $3,000) has been owed since that time. This is a substantial amount of money for a non-profit with a modest budget, particularly since they cannot ask contractors who work for them to go without payment for over a year. In addition to causing cash flow problems, tracking the withholding unnecessarily complicates accounting for the project.

Another lesson learned is that long-term maintenance, which is now the responsibility of the Town, is likely to be very difficult for them to carry out. Friends of Corte Madera Creek Watershed will continue, as volunteers, to help them and to work with MCSTOPPP and neighboring communities to develop an approach to deal with this issue.

Project Funding

The North Bay Watershed Association funded the design. The Proposition 13 award provided the bare minimum of funding to construct most of the brush layering, install plants provided by MCSTOPPP, and put in the drip irrigation system. A second allocation of Proposition 13 funding enabled us to install the fence to protect the plants and buy more plants. Funding from the Ross Valley Sanitary District (RVSD) and the San Francisco Bay Regional Water Quality Control Board paid a portion of the work done by Prunuske Chatham Inc. in the original scope of work, planting in January and December 2007, and funded expansion of the planting. Volunteers from Friends of Corte Madera Creek Watershed provided all project management, coordination with the Town of San Anselmo, maintenance of the drip irrigation system, and supervision of maintenance. In addition to providing plants, MCSTOPPP is providing monitoring. An accounting of matching funds is in Table 5, below. This does not include any matching work done after January 28, 2008, such as completing the final report, monitoring and reporting after January 2008, reporting from CDFG on the BMI sampling, installation and maintenance of the expanded drip irrigation system, and regular weeding.

Table 5: Matching funds

Category	**Paid by**	**Amount**
Personnel		
Friends Volunteers		12,717.00
County Staff	Marin County	1,200.00
Town Staff	Town of San Anselmo	296.00
Personnel Sub-total		**$ 14,213.00**
Construction		
PCI	RVSD	2,124.11
MCC	RVSD	9,535.90
Plants	RVSD	136.91
Plants	MCSTOPPP	261.72
Construction Sub-total		**$ 12,058.64**
Operations		
Fees	RVSD	30.50
Office Expenses	RVSD	19.43
Sign	RVSD	345.39
Disposal	Town of San Anselmo	30.00
Operations Sub-total		**$ 425.32**
Grand Total		**$ 26,696.96**

Outreach Conducted

Friends of Corte Madera Creek Watershed has installed a sign crediting the funders and have described the project on their website and in Creek Chronicles, their semi-annual newsletter. Friends of Corte Madera Creek Watershed has attempted to recruit volunteers to work on the project with very limited success.

Because of budget shortfalls, the Town no longer has a volunteer coordinator and Friends are having increasing difficulty getting community members to volunteer for any habitat restoration projects, including this one.

Follow-up Activities

Friends of Corte Madera Creek Watershed will continue to work with the Town of San Anselmo to recruit volunteers and to train Town staff on maintenance of the project. As funds are available plants will be added.

PROJECT ELEMENT TWO:
NOVATO CREEK WATERSHED CITIZEN'S WATER QUALITY MONITORING PROGRAM

Project Summary

The Novato Creek Watershed Citizen's Water Quality Monitoring Program is located in the Novato Creek Watershed in Marin County, California. Citizen volunteers from the Friends of Novato Creek monitored physical and biological water quality parameters at 10 sites in the Novato Creek Watershed during 2006-2007. Data from sites monitored for benthic macroinvertebrates by the Marin County Stormwater Pollution Prevention Program was incorporated into the FNC data assessment. Water Quality parameters monitored included temperature, pH, DO, specific conductance, turbidity, pathogen indicators, and suspended sediment concentration. The goal of this project was to develop a comprehensive citizen water quality and biological monitoring program utilizing a rigorous sampling design, which provided an assessment of the baseline conditions in the Novato Creek Watershed. The monitoring program provided data to be used by groups and agencies working in the watershed. Friends of Novato Creek developed a comprehensive monitoring plan and quality assurance plan, received approval of sampling sites, and conducted water quality monitoring as specified at these sites since May 2007. All samples were collected by FNC Citizen monitors according to the procedures outlined in the FNC QAPP and Monitoring Manual. Laboratory analyses for Pathogen Indicators, Suspended Sediment Concentration, and Benthic Macroinvertebrate assemblages were performed by certified laboratories with approved Quality Assurance Plans.

Background and Project Planning

The goal of the FNC CWQMP was to monitor and assess baseline data on physical, chemical, and biological water quality parameters collected by citizen volunteers and develop next steps and recommendations for future monitoring. Data developed in this program are submitted to SWAMP and the Regional Board for evaluating the Novato Creek Watershed for 305b reporting and 303d listing and for the development of future monitoring and assessment programs and strategies for the watershed.

Specific objectives of the monitoring program are to develop baseline data to evaluate beneficial use protection; measure water quality indicators and stressors

to characterize spatial and temporal trends; determine relationships between water quality indicators, specific stressors and land use, including water management; identify reference sites; and evaluate monitoring tools.

Goals of the program were to:

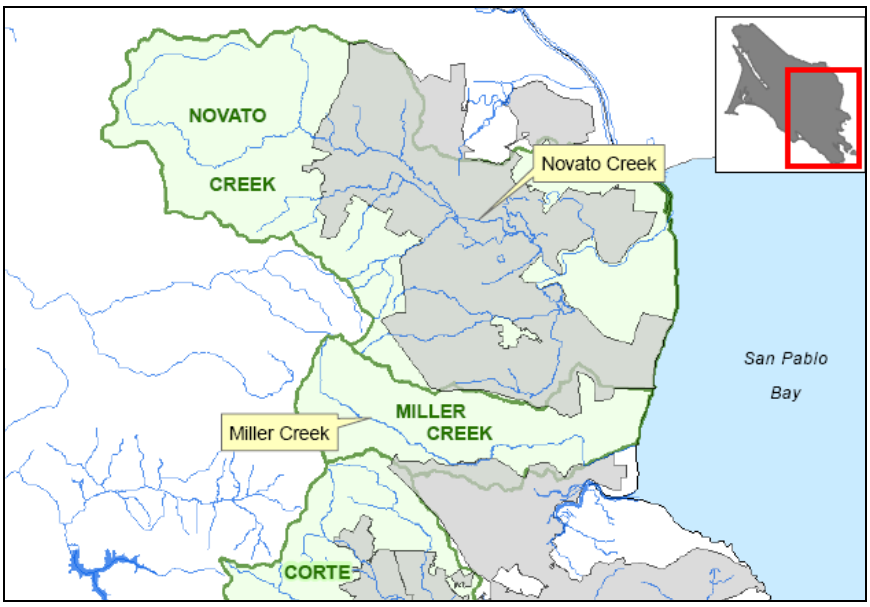
1) Provide baseline information on the basic water quality parameters, pathogen indicators, suspended sediment and macroinvertebrate assemblages assessed within the Novato Creek Watershed;
2) Determine the biotic condition for all sampling sites within Novato Creek (5 sites) and include integration of MCSTOPP data collected since 1999;
3) Provide an evaluation and comment on the relationship between biotic and habitat condition scores for all sites within the watershed;
4) Make recommendations to guide future diagnostic analysis and potential management actions for all sites within the Novato Creek watershed and make recommendations for future next steps including stressor identification and future monitoring plans;
5) Build awareness of water quality issues, aquatic resources and pollution prevention;
6) Evaluate the water and habitat quality compared to specific water quality criteria;
7) Screen for basic water quality problems
8) Supplement agency data by monitoring streams in the Novato Creek Watershed;
9) Contribute to the continued data collection efforts to assess watershed conditions over time.

Novato Creek Watershed and Monitoring Site Selection Criteria

The Novato Creek Watershed, one of the largest in Marin County, is a 44 square-mile drainage, which historically flowed year round. The Novato Creek encompasses over 19 miles of creeks and tributaries, which flow to the San Pablo Bay and originate at the headwaters of Novato Creek above the Stafford Lake Reservoir. The Novato Creek is a perennial tidally influenced creek which supports populations of threatened steelhead and other native fishes. The watershed includes diverse habitats near the San Pablo Bay with significant areas of tidal marsh and wetlands. It is located within the Pacific Flyway has been identified as a habitat for Clapper Rail, Salt Marsh Harvest Mouse and many State and Federally protected species. The Stafford Lake Dam and Reservoir (North Marin Water District) were constructed in 1951 below the Novato Creek headwaters, encompasses over 871 acres including adjacent lands. Upper areas of the watershed are impacted by the effects of the Stafford Dam and the lower areas of the watershed are impacted by restricted flows and depleted sediment load impacting the sediment supply downstream and causing further erosion through scouring. The upper reaches of the watershed are the primary sources of summer flows and ecologically beneficial gravels. Mid to lower reaches are urbanized and impacted by non-point source (NPS) pollution from storm drain runoff, construction runoff, bank and terrace erosion and hydro-modification (bank

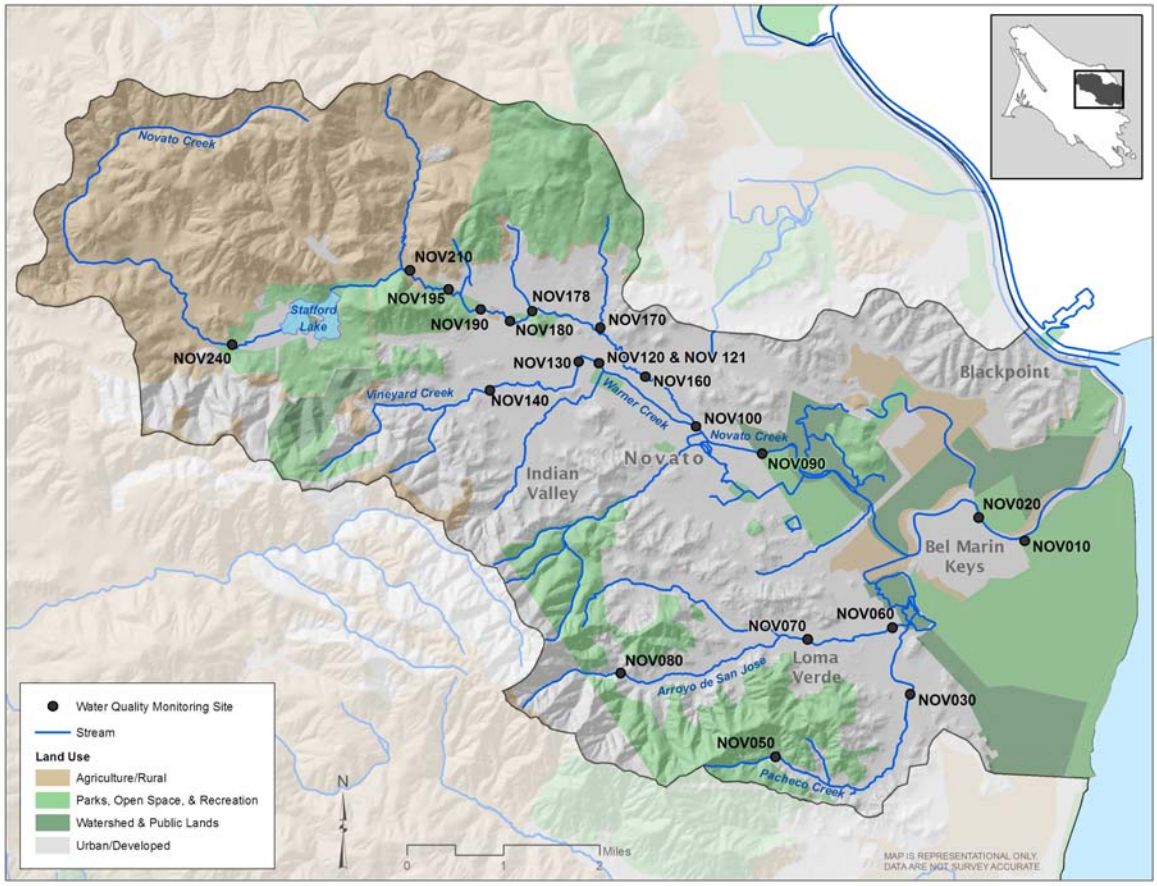
stabilization). The Novato Flood Control Project, a channelized section of the creek downstream, was built in 1987-90 and functions as a sediment trap; it has required dredging four times since construction. Novato Creek is a 2002, 303d listed impaired water body that is adjacent to the San Pablo Bay National Wildlife Refuge, Pacheco Pond Wildlife Preserve, and the State Coastal Conservancy Wetlands Restoration Project at Hamilton and Bel Marin Keys.

Novato Creek Watershed Study Area



The criteria used to select monitoring sites for this project are described below. The process for selection of appropriate sites for stream water monitoring is based on Novato Creek sub-watershed characteristics, past sites monitored by Marin County MCSTOPPP, land uses, and site access and safety considerations. The specific criteria for selection of monitoring sites were as follows:

(1) Inclusion of locations upstream of urban activity;
(2) Previous monitoring sites with historical data;
(3) Inclusion of a headwater location;
(4) Inclusion of sites within the City of Novato urban areas with public access;



All Novato Creek Monitoring Sites (Monitored 1999 – 2007)

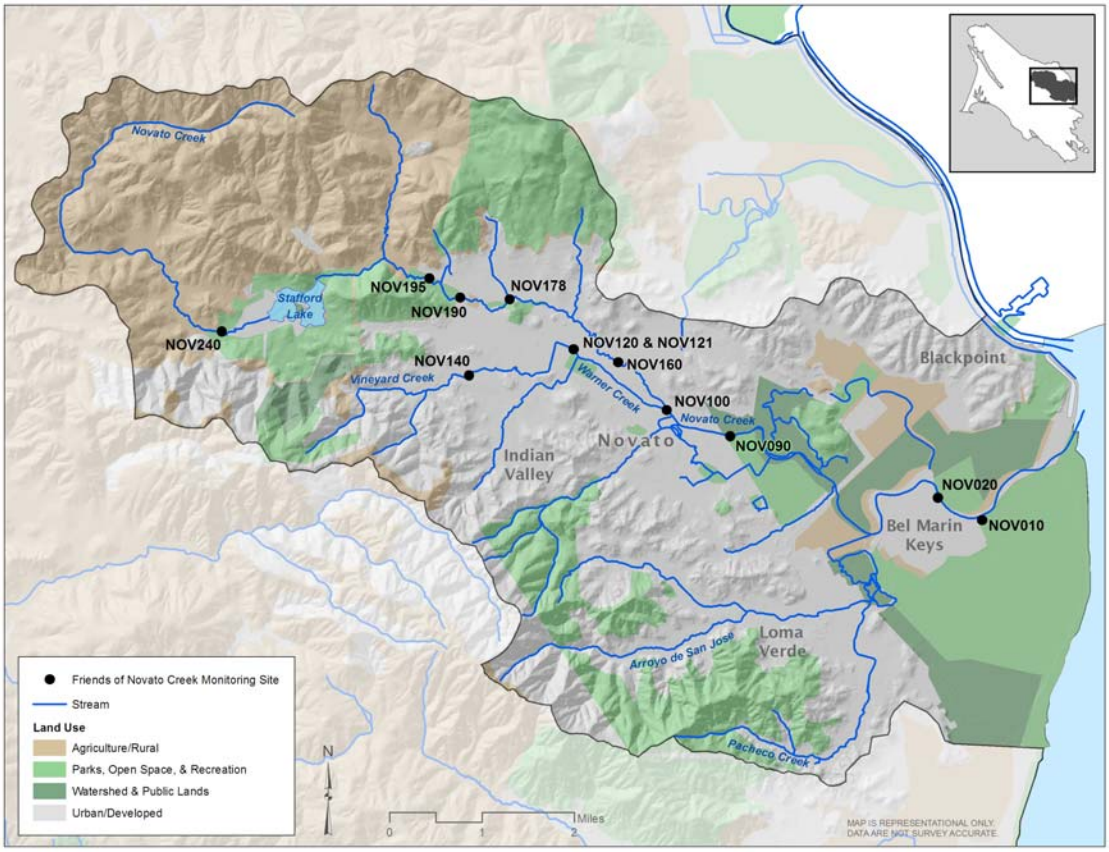
A total of 20 monitoring sites have been established in the Novato Creek Watershed using the SWAMP naming conventions. Each has distinct microclimates, terrains, urbanization history, water impoundment layouts, types of impacts, and distributions of land use activities.

In determining sampling sites for this project consideration was given to the potential water quality concerns in the watershed and sites historically monitored. Sites were considered in those areas, depending of course on factors such as site accessibility, access permission, and project funding. By placing monitoring sites in locations both upstream and downstream of high impact areas, it is possible to make inferences, directly related to specific land uses.

Establishing reference sites for the Novato Creek watershed is an important issue to address in the future. The criteria for establishing reference sites for a watershed are that they are accessible, are found in geographic and geologic conditions similar to those of impacted sites, and are as close to pristine historical conditions as is available in the watershed. The need for urban land use reference sites has also been identified, but their selection will be based on a different set of criteria.

Integrator sites should also be established for the watershed typically at the lowest point in the watershed that is not tidally influenced. Although these sites receive contaminants from all sources and land use impacts in the watershed, they are limited in providing a fully cumulative picture because of transience and dilution of contaminants. Integrator sites are used to evaluate the relative contribution of contaminants to the receiving waters (SFBRWQCB 2002).

BMI has been sampled historically at sixteen sites located in the Novato Creek Watershed (NOV) and sampled various years between the fall of 1999 through the spring of 2007 by Marin County (MCSTOPPP) and FNC. Within the watershed, two sites were located on Pacheco Creek (206NOV030, and 206NOV050), three on Arroyo San Jose Creek (206NOV060, 206NOV070, and 206NOV080), one on Warner Creek (206NOV120), two on Vineyard Creek (206NOV130, and 206NOV140) and eight on the main stem Novato Creek (206NOV160, 206NOV170, 206NOV178, 206NOV180, 206NOV190, 206NOV195, 206NOV210, and 206NOV240).



Monitoring Sites in 2007

Project Implementation

Water Quality Monitoring

Trained volunteer citizen monitors from Friends of Novato Creek monitored ambient water quality in the Novato Creek Watershed according to the FNC QAPPP and Monitoring Plan/ Monitoring Manual. Physical, water quality and biological parameters were monitored at specified sites in the Novato Creek Watershed identified in this plan. Water Quality parameters monitored included: Temperatue, pH, DO, Specific conductance, Turbidity, and Salinity. FNC citizen volunteer monitors took water quality measurements in the field as specified in the FNC Citizen Monitoring Program QAPP and Monitoring Plan (Appendix 2.2.4 - F).

Water Quality Parameters Monitored

Temperature	Tracks seasonal changes and areas of concern for thermal impacts. May be influenced by irrigation runoff and recreational uses.
Dissolved Oxygen	Changes in dissolved oxygen values may be due to changes in nutrient content, sediment load and/or the presence of biodegradable organic material. Aquatic organisms rely on the presence of oxygen. Water temperature and altitude, time of day, and seasons affect dissolved oxygen concentrations.
pH	To measure how acidic or alkaline the water is at the time of testing. Most aquatic organisms prefer a range of 6.5 to 8.0 pH. Mining, nutrients and other impacts can influence pH.
Conductivity/TDS	To indirectly measure the presence of inorganically dissolved solids (salts) such as chlorides and nitrates. Fertilizers, herbicides and pesticides, as well as some ions dissolved from mine waste contribute to conductivity.
Turbidity	To measure suspended particles, which diffuse light and absorb heat. Increased turbidity can increase temperature and reduce light available for algal photosynthesis. If the turbidity is caused by suspended sediment, it can be an indicator of erosion, either natural or man-made. High sediment loads can clog the gills of fish. Once the sediment settles, it can foul gravel beds and smother fish eggs and benthic insects. The sediment can also carry pathogens, pollutants, and nutrients.

Samples at 5 (increased to 10 for pathogens and SSC) sites were analyzed for suspended sediment concentration (SSC), turbidity, BMI and pathogen indicators (total coliforms, E. coli, and enterococcoccus) seasonally in the Spring / Winter. Seasonally samples taken for suspended sediment concentration were taken to the Sonoma Ecology Center for analysis. Seasonal samples taken for pathogen analysis were taken to the Marin County Public Health Lab in San Rafael CA.

Additional sites and sample frequency were included above the grant requirements at the recommendation of FNC technical advisors to make a total of 10 sites assessed for pathogen indicators and SSC. Standard water quality parameters were measured monthly using a 6600 YSI multiprobe monitor (dissolved oxygen, conductivity, temperature, salinity, pH) at each of 10 sampling sites monthly. Table 6.1 in the FNC QAPP summarizes the monitoring design for the physical and biological parameters to be measured, and specifies whether the samples will be analyzed by the monitoring group or sampled for later analysis by a professional lab, and the frequency of measurement.

Biological Monitoring

In 2006 and 2007 Friends of Novato Creek, a Marin County citizen monitoring group, contracted with Sustainable Land Stewardship Institute (SLSI) to evaluate benthic macroinvertebrate samples collected at established MCSTOPPP sampling sites within the Novato Creek Watershed and provide an assessment. Friends of Novato Creek volunteers collected the samples in the spring of 2006 and spring 2007 and completed the physical habitat assessment in accordance with the California Stream Bioassessment Protocol (CSBP-Rev. 2003).

Monitoring Parameters and Analysis Methods

Monitoring Parameter	Analysis Type	Frequency	Instrument	Method
				FNC QAPP
Temperature	F	M	YSI Multiprobe 6600	(Appendix:2, Section C, sub-a)
Dissolved Oxygen	F	M	YSI Multiprobe 6600	(Appendix:2, Section C, sub-a)
pH	F	M	YSI Multiprobe 6600	(Appendix:2, Section C, sub-a)
Conductivity (fresh water)	F	M	YSI Multiprobe 6600	(Appendix:2, Section C, sub-a)
Salinity (marine)	F	M	YSI Multiprobe 6600	(Appendix:2, Section C, sub-a)
Turbidity	F	M	YSI Multiprobe 6600	(Appendix:2, Section C, sub-a)
Total Coliform	P	S	IDEXX Colilert- 18	(Appendix:2, Section C, sub-c)
E. Coli	P	S	IDEXX Colilert- 18	(Appendix:2, Section C, sub-c)
Enterococcus	P	S	IDEXX Enterolert	(Appendix:2, Section C, sub-c)
Benthic Macroinvertebrates	P	A	--	CSBP (Appx:2; Sect C; sub-b)
Odor and Visual Observations	F	M	--	CSBP (Appx:2; Sect C; sub-b)
Suspended Sediment	P	S	Balance	(Appendix:2, Section C, sub-d)

Type: F: field analysis, L: in-house lab analysis, P: sample only, send to lab
Frequency: M: monthly, S: seasonal, X: irregular; A: Annual

Sampling Design Summary

One of the overall goals of FNC Monitoring Project was to develop a general picture or snapshot of Novato Creek Watershed health. Due to limited funding the sites were selected using the deterministic sampling design based on historic sampling locations, access and location relative to public access and beneficial uses. In the future a more comprehensive design using the application of the probabilistic sampling design principle, in which each location has the same probability of being selected as all the other locations may be recommended. However this approach required collection of a large number of samples to obtain good representation of the Novato Creek and tributaries. Future monitoring goals will be recommended to focus on the identification of potential stressors and on identifying specific problem area and potential reference and indicator sites. Directed sampling design can be used to:

1) evaluate the influence of tributaries
2) determine if beneficial uses are being protected at specific locations
3) follow-up on previous data indicating potential impacts
4) determine if specific land uses are having an impact on water quality
5) identify potential reference sites

Seasonal Rationale

The strategy used for the FNC studies focused on sampling based on hydrologic cycles. The two hydrologic cycles were the wet season (November-Jan), dry hydrograph/spring- summer (May-June) although sampling time was decided primarily by water patterns.

Field Operations

Field sampling operations were conducted by several FNC volunteer crews out of a pool of 20 trained volunteers. Each crew had been trained to used the specified field data sheet, equipment and documented collection protocols. All volunteer monitors followed the appropriate chain of custody procedures and sample retention procedures specified in the FNC QAPP (Appendix 2.2.4 - F).

Collection of discrete field measurements for water quality parameters using the YSI sonde was conducted at 10 sites by FNC volunteers. The YSI sonde was calibrated and programmed to measure pH, DO, temperature, specific conductivity, turbidity and salinity pre and post data collection. FNC volunteers were also responsible for pre-deployment calibrations and post-deployment accuracy checks. During sonde data collection and retrieval, volunteers recorded location attributes on data sheets and in photographs whenever possible. (Appendix 2.2.4 - F, Section D-a-i).

Water samples for Pathogen Indicators were collected at 10 sites in the watershed by FNC monitors following U.S.EPA methods for volunteer stream monitoring (U.S.EPA 1997). Sterile containers were obtained from MCPHL and samples were taken in for analysis within holding time limits after being stored.

Samples were collected at weekly intervals to enable generation of a 30-day average of 5 samples (Appendix 2.2.4 – F, Section D-c-i).

FNC crews collected BMI samples at 5 sites (May- June / May 2007) following the California Stream Bioassessment Procedure (CSBP) (Harrington 1999) with slight modifications. Three replicate samples were collected, each at a different riffle segment, within a Site (defined as a line of 150m). Each sample represents a collection of organisms captured with a D-net (0.5 mm pore size) from 3 riffle sampling squares. Each square had an area of 1x1 ft and was sampled to the depth of 4-6". The three sub-samples were pooled together and preserved in 95 percent ethanol in the field. In summary, a total of nine squares were collected, batched into 3 replicate samples [Note: This sampling design using 3 replicate samples has been recently replaced with sampling 8 riffle squares randomly along the entire 150m reach and pooling the organisms into one sample. Other aspects of the protocol were also revised (Ode 2007). FNC crews also performed the physical habitat assessment at each site, following the CSBP protocol, which is based on U.S.EPA's Rapid Bioassessment Protocol (Barbour *et al.,* 1999a,b).

Water samples for Suspended Sediment Concentration were collected at 10 sites in the watershed by FNC monitors following U.S.EPA methods for volunteer stream monitoring (U.S.EPA 1997) and SOP's listed in the FNC Monitoring Manual (Appendix 2.2.4 - F, Section D-d-i). Sterile containers were obtained from SEC and samples were taken in for analysis within holding time limits after being stored at 4 C.

Laboratory and Field Analyses

Benthic Macroinvertebrates

All samples were sorted and identified by the SLSI in accordance with the 2003 CSBP and the California Aquatic Macroinvertebrate Laboratory Network (CAMLnet) Standard Taxonomic Effort (STE). Three hundred individual organisms were selected randomly from each sample for identification (to the level of genus, where possible) and enumeration. For the analysis in this report, data from the three riffle samples per site were combined, and the raw data was standardized to the taxonomic levels specified in the CAMLnet STE (to accommodate analyses by different taxonomists) as described previously (SFBRWQCB 2007). The biological metrics shown in Appendix Table B-2 were then calculated.

Pathogen Indicators Analysis

Total Coliform, e-coli and enterococcus analysis in water samples were performed by the IDEXX methods used at the Marin County Public Health Lab. SWRCB / EPA approved methods for pathogen analysis will be used using the IDEXX Colilert/Enterolert ® QuantiTray system. Standard Method 9223 (APHA 1998), enzyme-substrate method that uses the IDEXX Colilert ™ reagent / Enterolert ™ reagent to count total coliforms and Escherichia coli and Enterococcus. Samples were collected in sterile containers provided by the contract analysis lab, the Marin County Public Health Lab in San Rafael CA (Appendix 2.2.4 – F).

Suspended Sediment Concentration Analysis

Seasonal Total Suspended Sediment and Turbidity was analyzed by the Sonoma Ecology Center, Sonoma CA. Methodology used will per Quality Assurance Project Plan, Sonoma Ecology Center Standard Operating Procedure for Sampling Suspended Sediment Concentrations and Turbidity November 30, 2001(Appendix 2.2.4 – F).

Pathogen Analyses

The MPN/100 mL count results from the five consecutive sampling events conducted weekly in the spring of 2007 and fall of 2007 were used to generate the summary statistics.

Suspended Sediment Analyses

Analysis of the FNC data is considered turbid if mg/L and NTU exceeded the values referenced in Newcombe & Jensen's 1996 report titled A Synthesis for Quantitative Assessment of Risk and Impact at 27 mg/L. For FNC samples, 27 mg/L equates to 36 Nephelometric Turbidity Units.

Data quality

Field and lab operators followed the FNC QAPP field procedures and the internal lab SOPs, as required to assure generation of data of known and documented quality. With some exceptions, the data reported in Section 3 and in all data are SWAMP compliant. This means the following:

(a) Sample container, preservation, and holding time specifications of all measurement systems have been applied and were achieved as specified;
(b) All the quality checks required by SWAMP were performed at the required frequency;
(c) All measurement system runs included their internal quality checks and functioned within their performance/acceptance criteria; and
(d) All SWAMP measurement quality objectives (MQOs) were met.

Project Performance

This section presents the results obtained in the 10 sites selected for monitoring in Novato Creek Citizen Water Quality Monitoring Project. Detailed information is presented in Appendix 2.2.3 in text, tables and figures pertaining to the individual sites. The Appendices also contain spreadsheets with detailed data on all samples, site monitoring, and water quality data files for each Monitoring Site.

Sites monitored include:

NOV 240 – Site is located above the influence of the Stafford Dam and Reservoir and is the least impacted by development. Grazing and cattle ranches are adjacent to the creek and headwaters.

NOV195 – Site is below the Stafford Dam and Reservoir with little urban influence. Does receive flow from Bowman Canyon and agricultural grazing lands.

NOV190 – Site adjacent to a public park (O'Hair Park) receive significant traffic by the public and adjacent Morningstar Horse Stables. Steelhead and Salmon observed migrating stream of this site.

NOV178 – Site is located downstream of a pubic park which receives heavy use (Miwok Park) and in a residential area.

NOV160 – Lee Gerner public park and MC/USGS Stream gauge site. Site has been historically monitored and is considered in downtown Novato. Influenced by stormwater runoff, trash and impact from this urbanized area.

NOV140 – Site located on a tributary (Vineyard Creek) which has had steelhead fry observed in the past several years. Adjacent to residential community with narrow border of riparian cover.

NOV120 - Warner Creek site historically monitored for BMI and located in a residential community under the urban impacts of adjacent land use.

NOV100 – Warner Creek at the confluence with Novato Creek. This site is under tidal influence and is bordered downstream by a concrete channel on both banks. Above the site Warner Creek has concrete channel on the left bank (upstream) and a vegetated bank on right bank. Area and local homes are known to flood.

NOV090 –Tidal section of the Novato Creek downstream of MC Flood control sediment basin which is dredged on average every 4 years. Site known to flood.

NOV020 – Site adjacent to homes in residential community of Bel Marin Keys and across from Novato Sanitary District outfall.

NOV 010 – Site is the lowest in the watershed. It is in the wetlands tidal area and is significantly influenced by tide. This section of the Creek is about 1.5 miles from the San Pablo Bay channel and below the majority of residential urban and industrial areas.

Benthic Macroinvertebrate Assemblages and Physical Habitat

In 2006 and 2007, volunteers from the Friends of Novato Creek (FNC) sampled seven sites in the Novato Creek watershed; 206NOV120 (2006 only), 206NOV140 (2006 only), 206NOV160 (2007 only), 206NOV178, 206NOV190, 206NOV195 and 206NOV240. FNC used the TRC sampling procedures described previously and volunteers were fully trained and audited by SLSII staff on both years.

Five sites were located on main stem Novato Creek (206NOV160, 206NOV178, 206NOV190, 206NOV195, and 206NOV240).

The downstream most sites were 206NOV120, 206NOV140, 206NOV160 are located well within the urban area and the uppermost sites (206NOV190, 206NOV195, 206NOV240) were located with open space with limited urbanization.

Biotic condition was determined by examining all the available data for a particular for each site surveyed. The IBI scores for each site was the primary measure used to assess the condition. Most sites had several years where the IBI scores were determine so the variability of the IBI values over the years of sampling and the most recent score was taken into consideration when making a final decision on existing biotic condition. In some cases, the individual metric scores from the IBI, the list of organisms occurring at the site and the physical/habitat measures were examined to help make a decision on the existing biotic condition of a particular site where a decision was less confident.

For all sites, a grade of confidence was determined using a four star system. A one star (♦) rating was given to a site where the data was limited, the site was not sampled recently and the biotic score did not correspond to what would be expected give the physical/habitat or basic chemistry measures taken at the site. A two stars (♦♦) rating was given to site where the problems listed for one star were not as serious. A three stars (♦♦♦) rating was given to a site where only less serious problems listed above were encountered and a rating of four stars (♦♦♦♦) was used when no problems were encountered in making a determination of biotic condition at a site.

Water Quality Field Measurements

Water temperature, DO (dissolved oxygen), pH and specific conductance, turbidity were measured at each site monthly and at the same time as other sampling events whenever possible. WQ parameters were also routinely measured at any bioassessment monitoring site and are used to determine acutely deleterious conditions and not necessary to determine chronic stressors.

Pathogen Indicator Data

Bacterial count results of individual samples are shown in Appendix 2.2.4- D - Pathogen Data Table D-2c, and summary statistics presented in Tables 3.1.3-1 through 3.1.3-4.

Five bacterial samples were collected at each of 10 monitoring sites in Novato Creek during sampling events in May /June 2007 and Oct/Nov 2007. All sites contained Total coliform, E. coli and Enterococus exceeding EPA standards for water safety and recreational water contact exceeding the 30 day geomean are listed in the appendices.

Site NOV240 has a population of resident geese which may contribute to higher coliform levels. The sites at public parks receive a high amount of public use (NOV160, NOV 178, and NOV190) , including homeless encampments under bridges near the downtown sites NOV160 and NOV178 may have an impact. Sites in the lower watershed NOV010 and NOV020 have had historically tested above standards and are used for water recreation by the adjacent community of Bel Marin Keys. Site NOV190 is below the influence of a horse stables which fronts the creek and site NOV195 is upstream of that location. Site NOV190 consistently shows higher numbers for pathogen indicators. It is expected that public use and sewer line leaks are a more likely source of coliform bacteria than waterfowl.
E. coli was primarily used to evaluate impacts at each site. For recreational waters, U.S.EPA recommends E. coli as the best indicator of waterborne pathogens. While fecal coliform bacteria as a group have been shown not to correlate as reliably as E. coli with disease-causing agents, although they are currently still a standard referenced in the Basin Plan. All water samples were also analyzed for total coliform bacteria, they are no longer a recommended indicator. For E. coli, a geomean above U.S.EPA's steady state limit of 126 MPN/100mL constitutes an exceedance.

During the spring 2007 sampling event NOV090 and NOV178 had the highest E-coli geomean, while enterococcus was the highest at the downtown Novato sites NOV160 and NOV178. Fall 2007 sampling showed a Geomean highest at two of the same sites NOV090 and NOV178 with NOV160 and NOV121 additional site which are impacted by urban stormwater runoff with a Geomean above 1000. NOV090 is located at the end of the sediment basin section of the Novato Creek and is under tidal influence.

Suspended Sediment Data

Suspended sediment concentrations (SSC) in the submitted in the spring 2007 samples ranged from 0 to 154 milligrams per liter (mg/L). Generally, although SSC varied greatly, these samples had high clarity. SSC in the samples tended to decline or rise depending on the order in which the samples were taken as indicated on the Data Crunch Sheet (see sample numbers NOV010 to NOV240). The results have a spatial variation, as all the samples were taken the same date. Samples which were collected in tidally influenced waters, as such samples tend to show higher SSC due to dissolved solids.

Spring 2007
Average concentration is 27.97 mg/L. Average NTU is 19.9
Analysis of the above data indicates waters from these samples are considered turbid based on Newcombe & Jensen's 1996 report titled A Synthesis for Quantitative Assessment of Risk and Impact at 27 mg/L. For the reported samples, 27 mg/L equates to 36 Nephelometric Turbidity Units.

Suspended sediment concentrations (SSC) in the submitted fall/ winter 2007 samples ranged from 0.2 to 2,554.5 milligrams per liter (mg/L). SSC varied greatly among these samples. SSC in the samples tended to decline or rise depending on the order in which the samples were taken as indicated on the Data Crunch Sheet (see Sample Numbers NOV160-1 to NOV190-43). The results have a spatial variation, as the samples were taken on various dates and locations. We recommend checking which samples were collected in tidally influenced waters, as such samples tend to show higher SSC due to dissolved solids.

Winter 2007-2008
Average concentration is 137.48 mg/L. Average NTU is 138.51.
The results from these samples appear to represent a wide range of SSC and NTU values. These samples range from one to five samples taken at a given location. For future sampling, we recommend Friends of Novato Creek collect a minimum of 30 samples at each location preferably in a single season or minimally over two seasons. These samples should be taken at different times and during representative storm events. Another recommendation is to gather flow data while sampling to develop a relationship between SSC and flow and NTU and flow. Once this relationship is established, Friends of Novato Creek can use automated flow data to determine annual sediment loads and yields, if automated flow data is available.

Overall the average sediment concentration indicates and exceedance of values considered turbid and could be considered impaired.

Methodology, Comparisons to Quality Benchmarks, and Data Interpretation
The data will be used for three overall purposes: To assess the overall health of the Novato Creek, to compare different reaches of the Novato Creek and tributaries relative to upstream land uses, and the snapshot of water quality in the watershed in the areas monitored.

These parameters are used to provide an overall assessment of water quality compared to established water quality criteria for other similar watersheds in Marin and Sonoma County, water quality parameters that may be available for other similar creeks, and any other water quality standards that may become apparent during the course of the project. Data was prepared in tabular form (Microsoft Excel format) to be easily compared to various published water quality standards.

Comparisons of Different Novato Creek Reaches

Water quality from the different reaches of the Novato Creek was compared to determine what, if any, impacts may be attributed to varying land uses. As expected the water quality and biological assemblages of benthic macroinvertebrates was higher the further up the watershed. While this effort was preliminary, further study to determine the relative impacts of different land uses and potential stressors and pollutants is needed.

Comparisons to Quality Benchmarks

FNC strives to collect data that can be used to evaluate the conditions in the Novato Creek Watershed via comparisons to water quality benchmarks such as water quality objectives and water quality criteria.

Pathogen data stands out as the majority of sites exceeded the 30 day Geomean for E- coli by significant margins.

Water quality benchmarks for temperature and dissolved oxygen were exceeded, particularly during the summer at low flow and in the lower tidal reaches of the creek. As we have seen episodic fish death indicating stressful conditions for aquatic life this could be a combination of factors i.e. dissolved oxygen and temperature thresholds. Stressful conditions are expected in watersheds with creeks that have intermittent flow and run dry in the summer, as does parts of the Novato Creek watershed. Water quality benchmarks for temperature and dissolved oxygen have been developed to specific beneficial uses, and thus may not be relevant to all waterways.

BMI Site Summaries and Sampling Recommendations for the Novato Creek Watershed

BMI information has been gathered in both fall and spring from 1999 through 2007. A total of 10 sampling events were used in the assessment with some sites having as many as nine sampling events and others with only one.

Discussion of the assessment and recommendations for future management action at those sites has been organized into four groups, and is included in the complete final monitoring report for this project element, included as Appendix 2.2.3.

Novato Creek Watershed Issues

Results from FNC BMI Monitoring data reinforces the insights gained in previous years sampling that the major factors affecting biological integrity in the Novato Creek are urbanization and flow regime. In the sites impacted by urbanization changes in benthic assemblages, and the effects of flow regime (low vs. perennial vs. intermittent) on invertebrates are obvious when compared with local undisturbed areas of the watershed.

After looking at in some cases many years of BMI data there were significant differences in invertebrate assemblages between streams that flow year-round and streams that go dry during the summer. Among minimally disturbed sites, intermittent streams had fewer taxa present compared to perennial streams. The lack of information on streamflow conditions of in the Novato Creek and tributaries limits our ability to understand the temporal and spatial patterns of intermittency and the biological effects.

Benthic macroinvertebrates in urban streams experience many potential impacts:

(1) impervious surfaces can cause rapid streamflow response during winter storms that can mobilize the stream bed and dislodge invertebrates and other biota;
(2) toxic pollutants in stormwater or dry season discharges, can cause sudden mortality;
(3) modified physical habitat caused by culverts or channelization can introduce barriers to organism dispersal, and removal of riparian vegetation can result in high temperatures and low dissolved oxygen levels, and
(4) the long, dry summers characteristic of our Mediterranean climate, coupled with streamflow diversions and groundwater pumping, can reduce stream flow to a trickle or cause the stream to dry out completely.

Lessons Learned

Future water quality sampling efforts will be designed to deploy the YSI probe in a continuous monitoring mode. Lessons learned included that the access to some sites was difficult for volunteers particularly in the winter months. Continuous monitoring will provide results which will provide an improved look at the watershed and specific areas of concern. FNC will be discussing potential reference and integrator sites with the Marin County Stormwater Pollution Prevention Program to coordinate sampling efforts.

Conclusions, Recommendations and Follow-up Activities

Results of the FNC monitoring program are consistent with most of the general conclusions and countywide recommendations for BMI sampling have been incorporated into the final monitoring report. The conclusions and recommendations listed below have been compiled provide Novato Creek watershed-specific recommendations for future sampling programs and investigations.

The following conclusions were identified:

- Biological monitoring has provided a snapshot assessment of the watershed which will provide a basis for future monitoring and restoration strategies. Benthic macroinvertebrate assemblages at sites influenced by urban areas, even where the physical habitat conditions are adequate, are generally in poor to very poor condition. Even benthic assemblages at

sampling sites that only drain small amounts of urban land use are often significantly degraded and dominated by a few pollution tolerant taxa. Of the 7 sites FNC sampled, only one site, NOV240 above the Stafford Dam received a Fair to Good rating and contained more numerous pollution-sensitive EPT taxa. This site should continue to be monitored in the future as it lacks an adequate data set. In addition new sites should be identified to evaluate potential stressors.

- There was evidence of significant algae growth (Spring – Winter) at a number of sites (particularly in the urban influence) which should be monitored for nutrients and chlorophyll a or sampled for algae.

- Continuous monitoring should be implemented at a minimum of one reference site in the watershed. Site NOV160 at the Novato Creek stream gauge is a potential recommendation for an urban site. Discrete sampling for water quality parameters was a good first step for the FNC Citizen Water Quality Monitoring Program but dissolved oxygen concentrations were measured during the day at various times do not reflect the nighttime lows between 2-6 AM. The Novato Creek Stream /Flow / Rainfall gauge at this site should be maintained as it was in non working order for a part of this project.

- Temperatures did not generally exceed guidelines for salmonids although several site locations were dry during the summer months. Again this should be monitored on an ongoing basis using continuous monitoring devices (HOBO temp).

- The Novato Creek Watershed Citizen's Monitoring Program established a consistent monthly monitoring program for assessed baseline water quality. Seasonal variations in pathogen and sediment conditions in the watershed are assessed over the spring/ summer and winter season and should continue to been assessed. The next step in the process will be to evaluate potential stressors using the CADDIS protocol.

- The Novato Creek Watershed has many potential stressors which impact habitat and water quality including urban storm water runoff, light industrial and agricultural uses; horse stables, cattle grazing and dairies, creek-side homes and businesses, Stafford Lake Reservoir and Dam, retail development and impervious surfaces, public parks and creek access, homeless impacts, trash and sewage spills,. Land development in Novato and fill of adjacent wetlands has increased storm water runoff contributing to flooding and sediment transport. Potential sources of sediment depletion and resulting in further erosion through scouring and excessive sedimentation downstream should be evaluated in future monitoring programs. The next step in the process will be to evaluate potential stressors using the CADDIS protocol.

- Streamflow and velocity measurements were not made during the water sampling events and additional data on streamflow are needed to better interpret water quality data. It is recommended to invest in operator training and in the field equipment needed to observe, estimate, and record streamflow at every site visit.

- The development of FNC citizen volunteers has increased pubic awareness through outreach and built the capacity of the watershed group. FNC has an ongoing mechanism for obtaining reliable water quality data and should continue to develop new tools for public outreach. At the present time over 30 members of FNC have participated in the citizen-monitoring program.

- Novato Creek is on the watch list for excessive sediment deposition, and assessment suspended sediment concentration can help direct future restoration and erosion control project Recommendations for erosion control activities would be the goal of future monitoring programs in the watershed which could prevent listing of the Novato Creek for impairment due to sedimentation.

PROJECT ELEMENT THREE:
PETALUMA WATERSHED RESTORATION AND OUTREACH

Background

The Southern Sonoma County Resource Conservation District (SSCRCD) has been leading locally-led conservation in the Petaluma River watershed for its entire history, over 60 years of service to the community. In 1999, the SSCRCD developed a plan, entitled the Petaluma Watershed Enhancement Plan (PWEP), which was built on a citizens' advisory committee with significant local landowner input. The SSCRCD's work under this Prop. 13 grant is a direct result of our plan to meet the implementation objectives specified in the PWEP. The San Antonio Creek watershed is the largest sub-watershed of the Petaluma River watershed and has the highest erosion and sedimentation rates, thereby is considered one of the SSCRCD's highest priority watersheds to seek funding and implement restoration projects to improve water quality and enhance riparian habitat. Prior to application for this grant, the SSCRCD had been working with landowners to identify goals and priorities and discuss conservation projects and potential funding. A strong rapport between the District and the landowners has been in existence for decades and with this on-going relationship the District proceeded appreciatively in continuing its on-the-ground efforts with the support of this Prop. 13 grant.

Project Planning and Implementation

The San Antonio Creek Project's goals were to improve aquatic and riparian habitat in addition to increasing bank stabilization by establishing riparian

vegetation and, thereby reducing sediment deposition in the creek, and ultimately in the tidal estuarine habitats. The project was designed to increase the length of healthy riparian corridor present in the watershed. In addition, the project involved the seasonal exclusion of cattle and the planting of native perennial grasses in the restoration areas.

Besides increasing bank stability by eliminating the influence of cattle, the increased vegetation will trap sediments, pathogens and nutrients carried in runoff entering the waterway, and eventually to San Pablo Bay. The project additionally provided an opportunity to inform, educate and provide technical guidance to long-term resident landowners (and in some cases, the greater Petaluma community) about non-point source pollution issues.

The outreach component was designed to be interactive not only for SSCRCD staff to provide technical advice but to listen and encourage comment and important on-the-ground input to the planning process. The project incorporated landowner/stakeholder involvement to address best management practices (BMPs) on private lands and assist landowners to implement restoration repairs that resulted in improved riparian habitat and enhanced water quality in the San Antonio Creek Watershed.

Meetings with interested landowners/stakeholders in the San Antonio Creek Watershed were conducted. Information and educational materials were developed and distributed to assist landowner's understanding of adverse impacts of non-point source pollution (sediment) to the watershed. Landowner feedback and participation were encouraged. Technical assistance to landowner's specific concerns was provided. Individual landowner projects were identified by conducting on-site evaluations and project recommendations for each site were developed. These projects were assessed in order to determine watershed management, restoration goals and priorities, and to identify projects that could be completed in a cost effective and timely basis. Acceptable landowner access agreement documents were then developed between the property owner and the SSCRCD, pursuant to grant and District requirements.

Key targets in determining project feasibility were to: 1) define specific projects where restoration design and plans met regulatory compliance, 2) identify projects that fit the cost parameters within the scale of available grant funding, 3) address sediment abatement for results in watershed enhancement, and 4) comply with CEQA, obtain any necessary regulatory permits, and perform work within grant timeline. Consultations were conducted with representatives from SFBRWQCB, CDFG, USACOE, and USFWS, in addition to Prunuske Chatham Inc., private environmental consultants.

Six individual project sites were initially identified and evaluated for restoration based on the recommended scope of work. Three of the six project sites were

determined to be categorically exempt, and were the focus of this project's funding.

Restoration designs and cost estimates for specific project sites were identified and developed. Established restoration techniques to develop specific project designs were utilized. Biological surveys were conducted, and agency consultations to discuss permits and procedures followed. Appropriate regulatory permits necessary to implement construction were then pursued. After initial consultations, site visits, and review of potentially significant impacts, all projects were determined categorically exempt and filed as such.

Management Measures Implemented

The larger goal of implemented management measures of this project were to conduct, achieve and complete activities identified in the Petaluma Watershed Enhancement Plan, including restoration of San Antonio Creek by reducing sedimentation and enhancement of riparian habitat. Expected near-term outcomes include enhanced in-stream and shaded riverine aquatic habitat from the revegetation of riparian corridors with native species, and a decrease in fine sediment deposition into the waterway as a result of the bank stabilization practices, and seasonal exclusionary cattle fencing.

Three project sites in the San Antonio Creek watershed were coded (for identification and privacy purposes) for evaluation, implementation and monitoring identification purposes (SA-L, SA-R, and SA-C). Maps of project locations are included in Appendix 2.3.1, Figures 1-3. Exclusionary fencing and revegetation restoration techniques were implemented on sites SA-L and SA-C. Landowners on Site SA-R requested only exclusionary fencing.

Project area SA-C: 7,500 lineal feet
Project area SA-R: 400 lineal feet
Project area SA-L: 200 lineal feet

A total of approx. 1.5 miles of fencing was installed. Total acreage of native plantings for restoration on 2 project sites was approximately 1.25 acres.

Project Performance

Consistent with the Project Assessment Evaluation Plan (PAEP), the project addressed reducing sediment deposition in San Antonio Creek by increasing riparian habitat in addition to increasing bank stabilization. Lengthening the riparian corridor and managing/restricting cattle access, results in improvements to both aquatic and riparian habitats. All three project sites, as implemented, were designed to meet the overall goals of sediment reduction.

Monitoring efforts to date are restricted to photo documentation of the implementation phase. Success or failure to produce the expected results is

impossible to document at this early stage. It can be assumed that the restriction of grazing animals that would normally enter waterways is an immediate sediment/nutrient reduction. However, it is not quantifiable at this time. In addition, all revegetation has only been accomplished within the late fall and winter of this reporting period and hence, percent of plant survivability remains uncertain. A major shortcoming is a long-term monitoring component was lacking in the current funding agreement. To more accurately assess the benefit, or success of these types of projects, intermittent monitoring would be essential to determine the value and level of success.

Lessons Learned

Several lessons have been learned as part of this consolidated grant process through Proposition 13.

- Effective use of funds:
  1) consolidated grants which subcontract with many parties require an inordinate amount of administrative and management time. A high percentage of the grant funds go to administration of funding rather than to on-the-ground improvements which actually meet the goals of the grant funds. No easy answer exists to improve the process. It seems that either the state manages the money and offers individual grants to a greater number of qualified recipients or, the alternative of consolidated grants process and pass on that administration to the grantee's fiscal agent.

  2) several of the participating landowners were keenly interested and willing to participate in restoration projects, however the costs to permit and construct were beyond the scope and scale of funding available in this grant. Many of these projects continue to be deemed high priority projects to reduce sedimentation and are documented to be significant sources of sediment. Considerable funding would be required to stabilize banks to reduce erosion with potential great water quality benefits. Unfortunately, the smaller amounts of funding restrict work to minor and lower cost techniques which contribute to achieving the goals but in a less significant way.

- Two simultaneous CEQA review processes (through local County and State Clearinghouse, as well as SWRCB in-house review) is duplicitous, costs money and time thereby lessens actual work time for on-the-ground water quality improvements. CEQA compliance is standard, required and SSCRCD takes compliance with CEQA & NEPA, and adherence to all permit regulations with strictness and seriousness.

- Public outreach has lasting and far-reaching benefits. Landowner involvement is key to "owning their own conservation efforts", seeking

advice and techniques, and taking long-term responsibility of their private property.

- Public and agency stakeholders contacted us throughout the grant period and were hungry for documents and data (PWEP and others) in web-based and electronic formats for variety of needs/purposes.

- Identified a need for mapping and GIS tools with watershed-level data to assist in regional assessments and project level documentation and tracking.

- Since the grant involved multiple agencies and multiple tasks in various North Bay watersheds, it did allow some communication and collaboration with participating entities.

Outreach

Education and outreach was a strong component of task performance for this project. Outreach was conducted in many forms and with many sectors of the public and stakeholders, including conferences, fairs, and events which featured landowners, policy makers, local community leaders, and in venues which were geared to local students. The messages and technical advice was geared to each audience and recipient as appropriate. For example, RCD disseminated their "*Creek Care Guide"*, demonstrated their watershed model to depict non and point-source pollution and to describe many processes, described the work of the District in planning and restoration project implementation, and represented the projects, the goals of the grant, and funding source availability to the community and stakeholders.

A significant portion of the outreach conducted as part of this grant was on-site, one-on-one advice and information exchange between the landowner, his/her agents, and RCD staff with technical expertise. This outreach was the hallmark of our efforts. Many months of dialogue and the first of the landowner meetings were used to identify potential issues, potential willing landowners, and help them identify areas for restoration. From this initial outreach and education effort, a prioritized list of restoration projects was identified and then evaluated to ultimately determine the few projects which were ultimately implemented based on appropriateness, eligibility, and available grant funding.

Several planting sessions were completed using student labor from the FARMS Leadership Program administered by the SSCRCD. The RCD was able to match some of the labor dollars to install plants incorporating an experiential, hands-on science based ecology program for high school students (FARMS). They learned that although approaches of this kind require a high level of coordination, both programs (the restoration grant and the high school education program) benefit and meet mutual goals. The high school students meet a mentor and see up-close-and-personal the stewardship of the land managing adult. Both the

landowner and the high school students see and feel the value of their tax dollars being leveraged and spent wisely. Assistance from their local Resource Conservation District is viewed as a win-win as we match landowners with funding sources and volunteers to meet conservation goals.

Agency consultation meetings were held regularly throughout the grant period. Since the writing of the proposal and contract, the San Francisco Bay Regional Water Quality Control Board has extended the date for the Petaluma River TMDL to 2019 and no significant dialog has ensued based on real work toward this process. RCD staff has investigated the existing TMDL process identified for listing of diazinon on Petaluma River with no resolution on its status with SFBRWQCB.

A *Half Century Report* (Appendix 2.3.3), thanking the community and highlighting the work of the District and willing landowners over fifty years was recently prepared and distributed watershed-wide as part of the District's outreach efforts. Interviews with landowners and input from watershed planning meetings was conducted to continually provide a dialogue for comment, information exchange, and to build trust between landowners and agency folks. Culmination of this grant does not terminate or put on hold the continued outreach to San Antonio area landowners. The draft enhancement plan will be distributed and continually updated to remain current and viable as the voice for future work. As stated below, the District will continue to be aggressive in its efforts to seek future funding to promote continued contributions to water quality improvement and land stewardship in the watersheds we serve.

Through our many landowner meetings we've garnered and piqued continued interest in working together, as the District serving as an advocate for the landowners. Through our work with the County of Sonoma GIS group, developing a watershed map, we will be able to share these maps as resources with landowners and to the local volunteer fire department to aid their ability to serve residents in many ways.

Project Funding

The projected costs of project were higher and initially proposed at $142,410. After review by grantor and/or fiscal agent, the funding for Task 2.3 was reduced to $112,130 which limited our scope and required revisions and scaling-back of proposed projects to match the available funding. The second phase of geomorphology study was initially proposed as part of the grant application and unfortunately this key baseline study was eliminated from the scope. This study is still considered vital to addressing the key information needs of the watershed in addressing issues, prioritizing projects, and in understanding the benefits/outcomes of restoration and bank stabilization projects.

In the 9th quarter, an additional $33,000 was awarded to SSCRCD to conduct additional same-scope tasks which helped to increase our ability to serve the community and extend and enhance existing restoration projects.

The overall project element was funded through state sources (CWA funds, through SWRCB) and our task was matched by local funding from the Sonoma County Water Agency (SCWA). Our reported match funding was $200,000, leveraged from the SCWA for a channel maintenance project to reduce erosion and improve habitat on the Denman Reach of the Petaluma River, being implemented during the same time frame as this grant. The RCD has other on-going related funding for channel maintenance and outreach and education in the Petaluma River Watershed, funded primarily by the Sonoma County Water Agency, the Center for Land Based Learning for the FARMS Leadership Program, and general funding from the SSCRCD.

As per the RCD's cooperative agreement with federal partner, USDA Natural Resources Conservation Service, the SSCRCD's projects and presence in the Petaluma River watershed has leveraged significant federal funding for several decades on soil and water conservation projects through the Environmental Quality Incentives Program, totaling over $13 million in the Sonoma Marin Dairy Belt.

The SSCRCD has aggressive plans to secure future funding from any available federal, state, and local fund. We work cooperatively with San Francisco Bay Joint Ventures, North Bay Watershed Association, and many other single agency or consortiums to this end. Providing technical assistance to landowners in our jurisdiction is 90% dependent on competitively sought grant funding. Achieving our mission is directly dependent on such funds.

Follow-up Activities

As stated above, to achieve water quality objectives requires not only implementation but follow-up, long-term monitoring and continued prevention, stabilization, and control of soil erosion. Bank stability and plant survivability monitoring should be considered as a follow-up activity.

The SSCRCD plans to aggressively seek funding to accomplish its goals and in carrying out the objectives in the Plan written for the San Antonio Creek watershed. Three baseline studies are needed to provide information to better prioritize and implement restoration projects, they include: second phase of the geomorphology study, hydrologic investigation and hydraulic modeling.

The SSCRCD plans to continue to hold landowner planning and outreach meetings to address key issues in the watershed. RCD will continue to seek funding based on the goals and objectives articulated in the Enhancement Plan and other plans which achieve our District's mission and adhere to state and federal conservation priorities. Specifically, the RCD plans to meet next with

landowners, inviting staff from CDFG, to hear about their on-going fish counts and proposed work in the watershed. The RCD will continue to represent and provide technical assistance to landowners in this watershed and cooperate fully with our partner, Marin RCD and other stakeholder agencies, to further water quality objectives in this watershed we share in both Counties.

The SSCRCD Board of Directors' primary goal is service to the community through continued education and outreach to and for the community. As such, one outcome from the grant outreach performed over the past couple of years is a plan for the SSCRCD to hold a "Petaluma River Conservation Forum" with stakeholders representing the Petaluma River Watershed. The Forum's goals are to: 1) network with stakeholders and bring increased familiarity of various groups, 2) find common missions and goals for future partnerships, strengthen on-going collaborations, 3) share available data and identify data gaps, and 4) position the partners in the watershed to seek funding and prioritize needs. SSCRCD is currently working with key stakeholders and sponsors in planning this one-day forum for spring 2008. Another goal of the forum gathering is to initiate an update of the PWEP, which will be almost a decade old and requires updating and landowner input to remain a vital and valuable planning and funding tool.

PROJECT ELEMENT FOUR:
REDWOOD CREEK WATERSHED SEDIMENT CONTROL ON MARIN MUNICIPAL WATER DISTRICT LANDS

The source of nonpoint pollution addressed by this project element is sediment from unpaved roads managed by Marin Municipal Water District. Studies have identified excessive fine sediment yield as an important factor limiting salmonids. Unpaved roads are often both a chronic source of fine sediment, through continual gullying or erosion, and a source of excessive sediment loading through episodic failures of entire sections of roads.

The project site is located in the upper portion of the Redwood Creek watershed on the south slope of Mt. Tamalpais, Marin County, California. The project is located entirely on MMWD-owned lands and as such, is publically accessible; the location is illustrated on the attached map.

Complete as built descriptions for each project element and specific measurables for the project, including type and number of actions and amount of sediment saved from entering the stream system, are detailed in the attached "Table 1 – Completed Work Summary," included in Appendix 2.4.3. A narrative describing project implementation is provided below.

Background
The goal of this project was to improve streambed quality in Redwood Creek and its tributaries for the benefit of native coho salmon and steelhead trout, by

reducing the load of fine sediments entering the creek through erosion. Redwood Creek is one of the more productive and restorable anadromous fish streams within Marin County, and is one of four major creeks in Marin County with remnant populations of both coho salmon and steelhead. The two most important elements needed for long term restoration of salmon habitat, and the eventual recovery of salmonid populations in the Redwood Creek watershed are the reduction of accelerated erosion and sediment delivery to the stream channel system, and improving estuarine rearing habitat. This project was designed to make a significant contribution toward the restoration of salmon habitat and the eventual recovery of salmonid populations in the Redwood Creek watershed by reducing road-related sediment delivery into the stream channel systems and thereby improving estuarine rearing habitat. Road sites treated in this project are expected, in total, to prevent 3991 cubic yards of sediment from being delivered to the Redwood Creek Drainage.

Project Planning and Design

The intent of the *Redwood Creek Watershed Sediment Control on Marin Municipal Water District Lands* project was to implement erosion control and erosion prevention treatments at high and high-moderate priority treatment sites located on MMWD property that collectively would reduce road-related sediment delivery into the Redwood Creek stream system by up to 4,000 cubic yards. Project sites were identified by Pacific Watershed Associates (PWA) in their 2002 assessment of Redwood Creek watershed sediment source sites. Because the project work area is located at the very top of the watershed, these repairs will reduce sediment delivery to the entire length of Redwood Creek.

Ten sites were originally included in the scope for this project; they are all stream crossings that required various repairs to reduce the severity and frequency of catastrophic inputs of sediment as well as reduce chronic inputs. These sites were the ten highest priority sites on MMWD lands identified in the 2002 PWA Redwood Creek watershed assessment. Treatment prescriptions were also identified in the assessment, and included installing larger culverts sized for 100-year events, installing culverts at the natural gradient to reduce likelihood of plugging and so that outflow will discharge on the natural channel bed, and the construction of critical dips to prevent the road from diverting stream flow if culverts fail. Chronic sediment delivery from road surface drainage to stream channels was to be addressed by constructing outsloping and rolling dips on sections of stream-connected roads. Site specific treatments for each of the ten project sites, consistent with Pacific Watershed Associate's prescriptions as described in the *Watershed Assessment and Erosion Prevention Planning Project for the Redwood Creek Watershed*, are as follows:

Site No. 40 Old Railroad Grade

1. Excavate top to bottom. Will involve removal of log retaining wall.
2. Install 42 inch CMP at natural grade, along CLP.
3. Install critical dip at right hinge line.
4. Install two rolling dips 480 feet of left road.

Site No. 41 Old Railroad Grade
1. Excavate crossing top to bottom.
2. Replace culvert with 42 inch at natural channel grade.
3. Install critical dip to right.
4. End-haul spoils to unknown site.

Site No. 52 West Point (Old Railroad Grade)
1. Excavate crossing top to bottom.
2. Install 60 inch CMP at natural channel gradient.
3. Install critical dip at left hinge line.

Site No. 50 West Point (Old Railroad Grade)
1. Excavate crossing top to base of culvert.
2. Replace culvert with 54 inch.
3. Install 30 foot, full round downspout.
4. Install three rolling dips to the right.

Site No. 56 Old Stage Road
1. Excavate crossing top to bottom.
2. Replace culvert with 48 inch at natural channel grade.
3. Install critical dip to right.
4. Install four rolling dips to left.
5. Import 27 cubic yards.

Site No. 57 Old Stage Road
1. Excavate crossing top to bottom.
2. Install 30 inch CMP at natural channel grade.
3. Install critical dip to right hinge.
4. Import 118 yards, replace retaining wall with 35 degree fillslope on backfill.

Site No. 58 Old Stage Road
1. Excavate crossing top to bottom.
2. Install 54 inch pipe at natural channel grade.
3. Install two rolling dips to 275 feet of right road.
4. Install one critical dip along right hinge.
5. Raise road one foot on backfill. Need 84 yards to rebuild.

Site No. 59 Old Stage Road
1. Excavate crossing top to bottom.
2. Replace culvert with 42 inch at channel grade.
3. Install critical dip to right.
4. Enhance existing outslope to left approach.
5. Install two rolling dips to left.
6. Clear/maintain IBD 30 feet left to capture springs.

Site No. 63 Old Stage Road
1. Excavate crossing top to bottom.
2. Replace culvert with a 60 inch at channel grade.
3. Maintain existing DRC's to left.
4. Outslope road with no IBD for 400 feet beyond second DRC.
5. Install one rolling dip to the left.
6. Outslope left road.

Site No. 66 Old Stage Road
1. Excavate top to bottom.
2. Install armored fill crossing.
3. Rock road surface 375 feet.
4. Rock fill face with 6 inch to one foot rip-rap.
5. Outslope with no ditch for 415 feet of left road

MMWD contracted with PWA in fall of 2005 for assistance in developing detailed cost figures and a scope of work for the road repair projects. By the end of the year, PWA had developed road logs for prescribed road treatments, and in early 2006, field layout of road upgrade and decommissioning treatments on all roads within the project area had been completed. In addition to the ten sites originally identified for inclusion in this project, six sites were subsequently added to the project scope (site numbers 37, 39, 42, 45, 61 & 62), so that a total of sixteen sites were included in the final work effort.

Site-specific problem statements, implementation tasks and net sediment savings for all project sites are summarized in the attached "Table 1 – Completed Work Summary" (see Appendix 2.4.3). The table lists all sites described above, plus the six sites that were added to the original project scope.

Project Implementation

In early 2006, MMWD contracted with Pacific Watershed Associates to scope the work effort and develop project detail, including completing preliminary and final design work and updating the original cost estimates. Over the next several months PWA staff conducted field layout of road upgrades to be implemented as part of this project, road logs and maps of the proposed upgrades were developed from the field work, and these were finalized and submitted to MMWD resource management staff. Preliminary design work for construction at road repair sites was then completed, and MMWD compiled construction bid documents, which were released in July of 2006. Unfortunately, only one bid for this construction contract was received, and was roughly four times higher than budget amount. This bid was rejected. The project had been scoped to include additional work areas, so in order to accomplish just the originally proposed tasks and keep the project within budget, MMWD decided to re-scope the project and postpone it until the following work season.

In early 2007, this project was scheduled for construction in the upcoming work season. In order to accomplish proposed tasks within budget and with the highest possible quality workmanship, the decision was made to construct the project using MMWD's Watershed Maintenance and Special Projects staff instead of putting the project out to bid again.

During spring of 2007, pre-project monitoring was conducted including photo-documentation, nesting bird surveys, frog surveys and plant surveys. Informational signs (24 x 36", mounted on plywood; see Appendix 2.4.3) were installed at numerous public access points. Construction materials were purchased and equipment was brought to project staging areas in preparation for construction activities, which began in the last week of June. For all sites requiring new culvert installations, high density polypropylene (HDPE) pipe was chosen as more cost-effective option than corrugated metal pipe (CMP).

Site treatments included installing larger culverts sized for 100-year events, installing culverts at the natural gradient to reduce likelihood of plugging and so that outflow will discharge on the natural channel bed, and the construction of critical dips to prevent the road from diverting stream flow if culverts fail. Chronic sediment delivery from road surface drainage to stream channels was eliminated by constructing outsloping and rolling dips on sections of stream-connected roads.

Construction activities on Old Stage Road sites occurred primarily in July and August 2007. The project work was complicated by the narrowness of Old Stage Road. There were very few turnarounds and no suitable locations for staging spoils, construction materials and equipment. Excavated material had to be trucked to a location next to West Point Inn where it remained until it was trucked back to refill upgraded crossings. Dump trucks had to back in to sites sometimes as much as ¼ to ½ mile. In addition, a fiber optic communication cable (FOC) is buried beneath the road surface and this required extremely careful excavations and redesign of culvert alignments. For example, in order to clear the buried FOC and ensure adequate road fill cover, Sites 58 and 63 required the use of slightly smaller culvert diameters and Sites 56, 58, 59 and 63 required the use of 22 degree elbows. All sites on Old Stage Road were successfully treated.
In addition, since these routes are major recreation routes and connected to nearby state and federal parks, access across construction sites was maintained after working hours and on weekends as much as possible. Access accommodations required significant site work at the beginning and end of each day. Also, keeping the public out of construction sites and informed of alternative routes and coordination with other stakeholders (e.g. West Point Inn, Marin County Fire Department, and Mt. Tamalpais State Park) required significant effort on the part of District staff.

Per PWA revised recommendation for Site 50 on Old Railroad Grade, the existing 48" CMP culvert was deemed sufficient if the existing 48" x 20' CMP

downspout was reconnected with a new 22 degree elbow. The approach to the stream crossing was outsloped. The other three sites on Old Railroad grade were completed per plan using HDPE culverts.

The additional six sites were on the same roads. Five were the next 5 highest priority sites on MMWD lands in Redwood Creek watershed (all moderate priority) and one was a moderate-low priority with a know history of chronic failure.

Site 39 was a new culvert installation. The culvert was downsized from specified size 30" diameter to 24" allow adequate cover. Fewer critical dips were constructed in order to reduce vegetation impacts. Site 42 was a road reshaping (outsloping with dips). More dips than specified were constructed in order to address a thru-cut. Site 45 was a ditch relief culvert replacement. Sites 61and 62 were shallow crossing with histories of chronic failures. We addressed 61 by constructing an armored crossing and 62 by replacing the undersized culvert. Site 37 was not completed because we were unable to start and complete this site before our seasonal completion date in November as specified in our DFG streambed alteration permit

Project Performance

The attached "Table 1 – Completed Work Summary," included in Appendix 2.4.3, lists all sites treated as part of this project. The table summarizes problems associated with each site, the originally recommended implementation tasks and departures from the originally planned treatment approach for each site. The table includes all sites addressed under this project, the ten sites originally identified for this work effort as well as the six sites that were added. The table lists estimated catastrophic sediment savings, chronic erosion savings and gross sediment savings for each site.

The intent of this project was to construct ten priority sediment reduction projects that collectively would reduce road-related sediment delivery into the Redwood Creek watershed by up to 4,000 cubic yards, as detailed in Table 1. At project completion, sediment reduction treatments were implemented at a total of 16 sites; total sediment savings resulting from this project is calculated to be 3,991 cubic yards. The effectiveness, and therefore expected benefits to anadromous salmonids, from the project is very high since the savings amounted to close to 100% of the expected savings.

District staff provided a pre-project site inspection on April 14th, 2005 which included grant project manager, Leslie Ferguson and other Regional Water Quality Control Board staff including Marla Lafer, Susan Gladstone, and Carmen Fewless.

A post project tour occurred on December 6th, 2007. This second tour was related permitting for similar work on MMWD lands in the Mill Valley watersheds

but visited Redwood Creek as representative completed work. Marla Lafer attended this tour which visited Redwood Creek sites on Old Railroad Grade and Old Stage Road.

Monitoring

The project erosion control improvements were monitored by MMWD staff during every significant storm during the winter of 2007-08, including the January 2008 storm. There was no evidence of stream flow in excess of culvert capacity and all culverts successfully passed woody debris, so none clogged. Most of the post construction photos included with this final report were taken on May 27, 2008. Since no post winter maintenance was conducted, these photos represent post January storm conditions (only with more vegetation evident).

Designs and Permits

PWA was hired to prepare treatment designs for this project, as well as to provide assistance in developing detailed cost figures and a scope of work for the road repair treatments. PWA developed road logs for prescribed road treatments, provided treatment designs, and conducted field layout of road upgrade and decommissioning treatments on all sites within the project area. Final treatment designs for project sites included improving road surface drainage by installing rolling dips; controlling road runoff through road shaping by outsloping the road; upgrading stream crossings by disconnecting road surface and ditch from stream, eliminating diversion potential; and installing 100-year culverts set at base of fill, culverts at stream crossings and ditch relief culverts; compacting of road surface; completely excavating fill, and using excavated spoil to outslope adjacent road. District staff made on-site modifications to PWA designs as documented above.

MMWD staff secured all the necessary permits for this project, including:

1. CA Regional Water Quality Control Board, S.F. Bay Region
   Water Quality Certification No. 2158.04 (mll) Site No. 02-21-C0537 dated December 13, 2005
2. US Army Corps of Engineers
   Nationwide Permits 3 and 27, File No. 28656N, dated July 20, 2006
3. CA Department of Fish and Game
   Streambed Alteration Notification No. 1600-2005-0033-03, dated April 18, 2005
4. NOAA Fisheries
   Letter of Concurrence No. 151422SWR05SR00205, dated April 18, 2005
5. US Fish and Wildlife Service
   Letter of Concurrence No. 1-1-05-I-2129, dated July 12, 2005

Lessons Learned
The take away lessons from this project include:

- We were impressed by the level of effort that many members of the public exerted in order to pass through areas we had closed during construction hours (Monday-Friday, 7-3:30). The project was designed to open construction sites after work hours and on weekends to allow public access for hikers, cyclists, and equestrians. Construction areas were closed during working hours for safety. Some hardy hikers and bikers pushed past a couple rows of exclusion fencing and 3-4 "area closed" signs. We were prepared for such occurrences, but marveled at the ability of people to somehow forget what they had passed by the time they reached the work site.

- This project contained many particular challenges: public lands with dedicated visitors (see above), very narrow roads, few locations for staging material and equipment, fiber optic cables that necessitated reconfiguring designs, very rocky substrate, and limited nearby water sources. All of these problems were foreseen except for the exact location of the fiber optics cable. Our project manager did an excellent job of planning for these challenges, which drives home the value of thinking the project all the way through and making contingency plans.

Project Funding
The table below lists totals for each fund source expended to complete the project, with breakdown as to grant dollars and other funding including in-kind services:

Souce of Funding	Amount of Funding	Nature of Funding
Fisheries Restoration Grant Program	$84,516.52	Grant dollars
SWRCB Proposition 13 Grant	$125,850.00	Grant dollars
MMWD	$58,828.45	Dollars and in-kind services
Total Project Costs:	**$269,194.97**	

PROJECT ELEMENT FIVE:
EROSION INVENTORY AND SEDIMENT CONTROL RECOMMENDATIONS FOR JACK LONDON STATE HISTORIC PARK WATERSHED

Background and Project Planning
The project purpose was to identify, characterize, and quantify sediment sources (e.g. roads, upland sources, water system features) most likely to impact fish-bearing streams if left untreated. The scope included assessing historical and current stream conditions, including areas of controllable channel erosion, and opportunities for cost-effective erosion prevention. Goals were to develop a prioritized action plan for erosion control and prevention for correctable or preventable sources of stream sediment that is now able to be implemented under separate funding. A combination of field techniques and GIS technology was used to produce the maps and queries included with this effort.

Activities were to develop a memorandum (included with action plan in Appendix 2.5.1) that prescribes site-specific treatments for active and abandoned roads and utility routes. A project partner, working under match funding, was California Department of Parks and Recreation.

Project Implementation
Management practices are described in detail in the report included in the appendix: *Inventory of Erosion Sites: Memorandum and Action Plan. Jack London State Historic Park Watershed. Sonoma Valley, California*. The work took place on a large area of dirt roads and trails in Jack London State Historic Park; a map of the area is included in Appendix 2.5.2.

Project Performance
All performance measures have been met. Specifically, the following were accomplished:

- Inventoried 100% of roads and trails in JLSHP using GIS and photo monitoring at GPS locations at all stream crossings and switchbacks. Results of the monitoring are included in the report, *Inventory of Erosion Sites* (Appendix 2.5.1).
- Maximized reduction of sediment delivery to “good” quality pools by using query based on fish habitat survey data in the action plan included with this report.
- Identified the top priority 10 treatments using DFG protocols for cubic foot savings of sediment in the action plan included with this report.

In addition, at least two current partnerships, funded through SWRCB and the California Coastal Conservancy, have been initiated between Sonoma Ecology Center and DPR to remediate the sediment sources identified using this funding. Implementation of best management practices begins in summer 2008.

Lessons Learned
The methods used in this task were successful. Sonoma Ecology Center recommends the use of photo monitoring protocols as outlined by the State Water Resources Control Board Clean Water Team in all road remediation projects. These protocols coupled with a strong knowledge of GIS/GPS technology are key to successful monitoring that can also be accessed by other groups needing the information. The project monitoring points, coupled with Sonoma Ecology Center's database of baseline data for the park, prove valuable time and again for others needing briefing on spatial relationships within the natural resource.

A lesson learned: the pools found by queries to be good fish-bearing pools were later partially in-filled with sediment in the New Years storm of 2005-2006. Major storms change pool depths overnight. Queries need to be run periodically, perhaps twice a year or quarterly, for the data to be of value to those seeking fish habitat information.

Outreach Conducted
Two public meetings were conducted under separate funding. A sediment-focused steering committee for the TMDL has met monthly. Public meetings will continue under California Coastal Conservancy funding and SWRCB Consolidated Grant work with State Parks.

Project Funding
Project funding for this task was $83,020. Sonoma Ecology Center matched it more than 2:1 with partial funding from Proposition 13 work ($40,000) focused on the Sediment Source Analysis for the sediment TMDL.

Follow-up Activities
Follow-up activities currently underway in JLSHP include two projects funded under separate contracts: (1) A State Coastal Conservancy grant was awarded to the Sonoma Ecology Center and State Parks in 2006 that will restore the headwaters of Mill Creek at Coon Trap, one of the hotspots identified with Consolidated Grant funding. (2) A State Water Resources Control Board Taking Action for Clean Water grant under Proposition 50 was awarded to Sonoma Ecology Center and State Parks in 2007 to rehabilitate portions of Coon Trap Road and Trail above the Mill Creek headwaters. These two contracts amounted to a combined total of $543,707: $173,707 for the Mill Creek headwaters and $370,000 for Upper Coon Trap Road and Trail. Both seek to achieve the sediment reduction objectives posed in the Sonoma Creek TMDL, in process.

PROJECT ELEMENT SIX:
WATERSHED STEWARDSHIP ASSISTANCE FOR LANDOWNERS

Background and Project Planning

The project purpose was to provide initial assistance and guidance to private landowners to allow them to implement appropriate BMPs and land management practices. The Sonoma Ecology Center assisted landowners regarding the appropriate species, planting techniques, and benefits of planting with native plants, as well as available BMPs to prevent erosion, enhance infiltration, improve riparian and aquatic habitat values, and in the process beautify their property. Other BMPs promoted included invasive weed removal, riparian revegetation, instream habitat enhancement, slope plantings to reduce erosion, removing fences that block salmonid passage, vegetation and stability, ephemeral or artificial channels that carry runoff to streams, stormwater dispersal structure, and bioretention areas. Assistance included referrals, conceptual drawings, information gathering, written assessment, and recommendations.

Two debris jams formed in the course of the 2005-2006 New Year's flood. They were determined by the Sonoma Ecology Center and the California Department of Fish and Game to warrant trash removal and large woody debris relocation given the risk of bank failure in subsequent flows, should the jams stay in place. Both jams contained woody pieces that fully spanned the channel: for upper Kenwood channel width with approximately 25 feet, as opposed to a 50 foot width at the Glen Ellen site. The Glen Ellen jam at Yell Lane required treatment using a crane and winch operated from Arnold drive. The upper Kenwood jam was cleared via hands tools in a stewardship group cleanup. Both projects were completed as a result of the newly formed Sonoma Valley Stream Stewards network in coordination with the California Department of Fish and Game

Project Implementation

Please see Appendix section 2.6 for documents reporting on the BMPs implemented under this task. *Landowner Database Guide* details the locations of each project, what was implemented, and the outputs of each implementation. Appendix 2.6.3 includes more in-depth information about several of the implementations, including planting plans and streambank stabilization details. Locations included:

- 1001 5th Street West, Sonoma, CA 95476
- 210 Tuscany Place, Sonoma, CA 95476
- 19275 Sonoma Highway, Sonoma, CA 95476
- 13340 Arnold Drive, Glen Ellen, CA 95442
- 4271 Lakeside Drive, Glen Ellen, CA 95442
- 1264 Hill Road, Glen Ellen, Calif. 95442
- 18070 Carriger Road Sonoma, California 95476
- Sonoma Creek adjacent to Yell Lane, Glen Ellen, approximately 1/4 mile downstream of the downtown Glen Ellen Bridge.

- Sonoma Creek approximately 400-500 feet downstream of the Highway 12 bridge north of Kenwood, between parcels 050-150-008 and 050-060-070
- 2555 Warm Springs Road, Kenwood, CA 95452

Project Performance
All performance measures have been met. Sonoma Ecology Center assisted more than 45 landowners on erosion and sediment reduction through 145 site visits as shown in the landowner log. Sonoma Ecology Center helped 10 landowners within the Sonoma Creek Watershed implement BMPs by removing invasive, non-native species and planting natives and removing debris jams. Please see Appendix 2.6.3, Best Management Practices Implementation Report for full details and photo documentation.

Lessons Learned
The methods used in this task were successful. This project pioneered an approach that Sonoma Ecology Center has found successful, to use public monies for outreach and education to landowners, and then wherever possible to use private funds from the landowner for implementation. Sonoma Ecology Center found that working with landowners' own crew was a good solution to long-term maintenance of the project site. Because often there is no funding to complete follow-up maintenance and monitoring, training the landowner or landowner personnel was very important to ensure the success of project sites. Landowners with bank stability issues seemed pleased to have a lower cost solution using biotechnical bank stabilization solutions as opposed to rock work solutions.

Outreach Conducted
Sonoma Ecology Center conducted outreach to landowners regarding the implementation of BMPs through Creek Salons as described in Appendix 2.7.1. Sonoma Ecology Center developed and distributed a "Stream Stewards" binder (previously submitted in hard copy). Sonoma Ecology Center conducts site visits and assessment for all interested landowners, providing them with appropriate plant lists and a description of the vegetation management and bank stabilization services, and any other pertinent information. A database was developed to track the history of outreach to streamside landowners, often over several years. With other funding, Sonoma Ecology Center hired a full-time stewardship coordinator to continue outreach and education to the community about BMPs.

Project Funding
Project funding for this task was $22,640. Sonoma Ecology Center matched it with $143,069 in funding from several other sources, including California Department of Fish & Game, Department of Conservation, US Fish & Wildlife Service, private foundations, and landowner contributions.

Follow-up Activities

Sonoma Ecology Center is continuing outreach and assistance to additional landowners, and conducting site assessments and assistance to implement BMPs to interested landowners. As of January 2008, site assessments and assistance in implementing BMPs has been conducted at over 20 additional sites. Sonoma Ecology Center are also continuing with monitoring and maintenance at most of the project sites.

PROJECT ELEMENT SEVEN: SONOMA CREEK CHANNEL REACH REHABILITATION TO SUPPORT TMDL IMPLEMENTATION

Background and Project Planning

The project purpose was to produce a conceptual channel rehabilitation plan and stakeholder buy-in, laying the groundwork for implementation phases of the Sonoma Creek sediment TMDL. Over 50 homeowners along the Kenwood to Glen Ellen stretch have expressed interest in riparian habitat restoration work. Site visits were performed and advice given for stabilizing banks, planting native vegetation, and improving habitat. Regular stewardship meetings with volunteer leaders were held in private homes and public halls. Sonoma Ecology Center began development of a stewardship web site and updated their landowner contact database.

Project Implementation

The project encompasses the entire reach of Sonoma Creek between the unincorporated towns of Kenwood and Glen Ellen. Appendix 2.7.1 includes a description of locations and implementation measures in *Sonoma Creek, Glen Ellen to Kenwood Reach. A Community-based Conceptual Management Plan*.

Project Performance

All performance measures have been met. Sonoma Ecology Center selected the 7.5 mile Glen Ellen to Kenwood Reach as the project site because it retains some of the highest value freshwater habitat remaining in the San Francisco Bay estuary for native fish and wildlife. Sonoma Ecology Center conducted 10 “salons” in neighborhoods in the project reach between August 2006 and March of 2007. Over 50 support letters from landowners were received, regarding implementing restoration projects on their sites, as well as a DFG letter supporting Sonoma Ecology Center work in the Glen Ellen to Kenwood Reach. Sonoma Ecology Center also received over 200 access agreements from participating landowners in order to implement the stream survey. Sonoma Ecology Center completed and submitted a conceptual design/plan which describes all aspects of the project in more detail, called *Sonoma Creek, Glen Ellen to Kenwood Reach. A Community-based Conceptual Management Plan*.

Lessons Learned
The methods used in this task were successful. Particularly, structuring the landowner outreach by street or neighborhood was well-received, as was the approach of listening to landowner desires and concerns more than telling them Sonoma Ecology Center's concerns. Stream steward leaders are particularly happy to have a designated stewardship coordinator joining Sonoma Ecology Center full time to help organize meetings, fundraisers, creek walks, public forums, a web site, and other community building activities. Sonoma Ecology Center had some trouble receiving access from all landowners within the survey reach, but we were successful in receiving access from at least one landowner from either side of the creek. This allowed completion of surveys on all 7.5 miles of stream.

Outreach Conducted
Much of the project was outreach, to landowners, regulators, and the restoration community. The project is ongoing, as is landowner outreach. Sonoma Ecology Center is contacting landowners who attended creek salons to follow up on their expressed wishes for enhancement work on their properties. Outreach continues as word spreads that the stewardship coordinator at Sonoma Ecology Center will work as a conduit between homeowners, businesses, agencies and grant funders to communicate needs and objectives with a cohesive positive approach.

Project Funding
Project funding for this task was $40,970. Sonoma Ecology Center matched it with $23,882 in funding from several other sources. Implementation funding is being sought.

Follow-up Activities
The project, when implemented, will be part of TMDL implementation. Sonoma Ecology Center is fund-raising to implement the plan, and continuing to build the stewardship groups' capacity via meetings, communications portals online, technical assistance, and referrals.

PROJECT ELEMENT EIGHT: SONOMA CREEK WATER QUALITY MONITORING: SUSPENDED SEDIMENT, BMI, AND SUMMER STREAM FLOW

Background and Project Planning
The project purpose was to monitor water quality in Sonoma Creek and major tributaries. The scope included collecting a variety of surface water data under an approved QAPP and monitoring plan, work with landowners for access to important data collection locations, and analyze and report on data to the extent funding allowed. Scope, goals, activities, and techniques are described in the individual subtask reports that follow. Sonoma Ecology Center partnered with California Department of Parks and Recreation, Napa and Southern Sonoma County RCDs, and California Department of Fish and Game.

Project Implementation

Conduct Suspended Sediment Monitoring

Suspended sediment concentration (SSC in milligrams per liter [mg/L]) and stream flow (Q in cubic feet per second [cfs]) were measured during wet storms in the Sonoma Creek watershed. The objective was calculating stream sediment loads as part of the sediment source analysis (SSA) for the Sonoma Creek sediment TMDL (total maximum daily load). Data from HY 2006, which included the highest stream flows on record for Sonoma Creek, are included for comparison and analysis.

Under this task, Sonoma Ecology Center implemented a program of grab sampling and data analysis for Sonoma Creek and tributaries. The sampling design and data collection strategy are explained in the Quality Assurance Project Plan (QAPP) prepared with technical assistance from State Water Resources Control Board (SWRCB) and California Regional Water Quality Control Board (RWQCB). The QAPP was appended to the Final Report of Volunteer Monitoring of Suspended Sediment Concentration and Turbidity prepared for California Regional Water Control Board, San Francisco Bay Region (SEC, 2002). Grab sampling was done during and directly following wet storms that produced stream sediment of 27 mg/L or more at Station A (STA, River Station 10.4+290), Sonoma Ecology Center's continuous stream monitoring station in Eldridge, California.

Sampling conducted in series at the 11 stations consisted of the simultaneous filling of one 15-mL turbidity cell and one 500-mL SSC sample bottle with stream water. SSC sample bottles were delivered under chain-of-custody protocols to the MUD Laboratory at the Sonoma Valley Watershed Station, Eldridge, California. Methods used for analyzing the SSC grab samples derive in part from the Redwood Sciences Laboratory Standard Operating Procedures for SSC Determination and from Standard Methods (2540B—Total Solids Dried at 103 to 105 degrees Celsius [C]). For more information about laboratory methods used, see the QAPP prepared for this study. The map presented in Appendix 2.8.1 shows monitoring locations.

Data were analyzed as part of the Final Sediment Source Analysis for Sonoma Creek Watershed, California, completed in support of Sonoma Creek's sediment TMDL. Nine of 11 sampling locations were chosen for data analysis for the following reasons:

(1) Accessibility and therefore ability to acquire large datasets.
(2) Representation of a variety of ecological conditions in Sonoma Creek watershed both across the valley - east to west, and along the valley - north to south.
(3) Inclusion of mostly tributary and one main stem Sonoma Creek location at SCG, the USGS gauge.

Conduct BMI Monitoring

In 2000, the Sonoma Ecology Center initiated a program to assess the biological and physical/habitat condition of various main stem and tributary streams within the Sonoma Creek watershed.

The objectives of the program were to:

(1) Provide baseline information on the macroinvertebrate assemblages within the Sonoma Creek watershed
(2) Evaluate the physical/habitat condition and the biological integrity using the Northern California IBI at sampling sites
(3) Provide recommendations and strategies for future monitoring.

Eleven monitoring stations were established and sampled during one, two, or three consecutive years following the standardized protocol, California Stream Bioassessment Procedure (Harrington, 1996), recommended by the California Department of Fish and Game (DFG). In April 2006, Sonoma Ecology Center again sampled the eleven original sites, along with three additional sites using an updated DFG protocol (Aquatic Bioassessment Laboratory, 2006). Jessie Olson of Sonoma Ecology Center was trained in the physical habitat portion (P-Hab) of the new sampling method by Jim Harrington from DFG in June 2006. After receiving training on the new protocol, the P-Hab portion of the assessment was conducted in July through October 2006.

The BMI samples collected in 2000 through 2006 were processed by SLSI in Chico, California and reported back as a stand-alone taxonomic list, and calculated and summarized aquatic macroinvertebrate community based metric values. An overall site score is calculated as the sum of individual metric scores. Sites are then ranked according to their scores and classified into groups with "good," "fair," and "poor" water quality. This system of scoring and ranking sites is referred to as an Index of Biotic Integrity (IBI) and is the end point of a multi-metric analytical approach recommended by the EPA for development of biocriteria (Davis and Simons, 1995). The original IBI was created for assessment of fish communities (Karr, 1981), but was subsequently adapted for BMI communities (Kerans and Karr, 1994). The first demonstration of a California regional IBI was applied to the Russian River watershed in 1999 (Harrington, 1999). The IBI for northern California (Rehn and Ode, 2006) is currently in draft form.

Please see Appendix 2.8.4 for sampling locations.

Base Flow Monitoring and Data Integration of Low Flow Data for Sonoma Creek Watershed

The purpose of this project element was to monitor summer low flow conditions recording the expansion in dry creek length over time in Sonoma Valley and create an all-inclusive low flow database.

Activities included monitoring the change of conditions from just after the last spring rains to just prior to the beginning of fall and winter rains at various locations previously established by Sonoma Ecology Center. Sonoma Ecology Center created a database in MS Access and incorporated previously collected base flow with current low flow data. The data is summarized in Appendix 2.8.7.

Sonoma Ecology Center began monitoring flow conditions in the beginning of April. Sites will use a 3 letter code that corresponds to that location. Photos, a waypoint, and water temp will also be taken at the site. Measured flow was done using the FLO-MATE flow meter as specified in the user manual until flows are insufficient for meter to be accurate. Once flows drop below that variable threshold, the bucket method was used where water is captured in a bucket in 3 successive trials then the results are averaged. A board was sometimes necessary to direct flow to the bucket. Flow reading was correlated to the nearest 15 minute interval that coincides with the USGS gauge # 11458500 on Sonoma Creek at Agua Caliente road. Waypoints indicating beginning and ending of the dry reaches were converted to their respective latitudes and longitudes. Data was entered into an existing Access data base and stored for future analysis. If these sites, or other sites of relevance, began to have subsurface flow, measurements were taken around the first sign of such flow with a late summer early fall follow-up visit to measure the extent of expansion of the dry on those creeks using a hand held Garmin device to take waypoints. Maps were generated by Sonoma Ecology Center to one, measure the extent of drying, two, mark the locations of metering locations. Time and funding permitting, Sonoma Ecology Center analyzed the relationship between rainfall and low flow conditions.

Low flow measurements were taken at the following locations, taking the driving route described:

Upper Watershed

Low-Flow Site #1: **Sonoma Creek @ Station A**. Automated GAUGE SITE across the Creek from the SEC Watershed Station.

Low-Flow Site #2: Asbury Creek @ Jack London Village. Head west on Harney to Arnold drive. Make right on Arnold. Head north for about 1.75 miles to Jack London Village, park in Village parking lot (it is on your right) but avoid prime parking those locations are for customers. Sampling is done in the culvert outlet.

Low-Flow Site #3: Graham Creek @ Emery Property. Leaving Asbury, turn right on Arnold drive. Continue through Glenn Ellen to Warmsprings road. Make a left on Warmsprings, head west to Sonoma Mountain road. Make a left on Sonoma Mountain. Follow So. Mt. road to the Emery gravel driveway (it will be on your left) about .9 miles up from the intersection of Warmsprings and Sonoma Mountain roads. Follow gravel drive until to the 1st driveway on your right, turn around and park at pullout then walk down to restoration site to sample.

Low-Flow Site #4: Sonoma Creek @ 986 Warmsprings road. Head back to Warmsprings road from the Emery property. Make a left on Warmsprings road. Follow Warmsprings road to 986 Warmsprings road. This is a several minute drive (maybe 5-10 minutes). The mailbox for 986 will be on your right and is about ½ way between Bennet Valley road and Hwy 12 on Warmsprings road and is east of Lawndale road. Don't block drives or the mailboxes; sample just downstream of restoration site 4a at the riffle's start.

Low-Flow Site #5: Sonoma Creek @ Sugarloaf State Park. Head east on Warmsprings road from 986. Follow road to hwy 12. Make a left at the lights at the end of Warmsprngs road and highway 12. Head north on 12 to Adobe Canyon road, turn right. Follow Adobe Canyon to the park's entrance (this is not the paying kiosk but at the base of the mountains just east of where the sign is at the 1st and lowest parking lot (currently unpaved). Park in this lot and sample at Goodspeed Bridge on its upstream side; total drive is 4 miles to SCS's parking/sampling site from the 986 address.

Low-Flow Site #6: Sonoma Creek @ Highway 12. Turn back down Adobe Canyon road to hwy 12. make a right. Stop at the drive just prior to the Xing of the road and Sonoma creek, but please no blocking mailboxes or access to the drive; total miles from SCS to SCH is 2.5 miles to parking. Walk to bridge on upstream side. Walk under hwy 12 bridge sample at staff plate.

Low-Flow Site #7: **Calabazas Creek @ Dunbar road**. Turn around and head south on Highway 12 past Kenwood and over the hill on the south end of Kenwood. Look for Dunbar road on your right (Dunbar is 2.9 miles from SCH). Veer right on Dunbar road; follow Dunbar past the school. Find parking south of Calabazas creek and Dunbar road crossing (0.9 miles from hwy 12). Sample at the culvert's staff plate enter sampling site on the LB downstream side of bridge.

Low-Flow Site #8: Stuart Creek @ Arnold drive. Continue down Dunbar road to Arnold drive; make a right on Arnold, sample site is at first bridge you'll come to and is a 2.1 mile drive from CCD. Parking will be on your left just past the Stuart Creek Bridge. Sample at the upstream side of the bridge where the concrete is notched where the flow enters an anthropogenic run, or any useable place along that run.

Lower Watershed

Low-Flow Site #9: Sonoma Creek @ the USGS gauge on Agua Caliente road. From the Watershed station, head west on Harney; make a left on Arnold drive and follow southbound to Agua Caliente road. Make a left on Agua Caliente. On your left near the bridge is a church, parking is southeast portion of church's parking lot near Sonoma creek and Agua Caliente's bridge. This site may be use for calibration purposes funding permitting; otherwise, data can be obtained from USGS's website.

Low-Flow Site #10: Sonoma Creek @ Larson Park. Continue east on Agua Caliente to hwy 12 from the USGS site. Make a right on hwy 12 and head south to Lichtenberg Ave (if you cross Boyes Blvd., you've gone too far). Make a right on Lichtenberg then right on Dechene Ave. Look to your right for semi-hidden road/drive named Larson Park, turn right on that road and you'll enter the park's

parking lot; park near creek and sample @ the dam. (The DF&G may be altering the structure in the near future so it may not stay the same).
Low-Flow Site #11: Carriger Creek at Marilyn Goode's Property. Drive back to 12 from the Larson Park location. Turn right on 12 then make a right on Boyes Blvd. Head west to Arnold drive. Make a left on Arnold south to Grove St. Head west on Grove to Marilyn's property pass Westerbeke Ranch (which is on the right), turn into property on left side, near fence with sign saying to something about WAR. Park in the Preserve's parking lot. Walk a short distance west down dirt road to sampling site.
Low-Flow Site #12: Rodgers Creek at Via Colombard. Head back to Arnold Drive, turn left on Arnold. Follow Arnold to Mission (Temelec sign), make a right. Turn left on Via Colombard, past Zinnia Ct., park at concrete bridge; this is the 1st Colombard/Rogers creek Xing; sample on the upstream side. 5 miles from CCM
Low-Flow Site #13: Nathanson Creek @ Nature Preserve. Return to Arnold drive, turn left on Arnold then make a right on Leveroni. Follow Leveroni rd across the Broadway intersection, the road changes names here but not direction of travel (stay heading east) Make a left on Larkin, then another left on Fine Avenue; park near the park. Walk across both foot bridges and turn left downstream to large multi-trunk Eucalyptus; step down to creek and sample.

Project Performance

Conduct Suspended Sediment Monitoring

Eleven stations were monitored, exceeding the target of five. Changes in suspended sediment concentrations were not observed over the grant period, nor over the period of 5 years Sonoma Ecology Center has been monitoring. Generally, streams draining the west slope of Sonoma Mountain pass over more erosive substrate and exhibit higher sediment loads, but there are substantial variations even within subregions of the watershed. All variations in suspended sediment concentration among streams were swamped by the effects of the 12/31/05 storm, which by far exceeded the sediment mobilization of multiple years previous.

Conduct BMI Monitoring

The 2006 biological metrics or IBI indicate that five of the monitoring sites are in good condition, six are in fair condition, one is in poor condition, and one is in very poor condition. See Appendix 2.8.6 for metrics at each site.

The physical habitat quality was also ranked (Appendix 2.8.8.)

In general, the sites in the upper watershed (north of Eldridge) scored higher for biological and physical metrics than those in the lower watershed. Upper watershed sites that scored high include Calabazas Creek, Graham Creek, Sonoma Creek in Glen Ellen, Sonoma Creek at Kenwood, and Stuart Creek. Of those sites, all but Sonoma Creek at Warm Springs Road (SCW) were considered suboptimal in terms of physical habitat condition. SCW was rated one category lower, marginal condition. Sites in the upper watershed that were

scored as fair in biological metrics included our farthest upstream site, Sonoma Creek at Sugarloaf Ridge State Park, as well as Sonoma Creek in Eldridge, Asbury Creek in Glen Ellen, and Mill Creek in Eldridge. Physical habitat scorings were suboptimal for the Sonoma Creek sites and marginal for Asbury and Mill Creeks. Lower watershed sites Nathanson Creek and Fryer Creek were scored as poor and very poor, respectively, while Sonoma Creek at Maxwell Park and Carriger Creek were scored as fair biological condition. Lower watershed sites were ranked as marginal in physical habitat with the exception of Carriger Creek and Sonoma Creek at Maxwell Park, which were scored as suboptimal.

Integrating and comparing 2006 results with results from 2000 through 2003 is not possible at this point. Because the new sampling method and the new IBI were used in 2006, the sample size and metrics differ from the earlier data.

Base Flow Monitoring and Data Integration of Low Flow Data for Sonoma Creek Watershed

All performance measures have been met. Using a hand-held digital flow-meter, Sonoma Ecology Center measured base flow on the main stem of Sonoma Creek and 7 tributaries. Environmental changes were not noted during the course of the project. There is not an observed change in baseline, beyond the observation that base flows are higher and decline more slowly to 0 feet per second in wet years. Base flows will continue to be monitored and the database will continually be updated

Lessons Learned

Conduct Suspended Sediment Monitoring

After several years of doing this monitoring activity prior to this grant, Sonoma Ecology Center felt they had worked out the best method before the grant began, and would not now alter it. They would have more confidence in the data if they could establish accessible sampling locations nearer to some tributaries' confluence with Sonoma Creek; if they had more sampling events overall; and if they had more data from the east side of the watershed. Overall, however, grab sampling provided an irreplaceable real-world check on the modeling and other analysis used in the Sediment Source Analysis.

Conduct BMI Monitoring

Integrating data collected in 2000 through 2003 with data from 2006 has been a challenge. Because of the new sampling method and the new IBI used in 2006, the sample size and metrics differ from the 2000 through 2002 data. Sonoma Ecology Center recently learned that they can run a Monte Carlo procedure on the 2000 through 2003 data to integrate and compare these data with 2006 data. They are currently waiting on the California Department of Fish and Game taxonomists to complete this statistical procedure.

Base Flow Monitoring and Data Integration of Low Flow Data for Sonoma Creek Watershed

The methods used in this task were successful. Sonoma Ecology Center simultaneously collected a database of rainfall using a network of volunteer monitors; attempts to relate their daily collected data to creek flows indicated daily readings do not comprise a fine enough dataset for peak hydrograph interpretation. Daily readings spread throughout the watershed do give information on rainfall spatial variability, which then may relate back to summer flows in specific sub-basins. More work needs to be done in this area, and more gauge acquisition for continuous readings throughout the valley.

Another successful aspect of this project was to measure the extent of dry stream reaches at the beginning and end of the non-rainy season. This approach has yielded specific information about the extent of dry reaches that act as barriers to fish mobility and ability to feed in important steelhead sub-basins. Sonoma Ecology Center highly recommends any group working on low flow projects follow a protocol of not only measuring flow at set locations throughout the dry season but also of (1) studying the USGS record on the nearest stream to identify the calendar date streams begin to fall to baseline flow levels, (2) when dry reaches first become evident on falling streams, using GPS to mark their farthest upstream and downstream points on a select group of streams suitable for nursery habitat, and (3) before cooler weather returns and base flow begins to rise, mark the farthest upstream and downstream points again. The elongation of these dry reaches over time, combined with flow information taken throughout the dry season, provides an understanding of not only base flow but how it relates to in-stream conditions.

Outreach Conducted

Conduct Suspended Sediment Monitoring

Using other funding, many presentations were made using this data, as part of the vetting process for the Sediment Source Analysis. Audiences included the Sonoma Creek Watershed Conservancy (primarily agricultural stakeholders), the general public, RWQCB staff, and RWQCB board. While Sonoma Ecology Center will continue to research sediment pollution levels in the future, the data-collecting phase of the sediment TMDL is over.

Conduct BMI Monitoring

Access to sampling sites was previously acquired; thus, no outreach took place.

Base Flow Monitoring and Data Integration of Low Flow Data for Sonoma Creek Watershed

Low-flow monitoring in part supported by this grant has been a topic of discussion in public meetings that include weighing limiting factors. Sonoma Ecology Center will continue to make these results available in Sonoma Ecology Center-led meetings supported by the current SWRCB Prop 50 project, Community-Based Watershed Management: Sonoma Creek Watershed.

Project Funding

Conduct Suspended Sediment Monitoring

This subtask's budget was $54,677. This amount was more than matched by funding from San Francisco Foundation, California Department of Fish and Game, Pacific State Marine Fisheries Commission, California Department of Parks and Recreation, Sonoma Valley Vintners and Growers Alliance, and Sonoma Ecology Center. Sonoma Ecology Center intends to maintain a very-long-term dataset on stream sediment levels, so they plan to seek funding for it indefinitely. Currently, this monitoring is being done with funds from a SWRCB Prop 50 grant, Community-Based Watershed Management: Sonoma Creek Watershed.

Conduct BMI Monitoring

The project was funded by Task 2.8 of this Consolidated Grant, as well as by a San Francisco Foundation Bay Fund Grant received in 2005. The projected cost was $6,200 from the Consolidated Grant and $3,000 from the SFF Bay Fund Grant. The actual amount spent on BMI was $6,000 from the Consolidated Grant. Match funds from the SFF Bay Fund Grant account for approximately $8,400. Currently we are planning to sample thirteen sites this spring using additional funds from the SFF Bay Fund Grant. In addition, Sonoma Ecology Center hosted a BMI training with Jim Harrington from DFG which earned $6,000 used to pay for 2007 sampling.

Base Flow Monitoring and Data Integration of Low Flow Data for Sonoma Creek Watershed

This task was solely funded by the grant. Continuing work is funded by SWRCB Prop 50 project, Community-Based Watershed Management: Sonoma Creek Watershed, with a budget of $14,559 for this work.

Follow-up Activities

Conduct BMI Monitoring

Once the Monte Carlo procedure is run on previous data, integration and analysis of 2000 through 2003 data with 2006 data will need to occur. Sonoma Ecology Center expects BMI monitoring to be a long term method of tracking water quality and TMDL attainment.

Conduct Suspended Sediment Monitoring

Data and analysis from this task will be part of the content for the revised Sonoma Valley Watershed Enhancement Plan, now in process. The TMDL process is being built on this and related data, largely collected by Sonoma Ecology Center. Sonoma Ecology Center intends to maintain a very-long-term dataset on stream sediment levels, so this type of monitoring will continue as funding allows.

Base Flow Monitoring and Data Integration of Low Flow Data for Sonoma Creek Watershed

Follow-up activities will involve continued monitoring of summer low flow conditions and updating the newly created surface-water database. Results will be incorporated into reports and presentations for Community-Based Watershed Management: Sonoma Creek Watershed.

D. OVERALL PROJECT EVALUATION, PROJECT ASSESSMENT AND EVALUATION PLAN

Overall, this grant afforded the participating entities (Friends of Corte Madera Creek Watershed, the Friends of Novato Creek, the Southern Sonoma County Resource Conservation District, the Sonoma Ecology Center and Marin Municipal Water District) with a tremendous opportunity to fill key data gaps and complete projects that will reduce nonpoint source pollution and restore native fish and wildlife habitat throughout the project area watersheds. Further, many of the tasks completed under the grant complemented each other, allowing for the overall effort to become greater than the sum of its parts. The overall project included restoration and fish passage, watershed stewardship and partnership, and direct TMDL implementation. Individual project elements included on-the-ground construction and restoration work to improve water quality, decrease sediment input and enhance habitat for salmonids (San Anselmo Creek Park: Riprap Removal and Restoration, Petaluma Watershed Restoration and Outreach, Redwood Creek Watershed Sediment Control); monitoring in order to assess and compile baseline watershed conditions and evaluate project implementation success (Novato Creek Watershed Citizen's Water Quality Monitoring Program, Sonoma Creek Water Quality Monitoring: Suspended Sediment, Benthic Macroinvertebrates, and Summer Stream Flow); data manipulation in order to create a prioritized sediment source database (Erosion Inventory and Sediment Control Recommendations for Jack London State Historic Park Watershed); outreach and education in order to encourage implementation of BMP's and improve land management practices (Watershed Stewardship Assistance for Landowners); and activities in preparation for TMDL implementation (Channel Reach Rehabilitation to Support TMDL Implementation in Sonoma Creek).

The Project Assessment and Evaluation Plan (PAEP) was prepared by MMWD staff (Appendix 1.1). This plan outlines the watershed program requirements of the grant. It also identifies the goals and actions required by major grant tasks as well as how the effectiveness of these tasks will be evaluated after implementation.

E. PROJECT ADMINISTRATION AND PROJECT FUNDING

Project administration by MMWD staff proved to be very challenging at times due to the number of changes made over the course of the grant period including but not limited to contractual changes, grant management and staff changes, procedural changes, accounting complications and the general coordination of eight different projects with five different sub-grantees. Managing timing issues with regard to approval requirements, procedures and processes for each different type of project (i.e. QAPP, PAEP, MP, CEQA, etc…) only added to the frustration and confusion for each of the sub-grantees and the overall administration of the grant. It would be helpful in the future if grants were designed for like or similar projects to reduce the amount of complicating circumstances that arose with the administration of this grant.

MMWD staff administration included the preparation of all the items contained in both Appendices and the preparation and coordination of information contained in the Draft Final Report for the overall grant. To date, ten quarterly progress reports, one advance invoice and nine expenditure invoices and the grant summary form have been submitted to the State Water Resource Control Board.

The quarterly progress reports and invoices are dated April 19, July 20, and October 20, 2006; January 22, April 23 and July 24, 2007. Grant Progress Reports for submittal nine and ten are dated October 26, 2007 and January 30, 2008 corresponding invoices are dated April 18, May 5, 2008 respectively. The last two invoices were delayed due to confusion created by the recoupment procedures of the initial advance payment and the reallocation of funds between line items during the July 1 – September 30, 2007 reporting period. The final invoice has not yet been calculated or submitted as of the filing date of this report and is due by November 2008. To date SWRCB funding for project administration by MMWD staff totaled $42,344.85 plus $18,090.18 in matching funds by MMWD.

The Project Assessment and Evaluation Plan (PAEP), also prepared by MMWD staff, was submitted to the SWRCB (Item 1 of Appendix 1, Project Deliverables).

As of the last submitted Quarterly Progress Report #10 (covering the period September 30 – December 31, 2007), the Marin Municipal Water District expended grant funds totaling $626,863.30 with match funding and in-kind services totaling over $800,000.00.

Additional grant funding for this project was provided by the North Bay Watershed Association, California Department of Fish and Game, with matching funds from Marin Municipal Water District, Friends of Corte Madera Creek Watershed, Ross Valley Sanitation District, Marin County Stormwater Pollution Prevention Program, Town of San Anselmo, Marin Conservation Corps, Friends of Novato Creek, Southern Sonoma County Resource Conservation District, Sonoma Ecology Center and citizens volunteers from all project areas.

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APPENDICES

PROJECT DELIVERABLES

Grant Agreement No. 04-155-552-2
Consolidated Concept Proposal for Nonpoint Source Projects
Greater San Pablo Bay Area

Project Deliverables

Appendix 1

Item 1	Performance Measures
1.1	Performance Assessment and Evaluation Plan (PAEP)
Item 2	**Project Implementation**
2.1	**San Anselmo Creek Park: Riprap Removal and Restoration, Town of San Anselmo, Marin County**
2.1.1	Design Plan, As-built Drawings and Area Map
2.1.2	Photo Documentation
2.2	**Novato Creek Watershed Citizen's Water Quality Monitoring Program**
2.2.1	Citizen Outreach
2.2.2	List of Participants
2.2.3	Report: Friends of Novato Creek ~ Citizens Water Quality Monitoring and Bioassessment in Novato Creek Watershed 2007
2.2.4	Appendices to Friends of Novato Creek ~ Citizens Water Quality Monitoring and Bioassessment in Novato Creek Watershed 2007
	Appendix A - General
	Appendix B - Benthic Macro-Invertebrates (BMI)
	Appendix C – Water Quality Field Measures
	Appendix D – Pathogen Data
	Appendix E – Suspended Sediment Concentration Data
	Appendix F – Quality Data and Monitoring Plan – QAPP & MP
2.2.5	Photo Documentation
2.3	**Petaluma Watershed Restoration and Outreach**
2.3.1	Project Area Maps
2.3.2	Landowner Access Agreements
2.3.3	Outreach Publication & Events
2.3.4	Photo Documentation
2.3.5	Report: San Antonio Creek Watershed Plan (Draft January 2008)
2.4	**Redwood Creek Watershed Sediment Control on MMWD Lands**
2.4.1	Design Plans and As-built Drawings
2.4.2	Permits
2.4.3	GIS Map of Project Sites, Project Sign, Table of Completed Work, Photo Documentation
2.4.4	CD of Additional Photo Documentation

Project Deliverables

Appendix 2

2.5	**Erosion Inventory and Sediment Control Recommendations for Jack London State Historic Park Watershed**
2.5.1	Inventory of Erosion Sites: Memorandum and Action Plan
2.5.2	Plates: Location Map, Sediment Production Map, Habitat Scoring Pools Graph, Map Good Pool Locations, Slope Stability Map
2.5.3	Tables: Ranking Criteria, Data Summary of Ranked Pool Attributes, Mean Tons per Acre Surface Erosion in Sub-watersheds
2.5.4	Appendices:
	Appendix A: Geomorphic Survey Protocols
	Appendix B: Graham Creek
	Appendix C: Asbury Creek
	Appendix D: Mill Creek
	Appendix E: Kohler Creek
	Appendix F: Historical Road Report
	Appendix G: Diagrams and Estimate for Restoration Plan
2.6	**Watershed Stewardship Assistance for Landowners**
2.6.1	Landowner Database Guide and Database of Landowner Contacts
2.6.2	Restoration Locations
2.6.3	Best Management Practices (BMP) Implementation Report
2.6.4	BMP Restoration Recommendations and Photo Documentation for: De Anza Moon Valley Sonoma Point Apartments Rancho de Sonoma Carter Ristad Spaulding Vadasz Sonoma Creek Debris Jam: Glen Ellen Sonoma Creek Debris Jam: Kenwood
2.6.5	Outreach – Creek Salon Flyer
2.6.6	Memorandum, Dated 8/27/08 – 2005 New Year's Eve Storms Supplementary Info
2.7	**Sonoma Creek Channel Reach Rehabilitation to Support TMDL Implementation**
2.7.1	Report: Glen Ellen to Kenwood Reach ~ A Community Based Conceptual Management Plan
2.8	**Sonoma Creek Water Quality Monitoring**
2.8.1	Suspended Sediment Map
2.8.2	Report: Sonoma Creek Watershed Sediment Source Analysis
2.8.3	Monitoring Plan Update
2.8.4	List of Sampling Locations
2.8.5	Taxa List
2.8.6	Biological Metrics Scores
2.8.7	Low Flow Monitoring Data
2.8.8	BMI Physical Habitat Scores