

APPENDIX A.3: FLOOD PROTECTION

Watershed	Existing Condition	Original Cite (Reviewer Edit)
Sonoma Creek	Sonoma County Water Agency (SCWA) responsible for flood control throughout Sonoma County. Zone 2A - Petaluma Creek Watershed Zone 3A - Valley of the Moon Watershed (Upper Sonoma Creek) Zone 9A - Lower Petaluma River and lower Sonoma Creek (zone not yet formed) Flood protection measures are addressed in County and City GPs.	42
	Major flooding (i.e. state of emergency declared in county) occurred in January and March of 1995, January 1997, and 1998. An average of \$30M in damage was caused per flooding event.	38
	Below Schellville area, reclaimed tidal lands retard dissipation of floods due to dikes and therefore prolong floods. Lands above tidal area (e.g. below town of Sonoma) and within floodplain can be inundated for days.	38
	Flooding can occur in tributaries to Sonoma Creek, specially in Nathanson Creek in and just below the Town of Sonoma.	38
	Stream Stewards Program and Sonoma Ecology Center measures peak flows/stream flows in Sonoma Creek and tributaries.	38
	San Francisco District of the U.S. Army Corps of Engineers (USACE) together with the Southern Sonoma Resource Conservation District (RCD) developed a Project Management Plan (PMP) outlining the planning process for the Sonoma Creek & Tributaries Integrated Feasibility NEPA/CEQA Report.	44
	Sonoma Creek & Tributaries Integrated Feasibility NEPA/CEQA Report will facilitate implementation of a lower Sonoma Creek watershed flood protection and restoration project.	44
Petaluma River	Sonoma County Water Agency (SCWA) responsible for flood control throughout Sonoma County. Zone 2A Flood Advisory Committee acts in an advisory role to SCWA on flood control related to Petaluma River watershed. Flood protection measures are addressed in County and City GPs. USACE/SCWA/City of Petaluma cooperate on planning/design/implementation of projects. Petaluma River Citizen Advisory Committee (CAC) created to oversee development of the River Plan, as mandated by the 1978-2005 GP. CAC appointed by City Council and composed of City of Petaluma residents and City staff. Petaluma River Access and Enhancement Plan developed by CAC. Purpose is to provide policy guidance to integrate community values into flood protection measures.	30
	Recent flooding includes floods of January 1982 (\$28M in flood damages), February 1986 (\$1M in flood damages), and February 1998.	(USACE Fact Sheet)
	First 33,000 ft, the Petaluma River is 200-foot wide, 8-feet deep. Next 69,000 ft to Western Avenue (w/in City of Petaluma), river is 100-foot wide and 8-feet deep. Upstream reach is 50-foot wide and 4-feet deep. Channel is continually maintained and dredged by the USACE. Dredging of the lower channel occurs on a 144-month cycle. Dredging of the upper reach occurs more frequently, on a 48-month cycle. Dredging of upper river channel (Western Avenue to Washington Street) last occurred in November 1996. Dredging of lower reach (mudflats) last occurred in October 1998. Additional dredging scheduled for summer of FY05 and FY03 respectively.	29

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Petaluma River (Continued)	New flood control project in Petaluma River reach located within the Payran residential neighbourhood (e.g. from confluence of Lynch Creek and Petaluma River to Lakeville Avenue). The project will widen the river to accommodate 100-year flood event (e.g. to year 2005 under GP build out) and 40-year flood event (e.g. to year 2040 build out). Project will be carried out by the USACE in cooperation with the City of Petaluma. Segment of river passes through a heavily developed area with houses, yards, and fences close to the river banks. Native riparian vegetation has been replaced by exotic grasses and brushes. The city is looking at enhancing river accessibility and ecological function of reach. Plans are outlined in the Petaluma River Access and Enhancement Plan report. Project design includes: U-shaped channel – completed in December 1998. Trapezoidal channel Vehicular bridges – two bridges were replaced by May 2001. Railroad bridges – Mainland Railroad Bridge replaced in March 2001. Mainland Railroad Approach not yet completed (FY02).	29
	Unavoidable impacts identified: loss of 1.42 acres of riparian scrub-shrub, 0.17 acres of shaded aquatic habitat, 0.18 acres of emergent marsh, 2.13 acres of intertidal mud flats, 6.8 acres of grassland habitat, 1.47 acres of exotic vegetation, gain of 4 acres of aquatic habitat.	29
	Issues with ACOE dredging since City close to threshold for dredging justification. If commercial shipping traffic decreases, City will have to find sources of funding for continuation of dredging activities.	29
Marin County	Severe flooding has occurred in 1952, 1955, 1958, 1967, 1970, 1982, 1983, 1986, 1997, 1998 in Corte Madera, Larkspur, Greenbrae, Ross, San Anselmo, San Rafael, and Novato. Last 30 years of flooding associated with El Niño weather pattern.	11
	Two forms of flooding: tidal flooding and watershed flooding.	11
	Marin County Flood Control District (MCFCWCD) oversees management of eight Flood Control Zones. Town of Corte Madera not incorporated into MCFCWCD. Budget based on property taxes and assessment overrides. Each zone varies greatly in size, financial resources, and hazard severity. Some zones have revenue surpluses while other zones have deficits.	11
	Flood Control Zone 1 (Novato Creek Watershed) – 1984 Novato Creek Flood Control Project approved. Have an annual debris removal program with the Marin Conservation Corps.	11
	Flood Control Zone 3 (Watersheds tributary to Richardson Bay) – Has completed a program for constructing major flood control works over the past several years.	11 (Liz Lewis)
	Flood Control Zone 4 (Tiburon Boulevard) - Bel Aire subdivision area draining East and West Creeks	11 (Liz Lewis)
	Flood Control Zone 6 (City of San Rafael)	11
	Flood Control Zone 7 (East of Civic Center) – Zone had severe flooding in 1982 and 1983 floods. Flood Control Zone 9 (Ross Valley) – Working on completing the Army Corps of Engineers project on Corte Madera Creek	11 11 (Liz Lewis)

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Marin County (Continued)	Baylands were filled to allow for development. Subsequent subsidence of bay fill reduced level of flood protection. Levees had to be constructed to protect lower baylands from tidal flooding. In addition, a system of pump stations, inlet channels, and pipes had to be constructed to drain stormwater out of low-lying bay lands.	11
	<u>Current Flood Control Projects:</u>	
	<ul style="list-style-type: none"> Las Gallinas Creek Watershed (Zone 7 Santa Venetia): Subsidence of Bay mud increased risk of local flooding. Levee system constructed to minimize tidal flooding from Las Gallinas Creek at confluence with San Pablo Bay. MCFCWCD staff have contacted USACE to determine federal interest in new flood control project at Santa Venetia. 	11 (Liz Lewis)
	<ul style="list-style-type: none"> Corte Madera Creek Flood Control Project: Earthen tidal reach at confluence with San Pablo Bay, maintained for navigation. Middle reach is a concrete channel. Upper reach is unmodified. Flood control channel has had conveyance reduced from 100-year flood event. 1982 flood overtopped channel. Channel dredged twice before, in 1982 and in 1996. Extension of flood control project approved in 2000 after much community opposition. Project includes: raising sidewalls of concrete channel by 1 to 3 feet, construction of new fish ladder. 	11
<ul style="list-style-type: none"> Novato Creek Flood Control Project: Four phase project constructed from 1987 to 1991. Channel modifications included excavation, realignment, widening, bank stabilization, floodwall construction, and levees on Warner Creek. Flood control channel can convey up to 50-year storm event flows. Channel reach in lower watershed is subject to tidal action and erosion rates in upper watershed are high. As a result, deposition rates in lower reach are high. Maintenance dredging carried out three times since construction and approximately every four years. 	11	
Novato Creek	Novato Creek is a perennial stream approximately 17 miles long. Novato Creek watershed covers an area of approximately 27,500 acres.	22
	Primary source of sediment in creek is local bank and terrace erosion in upper watershed. Sediment is carried down the stream to the flood control reach where it is accumulated. The flood control reach flattens the stream surface thus reducing the stream's sediment transport capacity.	22
	Novato Flood Control Project is a trap for upstream eroded sediment.	22
	High level of sedimentation in downstream reach. Exacerbated by railway crossing and marsh reclamation.	22
	There has been a trend of salt marsh reclamation for commercial buildings (e.g. mall/office buildings/movie theater) at lower Novato Creek watershed. Reclamation has impeded tidal flows into and out of tidal marshes. As a result, the channel has narrowed and aggraded.	22
	Cross sectional area of channel at railroad crossing is too narrow. It acts as a bottle neck.	22
	Fifteen high priority, eleven medium priority, and forty low priority erosion sites in upper watershed identified.	23
	Well developed riparian corridor in upstream reaches of Novato Creek. Below confluence of Novato and Warner Creek, creek under tidal influence therefore riparian vegetation consists of brackish to salt marsh vegetation.	20
	USGS stream/rain gage operated and maintained by Marin County Flood District	(Liz Lewis)

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Corte Madera Creek	Portion of Corte Madera Creek Flood Control Project unfinished due to litigation, transfer of district ownership, series of design changes.	3
	Four units: Unit One and Two - Extends from San Francisco Bay to College Avenue Bridge. Unit Three - Extends from College Avenue Bridge to location 600 feet downstream of Lagunitas Road Bridge Unit Four - Never built, stuck in litigation.	3
	Corte Madera Creek watershed has flooded 14 times over past 50 years. Floods causing major damage occurred in 1951, 1955, 1958, 1960, 1962, 1963, 1967, 1969, 1982-1983, 1986 (post Flood Control Project).	3
	Flooding in creek mainly due to: 1) small capacity of channel in Unit 4 reach, 2) constriction of flow from insufficient opening under Lagunitas Road Bridge, 3) backwater created from transition into existing Unit 3 channel.	3
	Flows greater than 5-year storm event (e.g. 3,200 cfs) overtop Sylvan Lane upstream of Lagunitas Bridge. This water flows down Poplar and Kent Avenues to inundate areas adjacent to existing flood control structures (e.g. Unit 1 through 3).	3
	Factors contributing to flooding: high rates of channel aggradation (deposition of sediments), bridge heights (size of Lagunitas Road Bridge affects channel design), tidal influence, and sea level rise.	3
	Friends of Corte Madera Creek conducted a Geomorphic Study with Cal-EPA funding (e.g. <i>Geomorphic Assessment of the Corte Madera Creek Watershed, Marin County, California</i> , December 2000). Purpose was to identify erosion sources in watershed to address excessive sedimentation in flood control channel.	6
	Public involvement includes: DAC (Design Advisory Committee with representatives from Larkspur, Ross, and Kentfield as well as Friends of Corte Madera Creek Watershed.	3
	Project sponsor is Marin County Flood Control District (MCFCD) Zone #9. They were told by a judge that they needed to complete the project. Marin County and U.S. ACOE have to find what constitutes completion of the project.	James Miller, Project Manager Corte Madera Creek Flood Control Project, USACE, 2003
	They are halfway through project, at concept design stage. They have completed a General Investigation (GI) and Concept Design and they are getting community approval on Concept Design. They have gone through Phase I of General Investigation.	James Miller
Concept design submitted for approval from three parties that have been determined by a judge to have the opportunity to approve/reject design: o Town of Ross o Kentfield – unincorporated so represented by Kentfield Planning Advisory Board o Marin County	James Miller	
San Rafael Creek	Lower reach of San Rafael Creek (from Inner Canal Channel to Grand Street bridge in the City of San Rafael) is dredged by the USACE every 4 years.	USACE Fact Sheet
	Dredging completed June 2002.	Al Paniccia, USACE, 2003

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San Rafael Creek (conitnued)	No flooding occurrences.	Al Paniccia, USACE, 2003
Arroyo Corte Madera del Presidio	Flood Control staff working to incorporate Mill Valley stormwater drainage system into unified GIS for development of Drainage Master Plan. This watershed has rainfall/flow gage operated and maintained by the Marin County Flood Control District	John Wooley, Senior Flood Control Engineer, 2003
	Stream flow/ rain gage operated and maintained by Marin County Flood District	John Wooley