Contra Costa Clean Water Program

Contra Costa Creeks Inventory and Watershed Characterization Report

Submittal to:

San Francisco Bay Regional Water Quality Control Board
(In fulfillment of NPDES Permit Provision C.8c)

Prepared by:

Carrie Dovzak
Contra Costa Clean Water Program
&
Chris Sommers
Eisenberg, Olivieri and Associates (EOA), Inc.

March 31, 2004

PREFACE

The *Contra Costa Creeks Inventory and Watershed Characterization Report* (Report) was prepared in compliance with Provision C.8 (c) of the Program's NPDES Permit. Using a watershed based approach to address the creeks defined by the approximately 30 major watersheds in Contra Costa County, this Report describes the geographic, physical and biological characteristics that affect the natural drainage of the area and designated beneficial uses. A large portion of the information presented in this Report was derived during the development of the *Contra Costa County Watershed Atlas* (2003), a project to which the Program contributed a considerable amount of time and resources. The information contained in this Report is intended to paint a rough picture of watershed and water body characteristics and attributes in Contra Costa County and should not be considered complete or precise.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

Contra Costa Creeks Inventory and Watershed Characterization Report

Contra Costa Clean Water Program

March 31, 2004

1.0 INTRODUCTION

Urbanization and related impacts to water bodies, including municipal and industrial stormwater discharges, hydromodification, loss of riparian and aquatic habitat, stream modification projects for flood control and urban development, and stormwater runoff polluted by industrial chemicals, hydrocarbons, pesticides, and legacy pollutants, can be significant deterrents to achieving water quality objectives and beneficial use attainment in local water bodies (SFBRWQCB 1995). Additionally, agricultural, rural and open space land use practices such as improper cattle management (i.e., over-grazing, manure management and encroachment) and pesticide applications can adversely affect water quality and aquatic habitat. In the Bay Area, great strides have been made to reduce pollution and restore and protect aquatic habitat in the San Francisco Bay (Bay) and its tributaries, in efforts to attain beneficial uses. However, impairments to water bodies still exist.

To effectively assess the sources of adverse impacts on water quality in Contra Costa County (County), a variety of biological, physical and chemical information has been collected in recent years. This information has certainly provided local watershed managers and agencies with a better understanding of water quality and associated impacts. However, without a firm understanding of the general characteristics of water bodies and associated watersheds, the information collected has little context. Furthermore, determining causes and sources of recognized impacts remains extremely difficult without initial characterization.

This *Creeks Inventory and Watershed Characterization Report* (Report) describes general physical, biological and political characteristics of the major creeks and watersheds in Contra Costa County, California. Additionally, recent and current water quality monitoring locations and activities are presented and discussed. The objective of the study is to provide valuable information regarding water body and watershed characteristics that can provide a context for evaluating adverse impacts of stormwater on water quality and beneficial uses of local water bodies and the Bay.

2.0 BACKGROUND

The Contra Costa Clean Water Program (Program) was reissued a Joint Municipal NPDES Permit (Permit) on July 21, 1999 by the California Regional Water Quality Control Board, San Francisco Bay Region (SFBRWQCB). The reissued Permit regulates discharges to the municipal separate storm sewer system (MS4) in Contra Costa County and covers the 19 incorporated cities, Contra Costa County and the Contra Costa Flood Control and Water Conservation District as Co-permittees. Provision C.8 (c) of the Program's Permit requires that, *"...Dischargers*

shall prepare a plan and conduct a Contra Costa County creek inventory as follows:

- *All of the Dischargers (i.e. Co-permittees) shall develop jointly and submit by September 1, 1999 a technical report acceptable to the Executive Officer, on existing creek inventory efforts and a plan to complete the creek inventory project.*

- *The Dischargers shall submit by September 1, 2000 a complete inventory and characterization report acceptable to the Executive Officer. The report shall include environment indicators as well as other relevant parameters of the creeks."*

In response to the Permit provision, the Program reported on existing creek inventory efforts in the FY 1998/99 Annual Report. In the Program's FY 1999/00 Annual Report, a Creek Inventory Work Plan was submitted. During FY 1999/2000 the Program created individual watershed maps, detailing creek locations, watershed and sub-watershed boundaries, culverts greater than 36 inches, and jurisdictional boundaries for all areas of Contra Costa County. On January 11, 2001 the Program submitted the watershed maps to the Board, during a meeting with SFBRWQCB staff.

On November 26, 2001, the SFBRWQCB issued a Notice of Violation (NOV) to the CCCWP regarding the Program's Annual Report 1999/2000, for "*Late Submission of, and Failure to Submit an Adequate Creeks Inventory*". In response to the NOV, the CCCWP submitted a draft work plan in January 2002 which outlined tasks, subtasks, timelines, responsible parties, and deliverables. SFBRWQCB staff made suggested improvements to the draft work plan submittal and revisions were made accordingly. The Program submitted a final work plan on March 19, 2002. The work plan was approved by SFBRWQCB staff and is included in Appendix "A".

This Report is intended to satisfy Provision C.8 (c) of the Program's NPDES Permit. Using a watershed based approach to address the creeks defined by the approximately 30 major watersheds in Contra Costa County, this report will recognize the geographic, physical and biological characteristics that affect the natural drainage of the area and designated beneficial uses.

3.0 GENERAL APPROACH AND WATERSHED CHARACTERISTICS

This section of the Report briefly describes the Program's general approach to characterizing watersheds in Contra Costa County. Additionally, the types and sources of information utilized are described. A majority of the information presented in this section was derived during the development of the *Contra Costa County Watershed Atlas* (2003), a project the Program contributed a considerable amount of time and resources. The information contained in this section is intended to paint a rough picture of watershed and water body characteristics and attributes in Contra Costa County and should not be considered complete or precise.

3.1 Approach to Creek Inventory and Watershed Characterization

In developing this Report, the Program has embraced the watershed approach. The United States Environmental Protection Agency (USEPA) defines the watershed approach as:

> *"...a coordinating framework for environmental management that focuses public and private sector efforts to address the highest priority problems within hydrologically-defined geographic areas..."* (USEPA 2002).

The California State Water Resources Control Board (SWRCB) has adopted the watershed approach in its water quality policies. The *Water Quality Control Plan for the San Francisco Bay Basin* (Basin Plan) defines the major features of a watershed management approach are: targeting priority problems, promoting a high level of stakeholder involvement, developing integrated solutions that make use of the expertise and authority of multiple agencies and organizations, and measuring success through monitoring and other data gathering (SFBRWQCB 1995). With over 30 major watersheds,19 jurisdictions, multiple public agencies and approximately 1320 miles of creeks in Contra Costa County, the watershed approach provides a logical framework to characterize creeks and watersheds in a manner that allows congruence between these dissimilar entities (Contra Costa County 2003a).

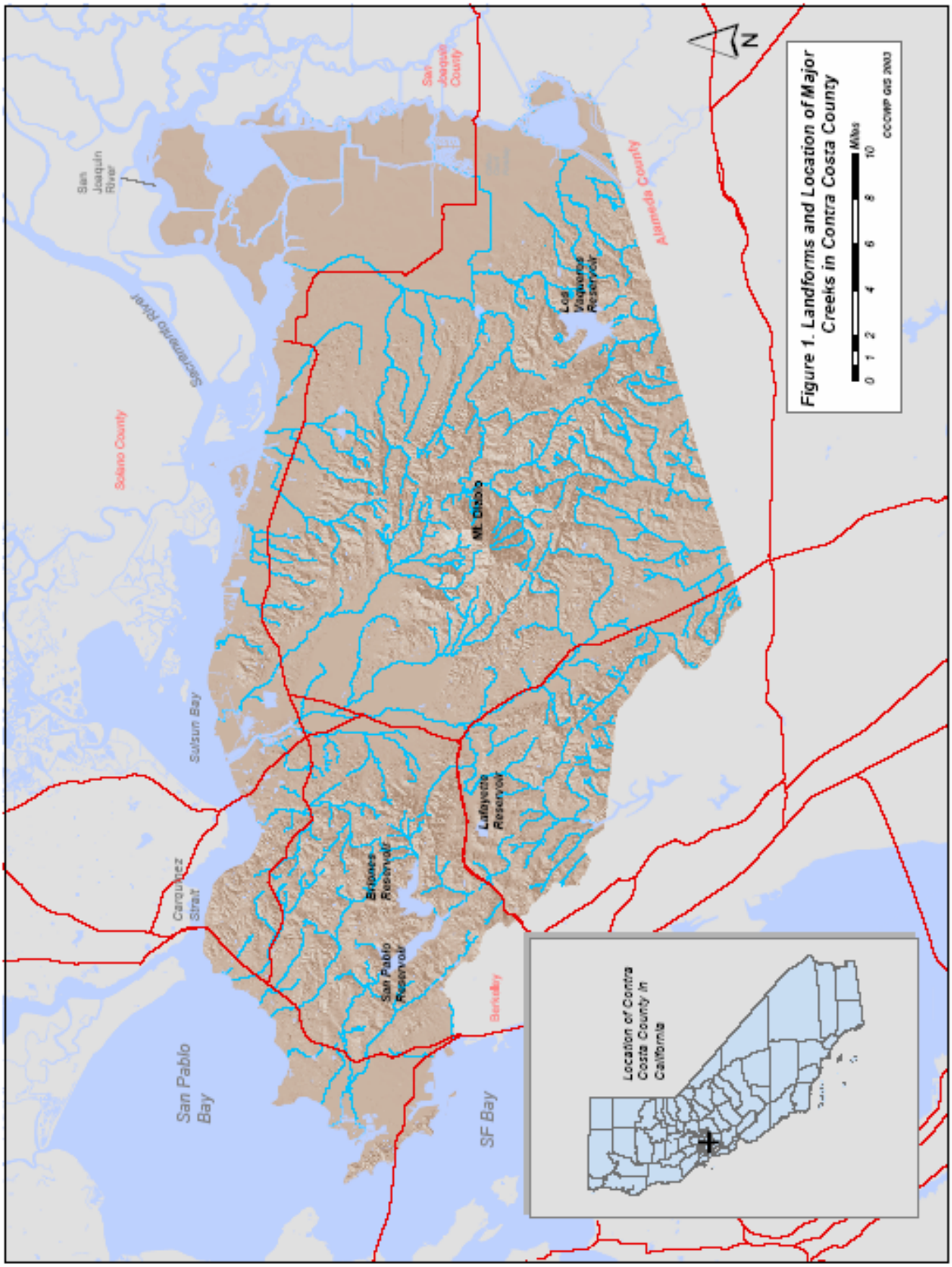
3.2 Watershed Characteristics

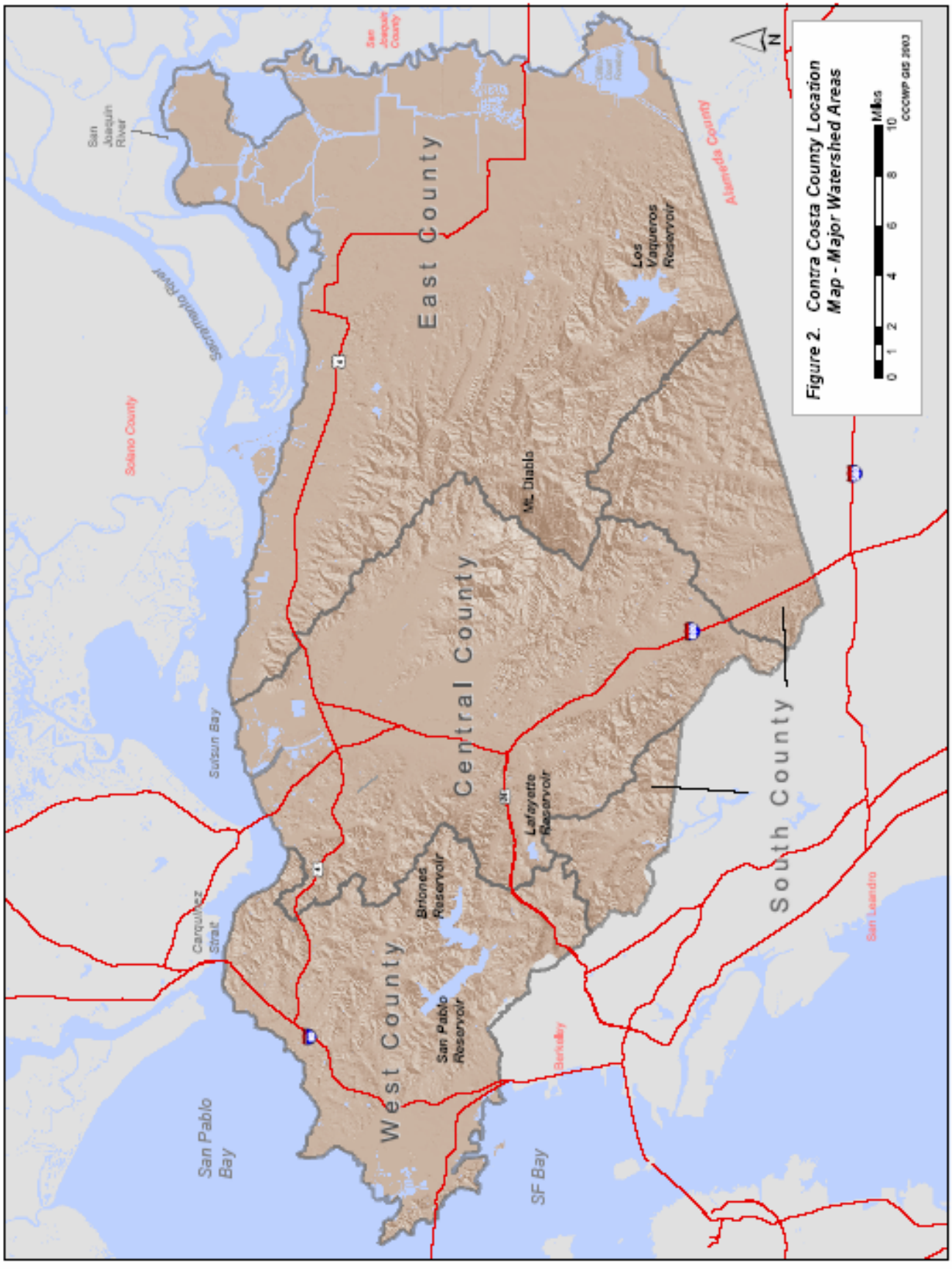
3.21 Geography

Contra Costa County (County) is located at the northeastern corner of the San Francisco Bay. With Mt. Diablo (3849 ft) centered at its interior, the county is encircled on three sides of its approximately 805 square mile area by major water bodies. Covering approximately 40 miles from east to west, and 20 miles from north to south, Alameda County forms the predominant border to the south and south west, while Marin, Solano, Sacramento and San Joaquin Counties share adjacent water body boundaries to the west, north and east, respectively. Figure 1 illustrates the geography, landforms and location of major creeks and water bodies in Contra Costa County.

In the Contra Costa General Plan (CCGP), the County is separated into three (3) physiographic areas; West County, Central County and East County. In this Report we have add a fourth category, South County, to more accurately describe the physiographic and hydrologic characteristics of the major watersheds, and to characterize those creeks that flow south into Alameda County (Figure 2).

Contra Costa County's proximity to water and its location in one of the most distinctive ecosystems in the world has been a decisive factor in its history and development; providing transportation, irrigation, abundant fish and wildlife, and an added aesthetic value to its already unique and impressive geographic setting. Mt. Diablo is a formidable landmark of the County, dominating the Central County landscape and establishing the headwaters for the County's major creek systems. The lower rolling topography of the East Bay Hills forms the west third


N
Figure 1. Landforms and Location of Major Creeks in Contra Costa County
Miles
0 1 2 4 6 8 10
CCCWP GIS 2003
San Joaquin County
Alameda County
Solano County
San Joaquin River
Sacramento River
Suisun Bay
Carquinez Strait
San Pablo Bay
SF Bay
Berkeley
Mt. Diablo
Los Vaqueros Reservoir
Lafayette Reservoir
Briones Reservoir
San Pablo Reservoir
Location of Contra Costa County in California


East County
Central County
West County
South County
Los Vaqueros Reservoir
Mt. Diablo
Lafayette Reservoir
Briones Reservoir
San Pablo Reservoir
San Joaquin River
Sacramento River
Solano County
Suisun Bay
Carquinez Strait
San Pablo Bay
SF Bay
Alameda County
San Leandro
Berkeley
N
Miles
0 1 2 4 6 8 10
CCCWP GIS 2003
Figure 2. Contra Costa County Location Map - Major Watershed Areas

of the area (following the NW-SE trend of the right lateral Hayward Fault and its off shoots) while the Diablo Range dominates the central and north eastern areas surrounding Mt. Diablo.

Alluvial plains and coastal estuaries, defining the lower elevations of the County, characterize the landscape as well. Forming the area north of Mt. Diablo, and the eastern parts of the County (originating from the uplands of the eastern watersheds) these areas were crucial in the County's development as an agricultural center. The alluvial plains and adjacent marshlands in West County, originally the site of early settlements and agriculture, are the site of heavy industry, manufacturing and residential areas due to their proximity to early means of transportation (water and rail). This is true for most of the coastal areas of the County, with the exception of East County which has remained agricultural.

3.22 Geology

New compilations of geologic maps published by the United States Geological Survey (USGS) during the past decade identify six major geologic assemblages in Contra Costa County. The juxtaposition of these assemblages is complex due to the highly faulted nature of the region, which according to USGS (1994) is dominated by broadly distributed transpressional faults, with both strike-slip and reverse motions, trending N30-60W. Offsets of 16–72 km of strike slip movement identified on the Calaveras Fault to the south may apply to other faults in the region as well, giving reason to the variability. As published by USGS (1994), the six major geologic assemblages in Contra Costa County are:

- Assemblage I – Berkeley Hills
- Assemblage II – Hercules Area
- Assemblage III – Pinole Area
- Assemblage IV – Martinez Area
- Assemblage V – Diablo Valley Area
- Assemblage VI – Eastern Area

Excluding the quaternary deposits that make up the majority of geologic materials in the area west of the Hayward Fault in the El Cerrito–Richmond area, the West County and eastern portion of Central County is comprised of tertiary deposits characterized predominantly by sandstones and mudstones. Mt. Diablo exposes older mesozoic volcanics including the underlying franciscan complex; while to the north quaternary sands, gravels, silt and mud dominate the valley where Concord and Walnut Creek are situated. The south eastern flanks of Mt. Diablo expose mesozoic sandstones, mudstones and conglomerates, while the north–eastern Diablo Range is comprised of younger sandstones and mudstones from the tertiary period. Quaternary deposits are dominate in the historically agricultural area of East County (USGS 1997). Major active fault systems mapped in Contra Costa County are presented in Figure 3.

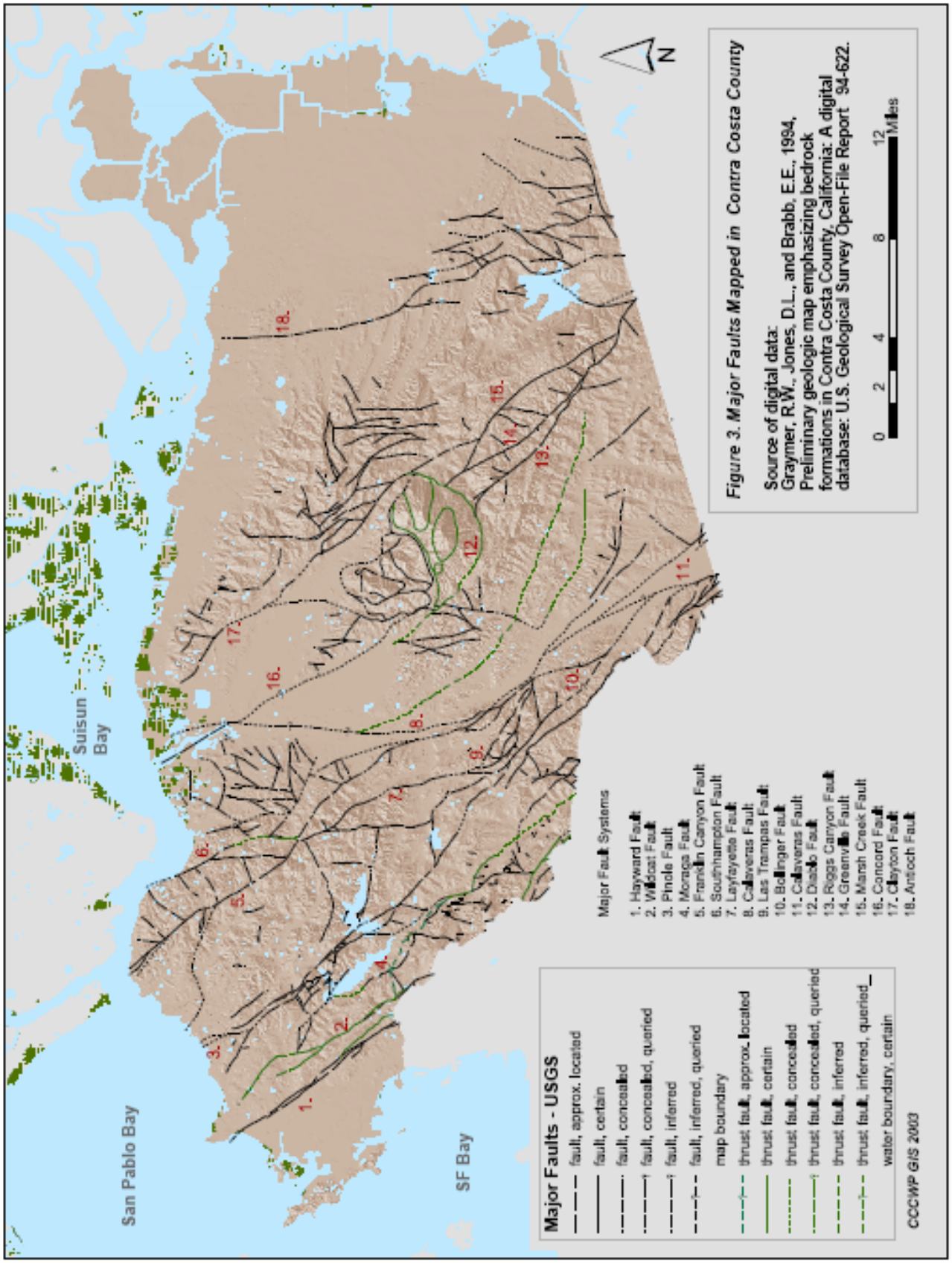


Figure 3. Major Faults Mapped in Contra Costa County

Source of digital data:
Graymer, R.W., Jones, D.L., and Brabb, E.E., 1994, Preliminary geologic map emphasizing bedrock formations in Contra Costa County, California: A digital database: U.S. Geological Survey Open-File Report 94-622.

3.23 Climate

Contra Costa County has a Mediterranean-type climate generally characterized by wet, moderately cool winters and dry, hot summers. Seasonally, more temperate and mild temperatures occur in the western part of the County, while more extreme temperatures occur in East County. Average summer temperatures in West County and East County are approximately 70°F and 90°F, respectively.

Precipitation is variable between points in West and East County, attributed to the County's distinct topography and proximity to the California coast. The rain shadow effect of the East Bay Hills and Mt. Diablo is evident in the average annual rainfall levels, which are highest just over the crest of the Berkeley/ East Bay Hills (33.75 inches/year) and lowest in East County (9.75 inches/year). Mt. Diablo clearly marks the point where precipitation drops off markedly into East County. In regards to temperature, proximity to the winds and coastal fog from the Golden Gate, West County and areas along the Carquinez Straits/ Sacramento-San Joaquin Delta Area receive cooling effects in the summer months, while the Central Valley tule fog affects the East County and Carquinez Straits/ Sacramento-San Joaquin Delta Area in the winter months.

The Costa County Flood Control and Water Conservation District has approximately 22 active rain gauge stations in their jurisdiction. Figure 4 presents mean seasonal rainfall patterns in the County based on data collected at these stations (Contra Costa County 2003b). In addition, estimated average annual precipitation for each watershed is listed in Appendix "B".

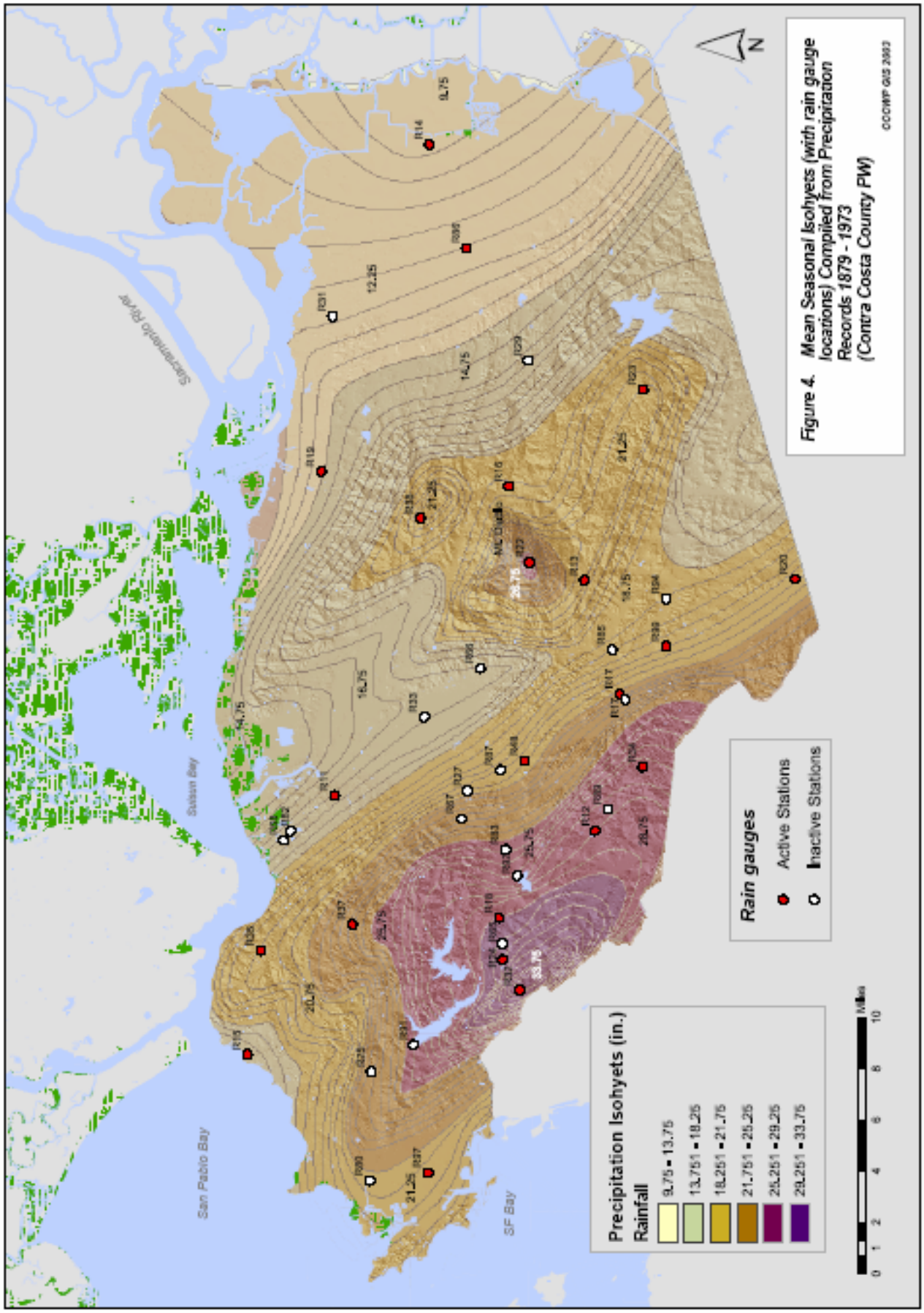
3.24 Creeks and Drainages

The Contra Costa Community Development and Public Works Departments worked together to generate a new creeks and drainages datalayer for use in the Watershed Atlas and this Report. The datalayer was mapped by interpreting previously developed orthographic photographs, 10-foot contours and storm drainage data. As a start, USGS data (i.e., National Hydrography Dataset High and Medium) were used to help determine the extent of the drainage areas that should be mapped. However, large drainages absent from the USGS dataset were also included. Draft data were "ground-truthed" and reviewed extensively by County staff. Although it may be added in the future, the detailed storm drain network in the county is currently not part of the Creeks and Drainages datalayer, although culverts that connect to open channels on both ends are.

The datalayer is referred to as "Creeks and Drainages" because the term "creek" usually refers to a channel with defined bed and bank. However, based on the methods used to develop the data, it was deemed impossible to determine with an accuracy where bed and bank exists. Therefore, the creek drainage layer may conceivable include "drainages" where no defined bed or bank exist. Additionally, no attempt was made to characterize the creeks/drainages by flow patterns (i.e., perennial, ephemeral or intermittent).

3.25 Watershed Boundaries

Watershed boundaries were updated by the Contra Costa County Public Works Department using Arcview GIS extension *ArcHydro* (ESRI) in combination with 10-


Sacramento River
Suisun Bay
San Pablo Bay
SF Bay
Precipitation Isohyets (in.)
Rainfall
9.75 - 13.75
13.751 - 18.25
18.251 - 21.75
21.751 - 25.25
25.251 - 29.25
29.251 - 33.75
Rain gauges
Active Stations
Inactive Stations
N
Miles
0 1 2 4 6 8 10
Figure 4. Mean Seasonal Isohyets (with rain gauge locations) Compiled from Precipitation Records 1879 - 1973 (Contra Costa County PW)
CCCWP GIS 2003

foot digital DEM dataset and the Contra Costa County streams layer. Boundaries in low gradient developed areas were adjusted using additional background information including: storm drain inventory, 10-foot contours, formed drainage area boundaries and digital orthophtotographs. These and other questionable areas were delineated using best professional judgment by consulting with Contra Costa County Flood Control Engineers and Hydrologists.

3.26 Land Use

Land use in Contra Costa County is planned and regulated by 20 of the 21 Co-permittees, excluding Contra Costa Flood Control and Water Conservation District. Land use information presented in this document is distilled from the Draft Digital Contra Costa County General Plan Map (Contra Costa County, 1995). For ease of presentation, similar land use types have been combined to create six (6) categories; Agricultural, Commercial, Industrial, Residential, Mixed and Open Space. The percentage of each land use type for each watershed is presented in Appendix "B".

3.27 Impervious Surfaces

Impervious surfaces are mainly constructed surfaces, such as rooftops, sidewalks, roads, and parking lots, which are covered by impenetrable materials such as asphalt, concrete, brick, and stone. These materials seal surfaces, repel water and prevent precipitation from infiltrating soils. Substantial increases in impervious surfaces can create many adverse effects to watersheds and water bodies. Increased imperviousness of watershed surfaces affects the volume of water available at local locations and the rates of water exchanges between locations. Additionally, aquatic habitats and biota can be increasingly degraded as greater percentages of watershed areas are made impervious. Percent imperviousness has been roughly estimated for each watershed using the typical percentage of impervious surface for each planned land use class. Please note the impervious surface estimates used in this report was developed using planned land use, not actual land use, and may reflect development planned, but not built. Figure 5 illustrates the estimated percent imperviousness in the County. Estimated percent imperviousness for each watershed in listed in Appendix "B".

3.28 Channel Type

Contra Costa County contains more than 1320 miles of creeks and drainages. To accommodate increases in the volume of runoff and reduce flooding and erosion, many of the creek banks in Contra Costa County have been modified. Typically, creeks in low lying urban areas often have concrete-lined or earthen banks, or they may run underground through culverts.

Using digital orthophotographs of the entire County, a channel type has been identified for each section of creek greater than 100 feet in length. For the purpose of this report, creek reaches have been grouped into four distinct channel types; natural, concrete, earthen and riprap. The percentages of each channel type are described for each watershed in Appendix "B".

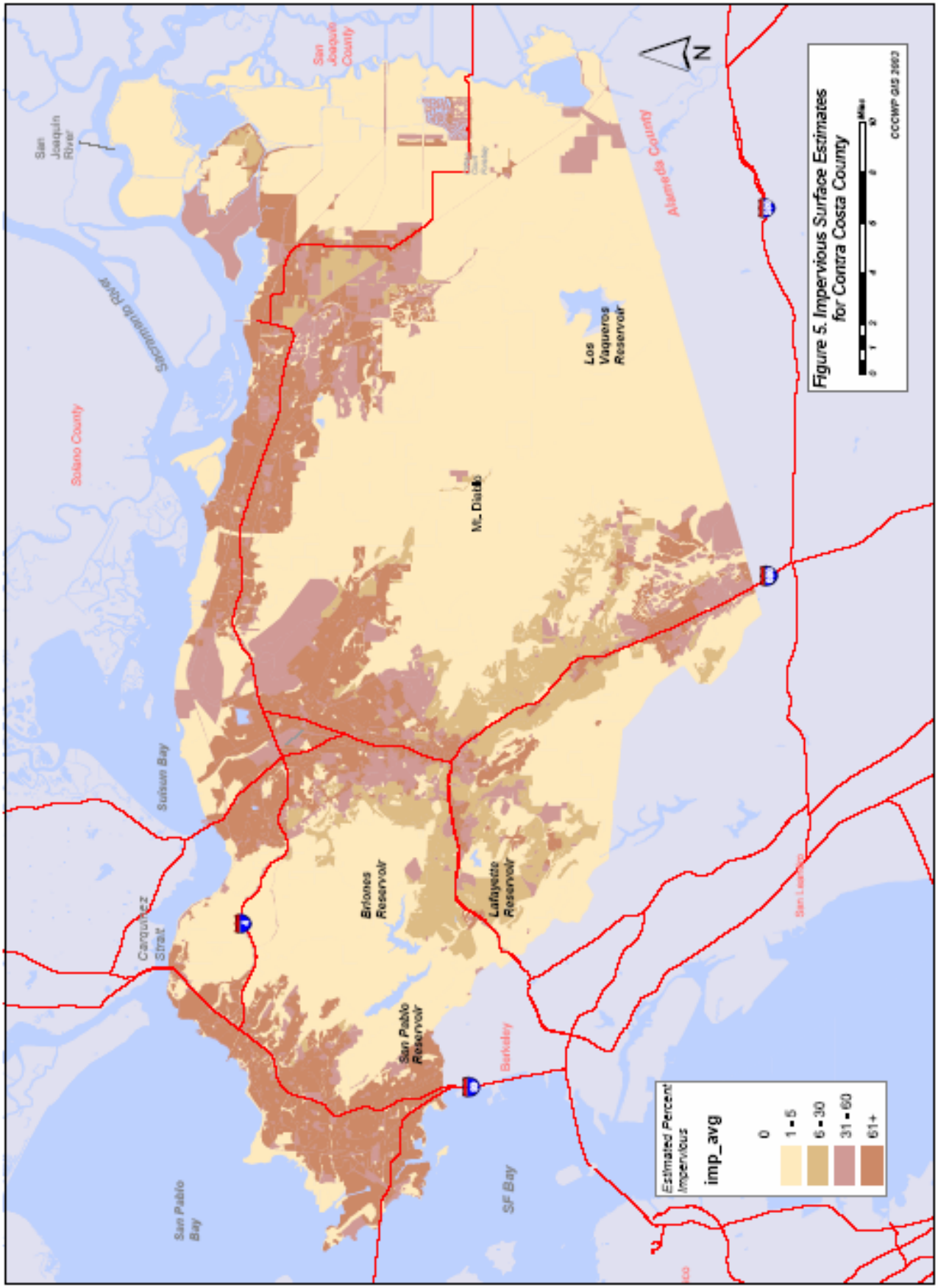


Figure 5. Impervious Surface Estimates for Contra Costa County
N
San Joaquin County
Alameda County
Solano County
San Joaquin River
Sacramento River
Suisun Bay
Carquinez Strait
San Pablo Bay
SF Bay
Briones Reservoir
Lafayette Reservoir
San Pablo Reservoir
Los Vaqueros Reservoir
Mt. Diablo
Berkeley
Estimated Percent Impervious
imp_avg
0
1 - 5
6 - 30
31 - 60
61+

3.29 Designated Beneficial Uses

Aquatic ecosystems provide many different benefits or uses to the people of the County. Beneficial uses have been designated by the Regional Water Quality Control Boards for a variety of water bodies in and adjacent to Contra Costa County. The beneficial uses which have been designated for creeks in the County are listed in Table 1. Designated uses are also further described for each applicable watershed.

Table 1. Beneficial uses designated for creeks in Contra Costa County(SFBRWQCB 1995).

Creek	Designated Beneficial Use						
	COLD	MIGR	REC-1	REC-2	SPWN	WARM	WILD
Wildcat Creek		E		E	E	E	E
Pinole Creek	E	E	P	P	E	E	E
San Pablo Creek		E		E	E	E	E
Rodeo Creek			P	E	E	E	E
Walnut Creek	E	E	P	P	E	E	E
Pine Creek	E		E	E	E	E	E
Mt. Diablo Creek	E	E	E	E	E	E	E

COLD-Cold Fresh Water Habitat, MIGR-Fish Migration, REC-1-Water Contact Recreation, REC-2-Non-contact Recreation, SPWN-Fish Spawning, WARM-Warm Freshwater Habitat, WILD-Wildlife Habitat; E-Existing Use, P-Potential Use

3.30 Historical and Current Fisheries Distributions

Historical status and current distribution of steelhead (*Oncorhynchus mykiss*) were assessed by the USEPA (Region 9) between 1992 and 2002, and results were recently published (Leidy et al. 2003). The primary goal of the study was to document past and current distributions in each of 58 watersheds west of Marsh Creek that enter the San Francisco Bay Estuary. Over 800 references were reviewed concerning these watersheds, including stream surveys, unpublished reports, museum records, interviews and other materials. Based on this information, values indicating the historical and current status of steelhead were assigned to each watershed in Contra Costa County. Values are defined as:

- DF – Definite Run or Population
- PB – Probable Run or Population
- PS – Possible Run or Population
- NP – No Run or Population
- UNK – Unknown/Insufficient Information

Figure 6 illustrates the streams in Contra Costa County that are believed to have had historical and/or current steelhead runs and populations, as identified by Leidy et al. (2003).

3.31 Program Monitoring Activities

The Contra Costa Clean Water Program (Program) has conducted a variety of water quality monitoring and watershed assessment activities since its creation in 1991. Monitoring and assessment activities have occurred on the Regional and local scale, with varying objectives and methodologies, and in estuarine and freshwater water bodies. Data collected from monitoring and assessment activities has been an integral source of information that aids the Program in evaluating the effectiveness of its actions, assessing beneficial uses in local water bodies, and directing scare resources to high priority areas within watersheds.

Current and recent monitoring efforts the Program has conducted are described in Section 4.0 for all applicable watersheds and water bodies. Although the Program contributes to various regional water quality monitoring activities conducted in the Bay and its tributaries (i.e. Regional Monitoring Program for Trace Substances and the Clean Estuary Partnership), the information presented in this section is specific to water quality monitoring and assessment activities conducted in specific watersheds in Contra Costa County for which the Program was the lead agency or conducted through the San Francisco Bay Regional Water Quality Board's Surface Water Ambient Monitoring Program (SWAMP), which the Program financially supports. Additionally, information on monitoring and assessment activities that have been or are currently conducted on a county-wide scale or in multiple watersheds is discussed below.

Contra Costa Monitoring and Assessment Plan

The Program developed the Contra Costa Monitoring and Assessment Plan (CCMAP) in 2000 to lead the Program's water quality monitoring and watershed assessment efforts (CCCWP 2000). CCMAP is intended to satisfy the Monitoring Program Provision in each of the Program's Joint Municipal NPDES Permits (Permits). This strategy provides the Program with a working plan designed to assess and monitor individual watersheds within Contra Costa County. The overall goal of the CCMAP is to identify and reduce/eliminate pollutants within Contra Costa's watersheds and protect designated beneficial uses.

The first phase of CCMAP was initiated within our pilot watershed (Alhambra Creek) in 2001. Lessons learned from this pilot effort were used to refine CCMAP during 2002 and 2003, when additional watershed assessments were conducted in Alhambra Creek, Pinole Creek, Upper Marsh Creek, Upper Kellogg Creek and Las Trampas Creek watersheds. Additional watersheds are currently slated for monitoring under CCMAP in 2004.

Contra Costa Citizens Monitoring/Assessment Program

In collaboration with Contra Costa County Community Development Department (CDD), the Program submitted a Proposition 13 grant application to the State Water Resources Control Board in Fiscal Year 2001/2002. In FY 2002/2003, the Program and CDD were notified they had been awarded a grant of $250,000.

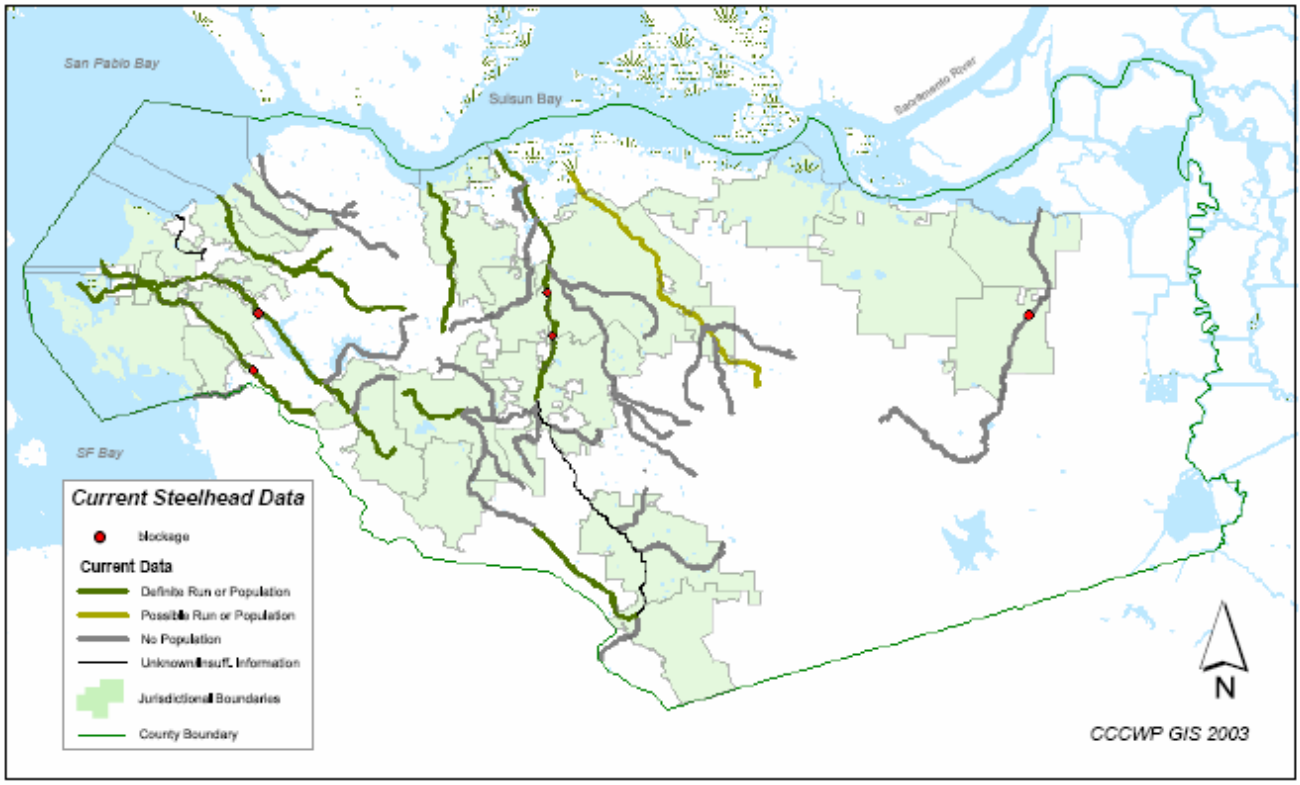
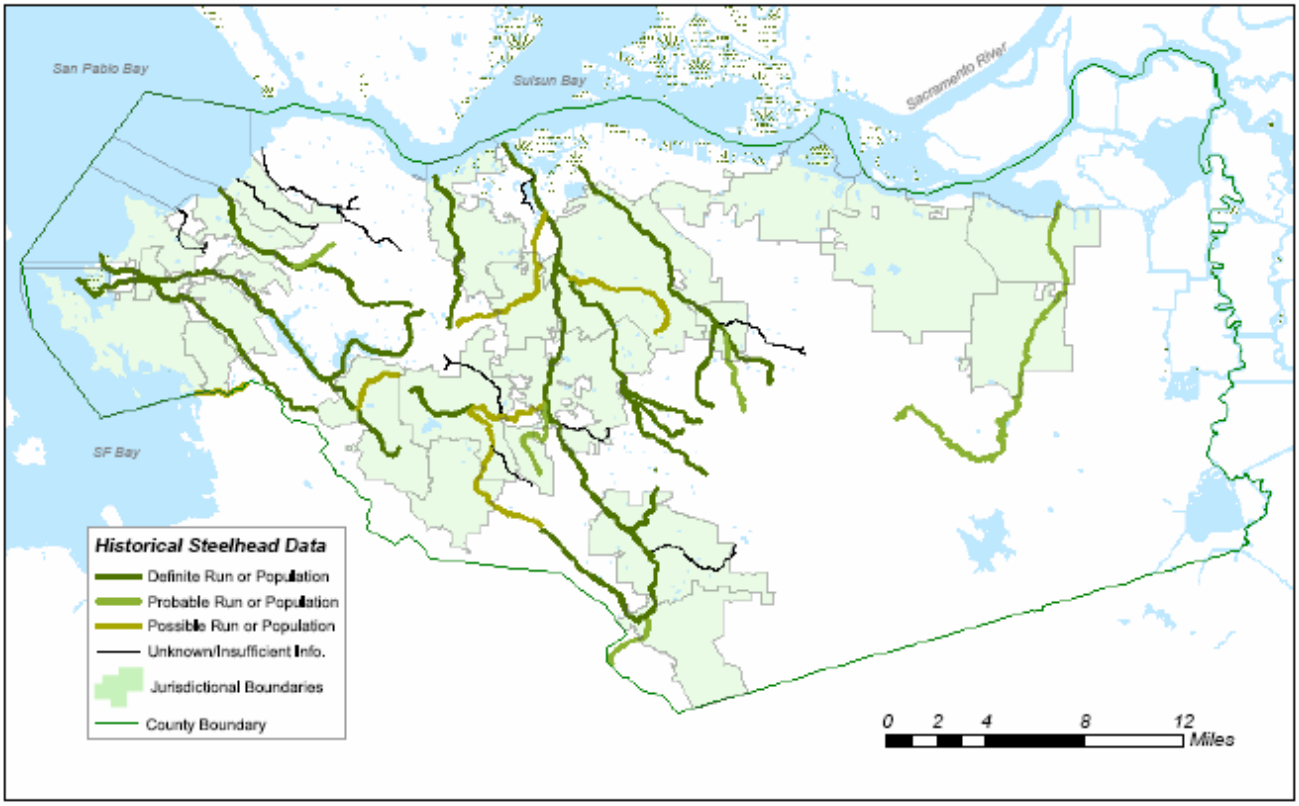


Figure 6. Current and Historical Status of Steelhead in Contra Costa County
From: Leidy, R.A. Becker, G.S. and Harvey, B. Historical and Current Status of Steelhead, Coho Salmon and Chinook Salmon in Streams of the San Francisco Estuary, CA. Oct. 2003



Through funding from the grant, the Contra Costa Citizen Watershed Monitoring/Assessment Program (Citizen Monitoring Program) will be created.

As the Citizen Monitoring Program is developed and implemented, citizen monitors will collect valuable Contra Costa County coastal water body and watershed information needed to identify water quality impairments and pollution sources. The prime Contra Costa watersheds and water bodies where citizens will collect data will be selected in early 2004.

Study of PCB, Mercury and Organochlorine Pesticides

To better characterize contributions of Polychlorinated Biphenyls (PCBs) from San Francisco Bay Area watersheds, the Bay Area Stormwater Management Agencies Association (BASMAA) member agencies conducted the *Joint Stormwater Agency Project to Study Urban Source of Mercury and PCBs* (Year One Joint Study) in October 2000 (KLI and EOA 2000) and the *Year Two Joint Stormwater Agency Project to Study Urban Sources of Mercury, PCBs, and Organochlorine Pesticides* (Year Two Study) in Fall 2001 (KLI and EOA 2001). The Program sampled a total of 31 sites in the County.

Contra Costa Golf Course Study

To examine potential water quality impacts and suggest best management practices (BMPs) related to golf courses and turf management the Program is currently conducting a special study designed to assess nutrient and pesticide runoff from golf courses within Contra Costa County. Beginning in 2004, approximately six (6) golf courses will participate in the study and water quality measurements will be recorded at up and down stream locations in adjacent water bodies. If successful, this study will provide valuable information regarding the concentrations of potential pollutants from golf courses. Additionally, results of the study could identify practical, cost effective pollution reduction methods that minimize adverse impacts to water quality by turf fertilizer/pesticide applications to golf courses and other turf areas.

3.32 Restoration Activities

A variety of stream and watershed restoration projects have occurred in Contra Costa in the recent past and/or are currently being planned or implemented. Many of these projects were partially funded by Program Co-permittees. Descriptions of these projects were originally presented in the *Contra Costa County Watershed Atlas (2003)*. Information on the projects included in the Watershed Atlas was collected from a variety of sources, including: Contra Costa Watershed Forum Restoration Project Database, San Francisco Bay Venture Restoration Project Database, East Bay Municipal Utilities District, East Bay Regional Parks District, Contra Costa Flood Control and Water Conservation District, and local creek and watershed groups. The general locations of the projects were digitized by the Contra Costa County Community Development Department in 2003 and are included in this report. For descriptions of the projects, please refer to the Watershed Atlas.

4.0 MAJOR WATERSHEDS AND WATER BODIES

For the purposes of this report, the County has been dived into 29 major watersheds, a few of which constitute the headwaters of major watersheds of Alameda County to the south. A list of these major watersheds and their respective land areas are presented in Table 2. Our characterization will focus on the four physiographic areas of the County; West County, Central County, East County and South County. These areas closely follow the USGS Hydrological Unit Catalog Code (HUC) boundaries, adopted by the State of California as watershed boundaries. HUCs falling within the CCC boundary include: 18050004 – San Francisco Bay (84), 18040003 – San Joaquin Delta (88), 18050002 - San Pablo Bay (91), and 18050001 – Suisun Bay (111).

Table 2. Major Watersheds of Contra Costa County (Contra Costa Clean Water Program Geographic Information Systems 2003).

WATERSHED NAME	AREA	
	Acres	Sq Miles
1. Alamo Creek / Tassajara Creek	26392.1	41.2
2. Alhambra Creek	10684.5	16.7
3. Baxter / Cerrito / Richmond Drainages	11831.6	18.5
4. Brushy Creek	23724.8	37.1
5. Carquinez Straits Drainages	6573.5	10.3
6. Cayetano Creek	4407.5	6.9
7. Concord	5548.7	8.7
8. East Antioch Creek	7261.0	11.4
9. Garrity Creek	3849.9	6.2
10. Grayson Creek / Murderers Creek	15350.6	24.0
11. Kellogg Creek	20867.1	32.6
12. Kirker Creek	11108.3	17.4
13. Las Trampas Creek	17217.0	26.9
14. Lower Marsh Creek	27059.2	42.3
15. Mt. Diablo Creek	24420.3	38.2
16. Peyton Slough	4101.5	6.4
17. Pine Creek / Galindo Creek	20132.2	31.5
18. Pinole Creek	9705.0	15.2
19. Refugio Creek	3115.7	4.9
20. Rheem Creek	1789.6	2.8
21. Rodeo Creek	6657.4	10.4
22. San Leandro Creek / Moraga Creek	13196.9	20.6
23. San Pablo Creek	27891.9	43.6
24. San Ramon Creek	34577.1	54.0
25. South San Ramon Creek	8365.2	13.1
26. Upper Marsh Creek	32930.4	51.5
27. West Antioch Creek	8182.0	12.8
28. Wildcat Creek	7019.8	11.0
29. Willow Creek and Coastal Drainages	15086.7	23.6

4.1 West County Watersheds

West County contains eight (8) major watersheds and seven (7) major creeks (Figure 7). All follow the trend of the Hayward Fault. Each major watershed and respective area is listed in Table 3. Major creeks in these watersheds include: San Pablo, Pinole, Wildcat, Refugio and Rodeo Creeks. A series of smaller creek drainages flow westward down the East Bay Hills (El Cerrito and Baxter Creeks) while Garrity and Rheem Creeks define smaller coastal drainages separating the larger watersheds mentioned above.

Table 3. Major West County watersheds in Contra Costa County (Contra Costa Clean Water Program GIS 2003)

WATERSHED NAME	AREA	
	Acres	Sq Miles
San Pablo Creek	27891.9	43.6
Wildcat Creek	7019.8	11.0
Pinole Creek	9705.0	15.2
Refugio Creek	3115.7	4.9
Rheem Creek	1789.6	2.8
Rodeo Creek	6657.4	10.4
Baxter / Cerrito Richmond Drainages	11831.6	18.5
Garrity Creek	3849.9	6.0
Carquinez Straits Drainages	6573.5	10.3

Generally, the watersheds of the West County have similar land uses. Rural lands, characterized by open space (East Bay Municipal Utilities District and East Bay Regional Park District lands) and large parcels of privately owned land (used primarily for grazing), exemplify the typical upper West County watersheds. The lower watershed areas bordering the Bay are where historical population centers, manufacturing and industries first originated, and continue to be the most urbanized and heavily populated of the watersheds. The major creeks in the West County area currently display physical characteristics relative to the degree of urbanization in the watershed. Many were greatly altered by channelization during the past 50-100 years for agricultural purposes and flood control. The following information briefly describes each watershed within the West County area.

1.1.1

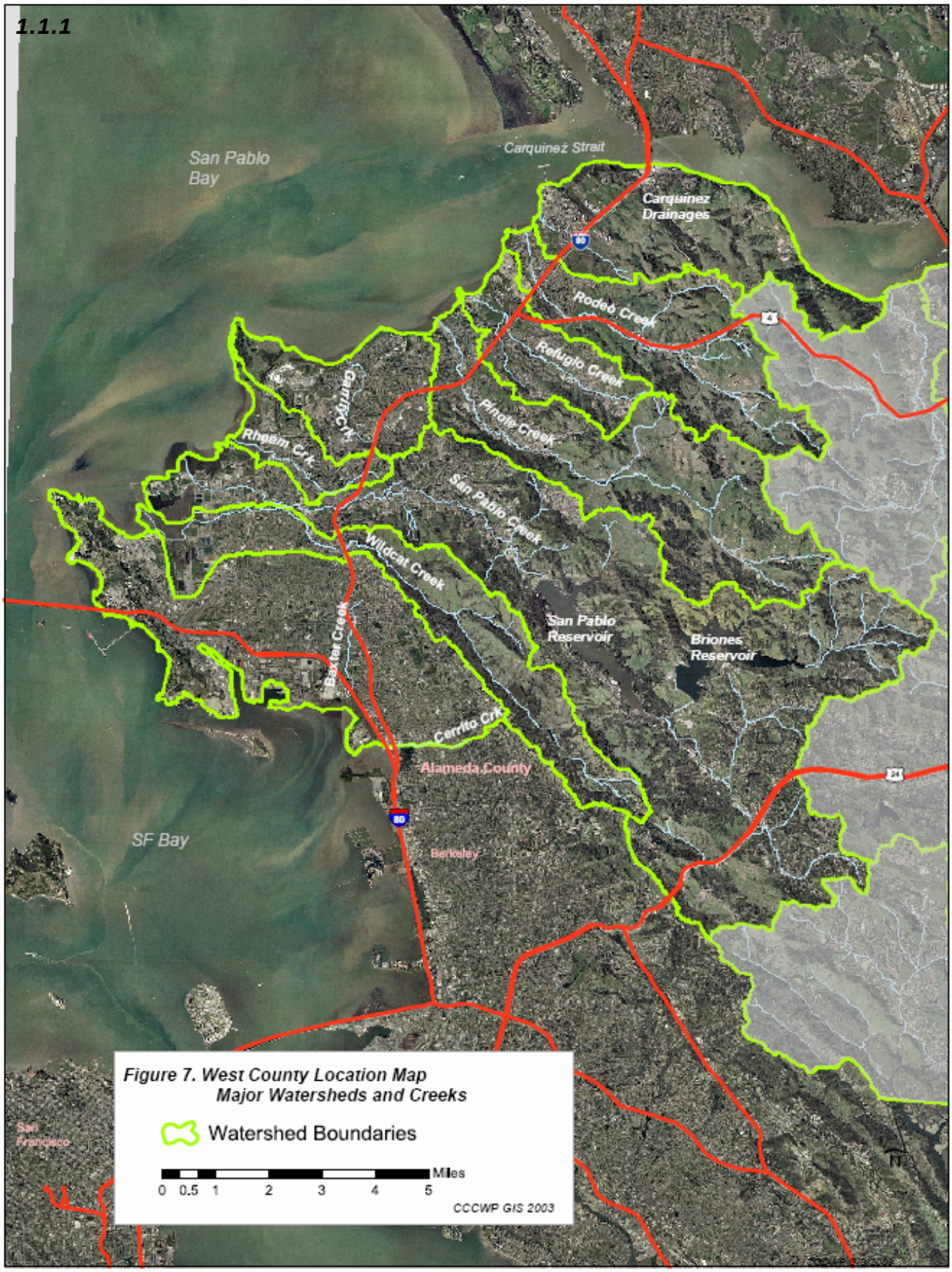


Figure 7. West County Location Map
Major Watersheds and Creeks

4.11 San Pablo Creek Watershed

The San Pablo Creek watershed covers 43.5 square miles in the heart of west Contra Costa County. Characteristic of other West County watersheds, the lower portions reflects years of occupation and industrialization, similar to adjacent watersheds, Wildcat Creek, Pinole Creek, Rheem Creek and Garrity Creek. The municipalities which are located in the watershed today are: City of Orinda, City of San Pablo, City of Richmond and unincorporated Contra Costa County (Figure 8.).

San Pablo Creek Watershed General Characteristics
• Elevation of Headwaters – 1170 ft.
• Total Length of Channels– 108.6 miles
• Longest Channel Reach – 19.7 miles
• 40% Incorporated, 60% Unincorporated
• Major Water Bodies:
• *San Pablo Creek* • *Bear Creek*
• *Cascade Creek* • *Castro Creek*
• *Lauterwasser Creek* • *Wilkie Creek*
• *San Pablo and Briones Reservoirs*

The headwaters of San Pablo Creek begin in the City of Orinda (1170 ft. elevation) a semi-rural residential area, before entering open space land, owned by East Bay Municipal Utilities District (EBMUD), and the San Pablo Reservoir, which has a capacity of 38,600 acre ft. of water. Tributary headwaters to the north enter the Briones Reservoir, a reserve reservoir to San Pablo Reservoir, which is also regulated by EBMUD. The protected watershed status of the EBMUD lands (9,379 acres) provide habitat for numerous species of animals and plants. This habitat is further enhanced by adjacent East Bay Regional Park lands of Briones and Tilden Regional Parks.

As water leaves the San Pablo Reservoir, it flows thorough rural and then heavily urbanized residential and commercial areas before reaching the saltwater marshes adjacent to Bay. From its headwaters in the City of Orinda, San Pablo Creek flows approximately 20 miles before reaching the San Francisco Bay.

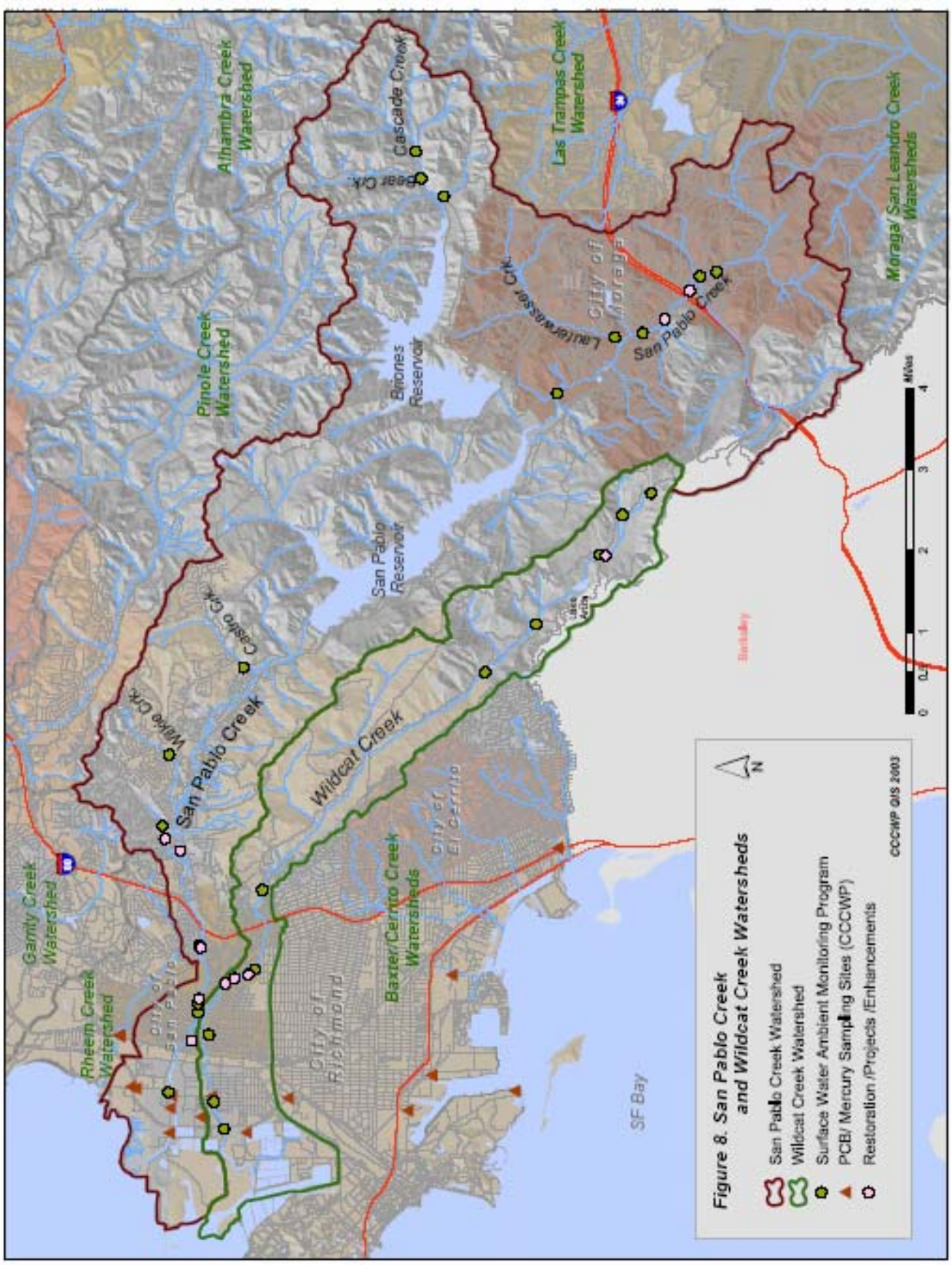
The largest planned land uses in the watershed are residential (28%) and open space (23%). The watershed is estimated to be made up of approximately 20 % impervious surfaces and 89% of the channel banks are currently natural. San Pablo Creek has the greatest estimated mean daily flow (32.1cfs) of any creeks in the County.

Fisheries

Data suggest that a steelhead population once existed in the San Pablo Creek watershed from the headwaters to the Bay (Leidy et al. 2003). However, habitat for steelhead in the watershed was most likely limited by the construction of the San Pablo Dam (1960). Populations now appear to only exist in the reaches below the Dam.

Monitoring Activities

The Surface Water Ambient Monitoring Program (SWAMP) is a statewide monitoring effort designed to assess the conditions of surface waters throughout the state of California. The SWAMP is directly funded by dischargers such as the Program. Responsibility for implementation of SWAMP activities in Contra Costa


Alhambra Creek Watershed
Cascade Creek
Las Trampas Creek Watershed
Moraga/San Leandro Creek Watersheds
Pinole Creek Watershed
Briones Reservoir
San Pablo Reservoir
Lauterwasser Crk.
San Pablo Creek
City of Moraga
Wildcat Creek
Wildcat Creek
Gamity Creek Watershed
Rheem Creek Watershed
Baxter/Cerrito Creek Watersheds
City of Richmond
City of El Cerrito
SF Bay
Berkeley
Miles
CCCWP GIS 2003
Figure 8. San Pablo Creek and Wildcat Creek Watersheds
San Pablo Creek Watershed
Wildcat Creek Watershed
Surface Water Ambient Monitoring Program
PCB/ Mercury Sampling Sites (CCCWP)
Restoration /Projects /Enhancements

County resides with the San Francisco and Central Valley Regional Water Quality Control Boards. In 2001, the SFBRWQCB conducted monitoring in the San Pablo Creek watershed. Sampling site locations and parameters analyzed are presented in Figure 8.

4.12 Wildcat Creek Watershed

The 11 square mile Wildcat Creek watershed consists of two main sections, characteristic of both San Pablo and Pinole watersheds to the north (Figure 8). The upper watershed contained in Wildcat Canyon, and the lower watershed, which enters the alluvial plain at Alvarado Park and continues to Wildcat Marsh and San Francisco Bay. Elevations run from 1900 ft. at Vollmer Peak in the Berkeley Hills, to sea level at the Bay. The City of Richmond and the City of San Pablo, are located in the lower half of the watershed, while unincorporated County and EBRPD land occupy the upper watershed.

Wildcat Creek Watershed General Characteristics
• Elevation of Headwaters – 1900 ft.
• Total Length of Channels– 22.2 miles
• Longest Channel Reach – 13.5 miles
• 61% Incorporated, 39% Unincorporated
• Major Water Bodies:
• *Jewel Lake* • *Lake Anza*

The geologic characteristics affecting the 13.5 mile Wildcat Creek are complex. Trending in the same direction as the Hayward Fault, the creek leaves the Berkeley Hills and enters the massive alluvial fan, where sediments have been deposited the Wildcat and San Pablo Creeks over thousands of years. Repeated drought and flood events have continually changed the shape of the fan and the course of the creek, which historically and from time to time has been physically linked to San Pablo Creek.

Characteristic of most West County watersheds, early Mexican and European occupation introduced farming and livestock to the area in the early 1800's, having a major effect on this landscape, which previously had been managed by native peoples. Rancho San Pablo included this area, and the rich alluvial plain sediments supported the farming of fruits and vegetables, while the middle and upper watershed provided pasture for livestock and horses. During this time, introduced shallow rooted annual grasses replaced native perennial bunch grasses throughout the area. During the late 1800's the alluvial plain became increasingly urbanized as farming gave way to industry and manufacturing after a deep water port was established at Point Richmond, which also became the end of the Santa Fe Railroad line. Oil refining was introduced as an industry in 1900, and remains a major industry in the area today.

The watershed is estimated to be made up of approximately 20 percent impervious surfaces and 90 percent of the channel banks are currently natural. Wildcat Creek has an estimated mean daily flow of 7.7cfs.

Fisheries

Data suggest that the Wildcat Creek watershed supported a steelhead run historically, but introduction of passage barriers and habitat degradation have limited the ability of the watershed to sustain a viable population (Leidy et al.

2003). Presently, steelhead successfully reproduce in a portion of Wildcat Creek below Jewel Lake and in areas above Lake Anza.

Monitoring Activities

The Surface Water Ambient Monitoring Program (SWAMP) is a statewide monitoring effort designed to assess the conditions of surface waters throughout the state of California. The SWAMP is directly funded by dischargers such as the Program. Responsibility for implementation of SWAMP activities in Contra Costa County resides with the San Francisco and Central Valley Regional Water Quality Control Boards. In 2001, the SFBRWQCB conducted monitoring in the Wildcat Creek watershed. Sampling site locations and parameters analyzed are presented in Figure 10.

Also in 2001, the Program supported the San Francisco Estuary Institute (SFEI) in conducting an extensive study titled, *Wildcat Creek Watershed: A Study of Physical Processes and Land Use Effects*, whose main objective was to determine the changes and effects of land use and nature on the distribution and supply of sediment and water (SFEI 2001). This document explores the history, hydrology, land use, geology, and physical aspects of the watershed in detail, following a watershed science approach that SFEI hopes will enable other watershed scientists in the area to characterize the health of local watersheds by following similar methodologies.

4.13 Pinole Creek Watershed

Pinole Creek is a perennial stream (in the Valley area) that receives drainage from an approximately 15.3 square mile area in western Contra Costa County (Figure 9). The headwaters of the creek are located in the Briones Hills (1260 ft. elevation), sharing a border with adjacent Alhambra and San Pablo Creek watersheds. Pinole Creek follows a northwesterly direction for approximately 11 miles before reaching the San Pablo Bay, the creek passes through a variety of land uses characteristic of other west County watersheds. Unincorporated County land, EBMUD protected watershed and the City of Pinole comprise the largest part of its area, with a small section of the City of Hercules in the lower watershed.

Pinole Creek Watershed General Characteristics	
• Elevation of Headwaters – 1260 ft.	
• Total Length of Channels– 46.6 miles	
• Longest Channel Reach – 11.0 miles	
• 27% Incorporated, 73% Unincorporated	
• Major Water Bodies:	
• *Pinole Creek*	• *Lagoons Creek*
• *Pavon Creek*	• *Pereira Creek*
• *Oak Moth Creek*	• *April Creek*
• *Costa Creek*	• *Cottonwood Creek*

West County watersheds characteristically have three principal land uses: urban, (residential, commercial, and industrial) rural, (agricultural lands) and protected watershed/open space. In the Pinole Creek watershed is made up of approximately 32% urban land use, 38% protected watershed/open space and 30% rural agricultural lands. The lower portion of the watershed is within the boundaries of the City of Pinole (population 19,039 in 2000) incorporated in 1903. The City was originally settled in the broad, alluvial floodplain of Pinole

Creek and low lying areas of the San Francisco Bay, close to transport provided by shipping on the Bay and the new railroad in 1878. Interstate 80 forms a man-made margin where Pinole Creek leaves the confines of the East Bay Hills. From this point to the Bay, U.S. Army Corp of Engineers carried out extensive work on the Pinole Creek channel in the 1950's to control flooding in the downtown area.

The middle third of the watershed is owned and managed by the East Bay Municipal Utility District (EBMUD), and contributes to the relative health of Pinole Creek by being managed as a water supply watershed. Various restoration projects along the tributaries that feed Pinole Creek (such as the Pavon Creeks restoration project) have provided shade and habitat to areas previously denuded by grazing and erosion.

The upper watershed is comprised of private ranchlands and ranchettes, and remains a Northern California Oak woodlands and grasslands landscape, despite the introduction of non-native vegetation and grazing to the area in the 1800's. The Briones Hill Planning Area restricts parcel size to 5 acres or more in most parts of the upper watershed. At the very tip of the upper watershed lies the northwestern portion of Briones Park, which is owned and maintained by the East Bay Regional Parks District (EBRPD).

The watershed is estimated to be made up of approximately 15 percent impervious surfaces and 92% of the channel banks are currently natural. Pinole Creek has an estimated mean daily flow of 10.4cfs.

Fisheries

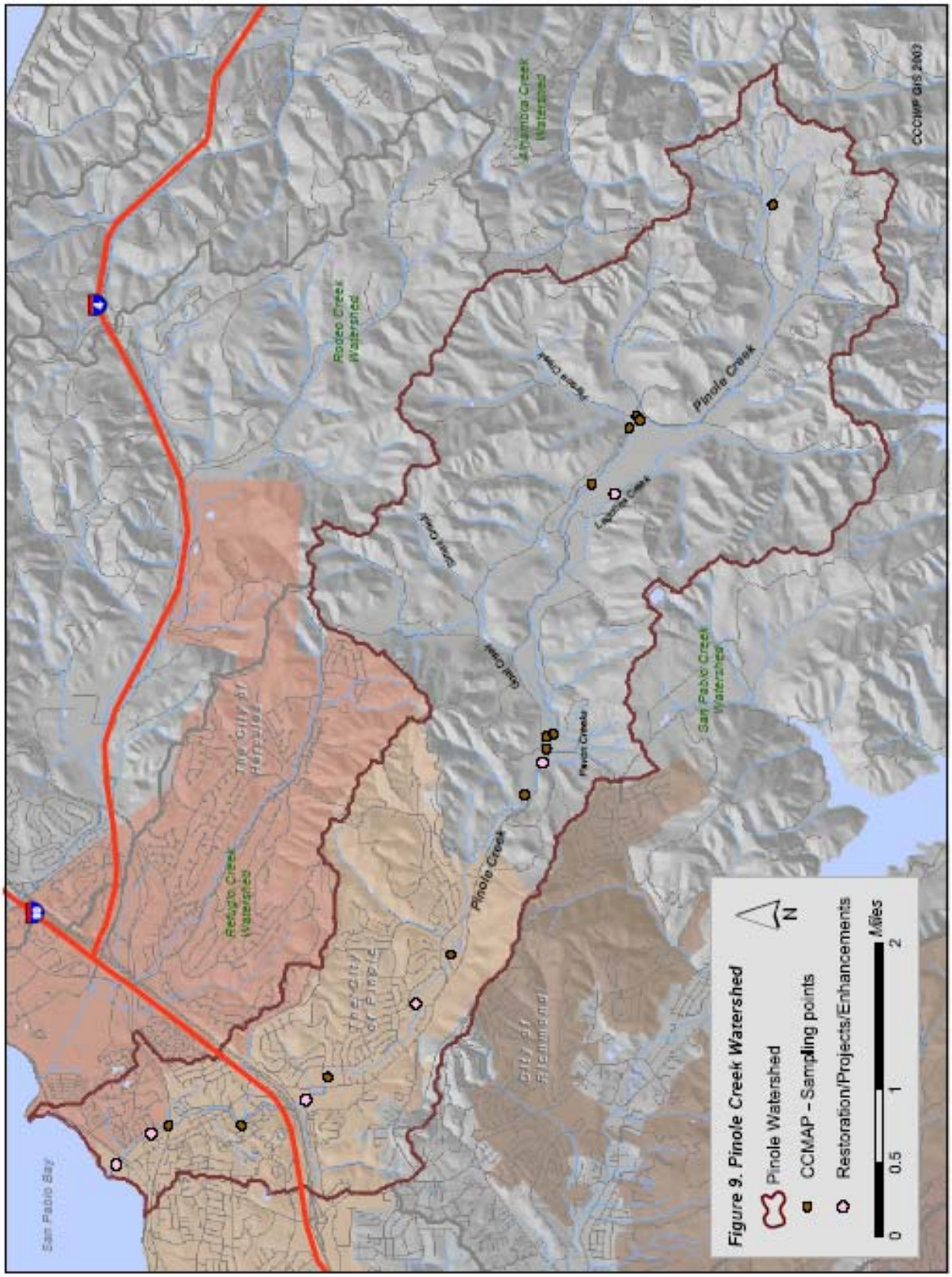
Data suggest that Pinole Creek watershed historically supported a steelhead run (Leidy et al. 2003). Steelhead presently continue to enter the watershed although the size of the run has not been documented.

Monitoring Activities

The Contra Costa Clean Water Program initiated the Contra Costa Monitoring and Assessment Plan (CCMAP) to assess the biological integrity of streams and the 'health' of watersheds in Contra Costa County. In 2002 and 2003, the Program conducted biological and physical habitat assessments, and general water quality monitoring in the Pinole Creek watershed. Monitoring site locations and parameters sampled are presented in Figure 9.

4.14 Baxter/Cerrito/Richmond Drainages

This 18.5 square mile area is a series of sub-basins containing two historically important East Bay waterways, Baxter Creek and Cerrito Creek (Figure 10). Located at the southwest portion of Contra Costa County, the area encompasses the end of the southwest facing slopes of the East Bay Hills, plus the alluvial plain and flatland area west to San Francisco Bay. Wildcat Creek watershed forms the northern boundary and Marin Creek watershed (Alameda County) the south.


Pinole Creek
Rodeo Creek Watershed
Alhambra Creek Watershed
San Pablo Creek Watershed
Refugio Creek Watersheds
San Pablo Bay
Pinole Creek
Figure 9. Pinole Creek Watershed
Pinole Watershed
CCMAP - Sampling points
Restoration/Projects/Enhancements
N
0 0.5 1 2
Miles

An area rich in history, archeological sites throughout the watershed cover the history of the area's earliest inhabitants. Shellmounds are scattered throughout the tidal marshes of this area near the San Francisco Bay, where abundant shellfish, fish and game sustained villages of Native Americans. As with adjacent watersheds in the West County area, in the early 1800's this land was part of Rancho San Pablo. Early land use included farming and grazing, which converted to industry and residential neighborhoods in the late 1800's and early 1900's. The Richmond flatlands were first drained for agricultural use, and later became the site of industry following the introduction of the railroad to the region. Many tributaries of Baxter and Cerrito Creeks (including Wildcat Creek and San Pablo Creeks to the north) were lined, culverted underground and diverted during the first half of the 20th century to accommodate the new urbanization of the region.

This flat lying area between the Berkeley Hills and Pt. Richmond is now served by an extensive municipal stormwater system. The cities of Richmond and El Cerrito are the two municipalities that cover a majority of the watershed area, with the unincorporated County community of Kensington located in the headwaters of Cerrito Creek.

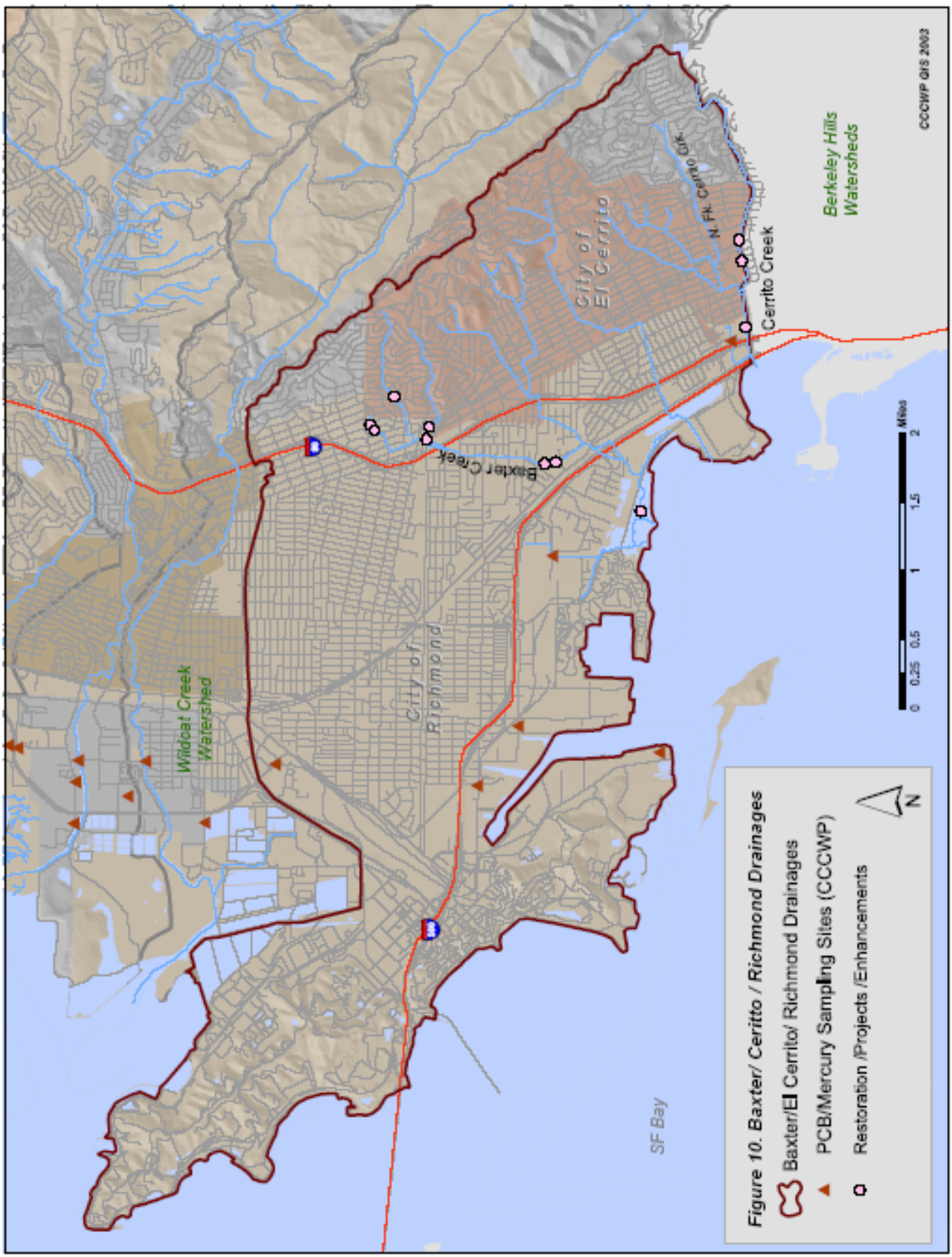
Monitoring Activities

As follow-up studies to the *Joint Stormwater Agency Project to Study Urban Source of Mercury and PCBs* (Year One Study) and the *Year Two Joint Stormwater Agency Project to Study Urban Sources of Mercury, PCBs, and Organochlorine Pesticides* (Year Two Study), bedded sediments were sampled from storm drainages in the West County area during 2001 and 2002 PCB Case Studies. The case studies were designed to better characterize sources within drainage areas where relatively high concentrations of PCBs were previously determined during the Year One Study and the Year Two Study. The locations of sites sampled during the 2001 and 2002 PCB Case Studies in the Richmond Drainages are presented in Figure 10.

Baxter Creek

Baxter Creek Watershed General Characteristics
• Elevation of Headwaters – 1010 ft.
• Total Length of Channels– 14.4 miles
• Longest Channel Reach – 2.9 miles
• 96% Incorporated, 4% Unincorporated

Baxter Creek and its tributaries originate in underground springs beneath El Cerrito's Mira Vista Golf Course and flows down from the hills in three branches to San Francisco Bay. After running through Canyon Trail, Poinsett, and Mira Vista Parks, the creek forms one stream near the Gateway Property at San Pablo and MacDonald Avenues in El Cerrito and Richmond, and then flows through Booker T. Anderson, Jr., Park and the Richmond flats into Stege Marsh and the San Francisco Bay.


Berkeley Hills Watersheds
CCCWP GIS 2003
City of El Cerrito
N. Fk. Cerrito Crk.
Cerrito Creek
Baxter Creek
City of Richmond
Wildcat Creek Watershed
SF Bay
Miles
0 0.25 0.5 1 1.5 2
N
Figure 10. Baxter/ Ceritto / Richmond Drainages
Baxter/El Cerrito/ Richmond Drainages
PCB/Mercury Sampling Sites (CCCWP)
Restoration /Projects /Enhancements

The Baxter Creek watershed is estimated to be approximately 18.5 square miles and is made up of approximately 65 percent impervious surfaces. Roughly 41 percent of the channel banks are currently natural, while 57 percent are concrete-lined. Pinole Creek has an estimated mean daily flow of 8.2cfs.

Cerrito Creek

Cerrito Creek straddles the Contra Costa/Alameda County border, draining the hills of El Cerrito and the unincorporated community of Kensington before emptying into the Albany Flats and the Bay, just south of Point Isabel Regional Shoreline.

Cerrito Creek Watershed General Characteristics
• Elevation of Headwaters –910 ft.
• Total Length of Channels– 5.8 miles
• Longest Channel Reach – 2.4 miles
• 58% Incorporated, 42% Unincorporated

The watershed is estimated to be made up of approximately 65 percent impervious surface and 30 percent of the channel banks are currently natural, while 54 percent are concrete-lined. No mean daily flow has been estimated for Cerrito Creek. While steelhead may have used Cerrito Creek historically, no direct evidence of a viable run occurring in the watershed exists. Flood control facilities and development have likely altered the system and the creek presently appears to be incapable of supporting a viable steelhead run.

4.15 Refugio Creek, Rodeo Creek and Carquinez Watersheds/Drainages

This section combines the watersheds of Rodeo Creek, Refugio Creek and the various drainages that flow into the Carquinez Strait. The watersheds are located at the northwest corner of Contra Costa County, and cover approximately 25.5 square miles of diverse land cover, including pristine oak-covered hills, an interstate highway, ranches, heavy industry, towns and new residential development. The City of Hercules and the unincorporated communities of Rodeo, Crockett and Port Costa are located in these watersheds (Figure 11).

Refugio Creek (4.5 miles), Rodeo Creek (8.3 miles), Canada del Cierbo Creek (2.86 miles) and Edwards Creek (2.0 miles), trend northwest and are characteristic of other West County drainages, which have a rural upper watershed and an urbanized and/or industrialized lower watershed. However in contrast, these watersheds do not have the usual flatland areas in their lower reaches characteristic of the watersheds of Pinole, San Pablo, and Wildcat Creeks.

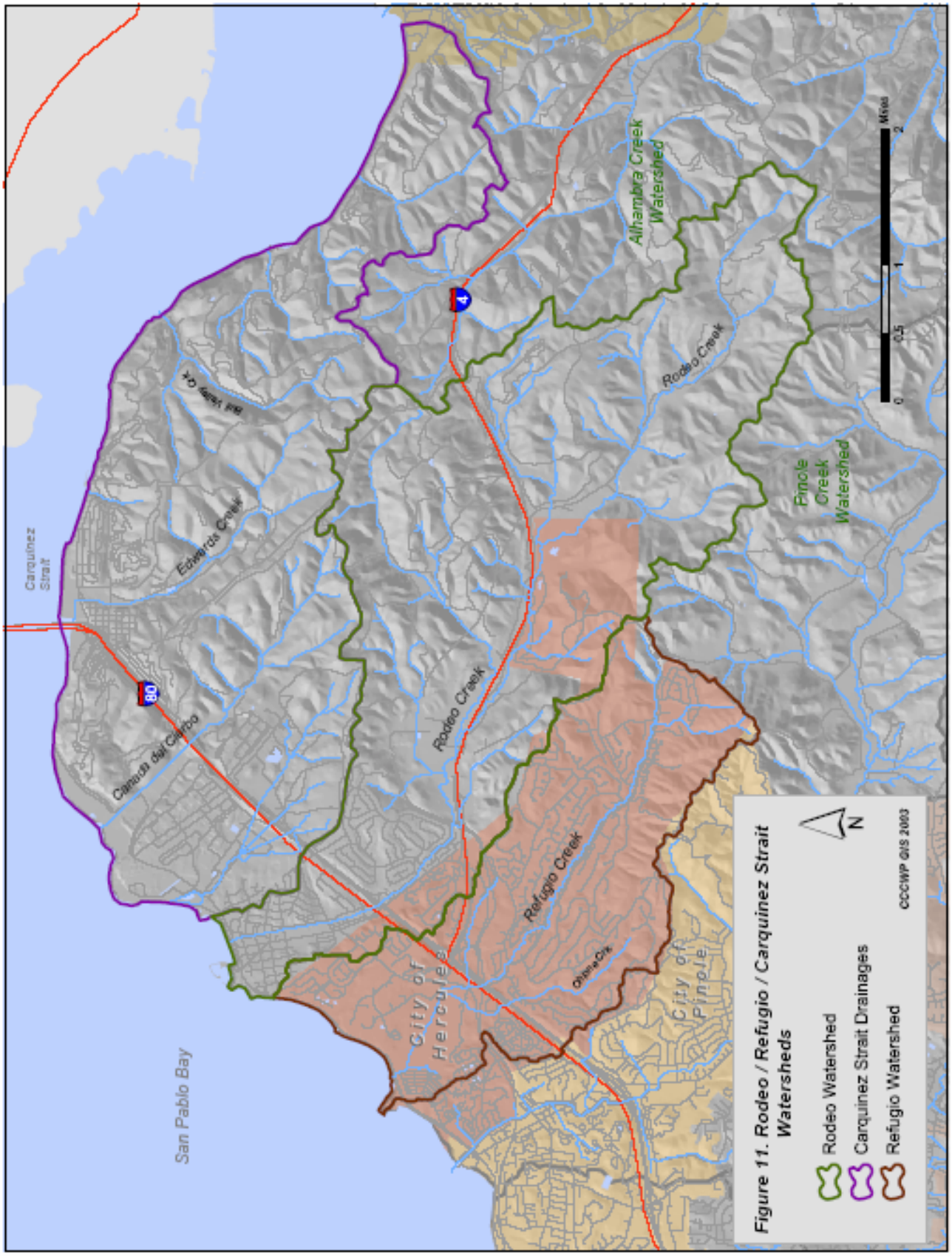


Figure 11. Rodeo / Refugio / Carquinez Strait Watersheds

Refugio Creek

A large majority of Refugio Creeks' small watershed area is located in the City of Hercules. The area is made up of predominantly residential land uses.

Refugio Creek Watershed General Characteristics
• Elevation of Headwaters –780 ft.
• Total Length of Channels– 9.2 miles
• Longest Channel Reach – 4.5 miles
• 97% Incorporated, 3% Unincorporated

The watershed is roughly 4.9 Square miles and is estimated to be made up of approximately 50 percent impervious surfaces. Roughly 83 percent of the channel banks are currently natural, while 15 percent are concrete-lined. Estimated mean daily flow is 4.2 cfs.

Monitoring Activities

The Contra Costa Clean Water Program initiated the Contra Costa Monitoring and Assessment Plan (CCMAP) to assess the biological integrity of streams and the 'health' of watersheds in Contra Costa County in 2000. The Program is currently considering initiating monitoring in the Refugio Creek watershed under CCMAP in 2004. Sampling site locations have yet to be determined.

Rodeo Creek

The upper watershed of Rodeo Creek and its tributaries, begin in private ranchland or EBRPD land before transitioning through an industrial area and the community of Rodeo. Problems with excessive headwall erosion in the upper watershed are concerns here. Two smaller drainages to the north of Rodeo, including Canada del Cierbo Creek and an unnamed creek, begin in undeveloped land on the east side of Interstate 80 before being diverted underground through refinery properties.

Rodeo Creek Watershed General Characteristics
• Elevation of Headwaters –1100 ft.
• Total Length of Channels– 31.6 miles
• Longest Channel Reach – 8.4 miles
• 12% Incorporated, 88% Unincorporated

The watershed is approximately 10.4 square miles in area. Impervious surface are estimated to make up of approximately 65 percent of the land and 91 percent of the channel banks are currently natural, while 5 percent are modified/earthen. Mean daily flow for Rodeo Creek is estimated to be 7.0 cfs.

Monitoring Activities

The Contra Costa Clean Water Program initiated the Contra Costa Monitoring and Assessment Plan (CCMAP) to assess the biological integrity of streams and the 'health' of watersheds in Contra Costa County in 2000. The Program is currently considering initiating monitoring in the Rodeo Creek watershed under CCMAP in 2004. Sampling site locations have yet to be determined.

Carquinez Drainages

Carquinez Creek Drainages General Characteristics
• Elevation of Headwaters –ft.
• Total Length of Channels– 27.0 miles
• Longest Channel Reach – 2.9 miles
• 1% Incorporated, 99% Unincorporated

The shorter, steeper Carquinez Drainages flow from north–south to east-west following the shape of the land, with the exception of Edwards Creek, which follows a north-westerly trend before turning into the Carquinez Strait near the Carquinez Bridge. These drainages are mostly unnamed except for Bull Valley Creek (2 mi.), which flows north through the town of Port Costa, first filling the reservoir used for its water supply located just south of town. The upper watersheds of these smaller drainages also begin in EBRPD land and/or ranchlands before reaching residential areas or industry located on the shores of the Carquinez Strait.

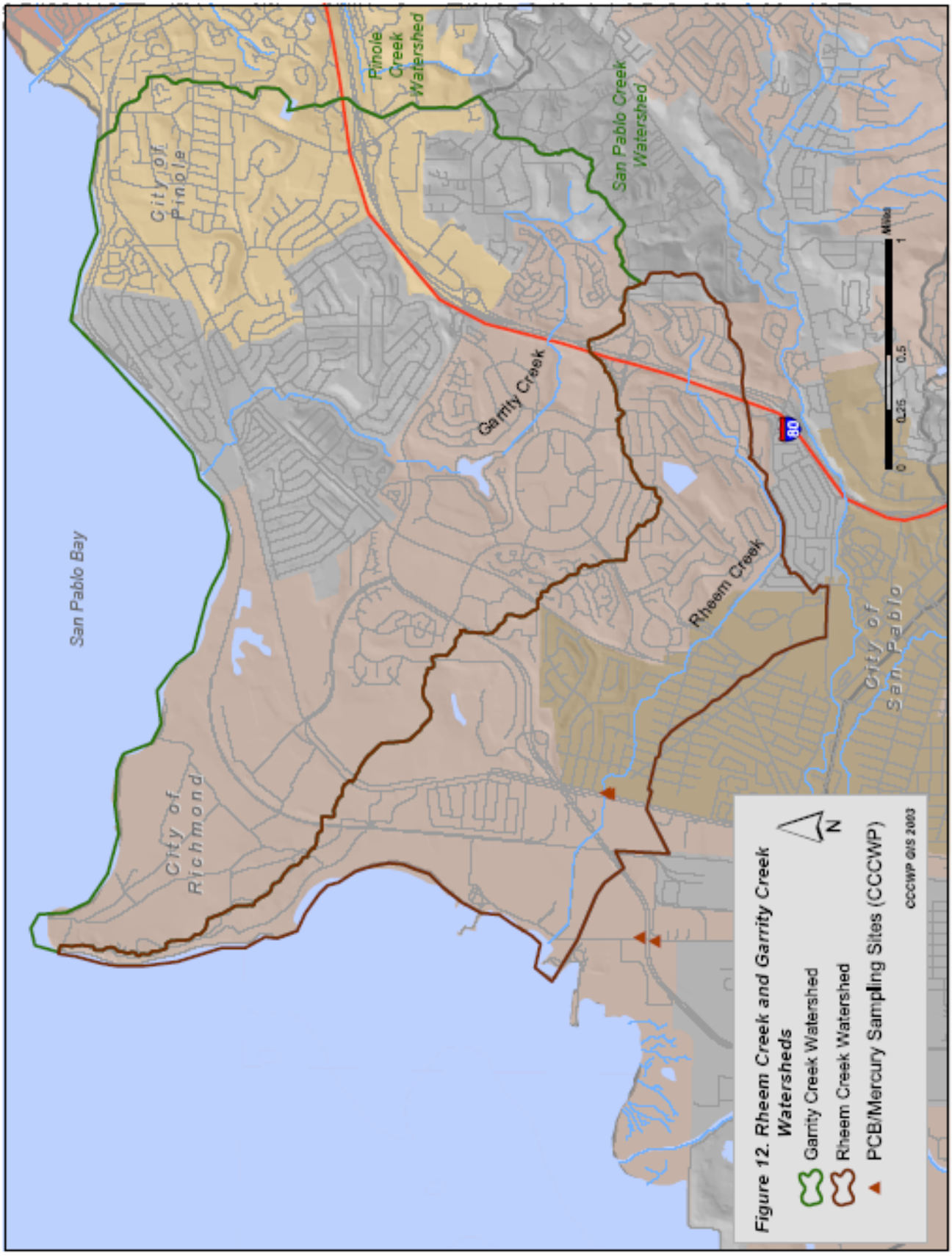
The drainages are approximately 10.3 square miles in total area. Impervious surfaces are estimated to make up approximately 65 percent of the area and 81 percent of the channel banks are currently natural.

Monitoring Activities

The Contra Costa Clean Water Program initiated the Contra Costa Monitoring and Assessment Plan (CCMAP) to assess the biological integrity of streams and the 'health' of watersheds in Contra Costa County in 2000. The Program is currently considering initiating monitoring in the Carquinez Drainages under CCMAP in 2004. Sampling site locations have yet to be determined.

4.16 Rheem and Garrity Creek Watersheds

This nine (9) square mile area includes the watersheds of Garrity Creek (3.6 mi.) and Rheem Creek (3.4 mi.). Located in the west part of the County, this urbanized area includes sections of the cities of Richmond, Pinole and San Pablo, as well as a small portion of unincorporated County (Figure 12). Point Pinole Regional Shoreline is located at the western-most tip of the area, providing 632 acres of parkland to the watershed, and marking the northern-most boundary of the historic Rancho San Pablo. In 1892, the Giant Powder Company moved to the area (now the regional park). The company town, named "Giant" quickly made this area a populated, industrial center. The Carquinez Golf Club leased land just east of the explosive factory in 1934, and presently the Richmond Country Club occupies 180 acres of open space in the same location.


Pinole Creek Watershed
San Pablo Creek Watershed
City of Pinole
Garrity Creek
Rheem Creek
San Pablo Bay
City of Richmond
City of San Pablo
80
Miles
0
0.25
0.5
1
N
Figure 12. Rheem Creek and Garrity Creek Watersheds
Garrity Creek Watershed
Rheem Creek Watershed
PCB/Mercury Sampling Sites (CCCWP)
CCCWP GIS 2003

Garrity Creek

Garrity Creek Watershed General Characteristics
• Elevation of Headwaters –ft.
• Total Length of Channels– 4.1 miles
• Longest Channel Reach – 3.7 miles
• 73% Incorporated, 27% Unincorporated

On the 1895 USGS topographic map, Garrity Creek and its tributaries are drawn as intermittent, except for a reach of a southern tributary that we acknowledge as Garrity Creek today. Its northern-most tributaries have been diverted underground to accommodate residential areas. The remaining reaches of Garrity Creek drain a small area of West El Sobrante and East Richmond before being culverted under a residential neighborhood and Interstate-80. Passing just north of the approximately 80-acre Hill Top Mall, the creek flows into Hilltop Lake before entering an earthen channel to San Pablo Avenue and the San Pablo Bay.

Garrity Creek watershed is approximately 6.2 square miles in area. Impervious surfaces are estimated to make up of approximately 60 percent of the land and 40 percent of the channel banks are currently natural, while 35 percent are concrete-lined. Mean daily flow for Rodeo Creek is estimated to be 5.4 cfs.

Rheem Creek

Rheem Creek Watershed General Characteristics
• Elevation of Headwaters –ft.
• Total Length of Channels– 3.4 miles
• Longest Channel Reach – 3.4 miles
• 97% Incorporated, 1% Unincorporated

The headwaters of Rheem Creek begin just east of Interstate 80 in a residential neighborhood of Richmond. On its route to San Pablo Bay it passes into the City of San Pablo for one mile before entering the City of Richmond again. One third of the creek is culverted under residential areas, while the other two-thirds are above ground in concrete and earthen channels. Flowing through a variety of industrial and residential land uses, it reaches the Bay one-half mile south of the Point Pinole Regional Shoreline. The total area of the watershed is approximately 2.8 square miles.

<u>Monitoring Activities</u>

Wet-weather fixed station water quality sampling was conducted by the Program for three (3) consecutive years (i.e., FY 1993/1994 through 1995/1996). Two streams, Rheem Creek and Walnut Creek, were monitored for runoff, physio-chemical and chemical water quality parameters, and toxicity. Effective FY 1996/1997, wet weather monitoring was suspended at the request of the San Francisco Bay and Central Valley Regional Water Quality Control Boards. The discontinuation of sampling occurred because the results were not providing highly useful information to the Program for evaluating the effectiveness of its management program or environmental effects. The site location in Rheem Creek where wet weather sampling was conducted is presented in Figure 13.

As follow-up studies to the *Joint Stormwater Agency Project to Study Urban Source of Mercury and PCBs* (Year One Study), bedded sediments were sampled from storm drainages in the Rheem Creek watershed during a 2001 PCB Case Study. The case studies were designed to better characterize sources within

drainage areas where relatively high concentrations of PCBs were previously determined during the Year One Study. Sampling sites were selected in Lower Rheem Creek (San Pablo) area and Drainage Area 114 (Richmond). Sampling site locations are presented in Figure 12.

4.2 Central County Watersheds

While the West County creeks are not dominated by one creek system, the most significant water body that defines Central County is Walnut Creek, whose watershed encompasses approximately 70% of the landmass of Central County. (Figure 13.) This formidable watershed includes the sub-watersheds of Concord, Grayson Creek/Murderers Creek, Las Trampas Creek, San Ramon Creek and Pine Creek/Galindo Creek. Each major watershed and its respective size are listed in Table 4.

Table 4. Major Central County watersheds in Contra Costa County (Contra Costa Clean Water Program GIS 2003)

WATERSHED NAME	AREA	
	Acres	Sq Miles
Alhambra Creek	10684.5	16.7
Walnut Creek		
Concord	5548.7	8.7
Grayson Creek / Murderers Creek	15350.6	24.0
Las Trampas Creek	17217.0	26.9
Pine Creek / Galindo Creek	20132.2	31.5
San Ramon Creek	34577.1	54.0
Mt. Diablo Creek	24420.3	38.2
Peyton Slough	4101.5	6.4

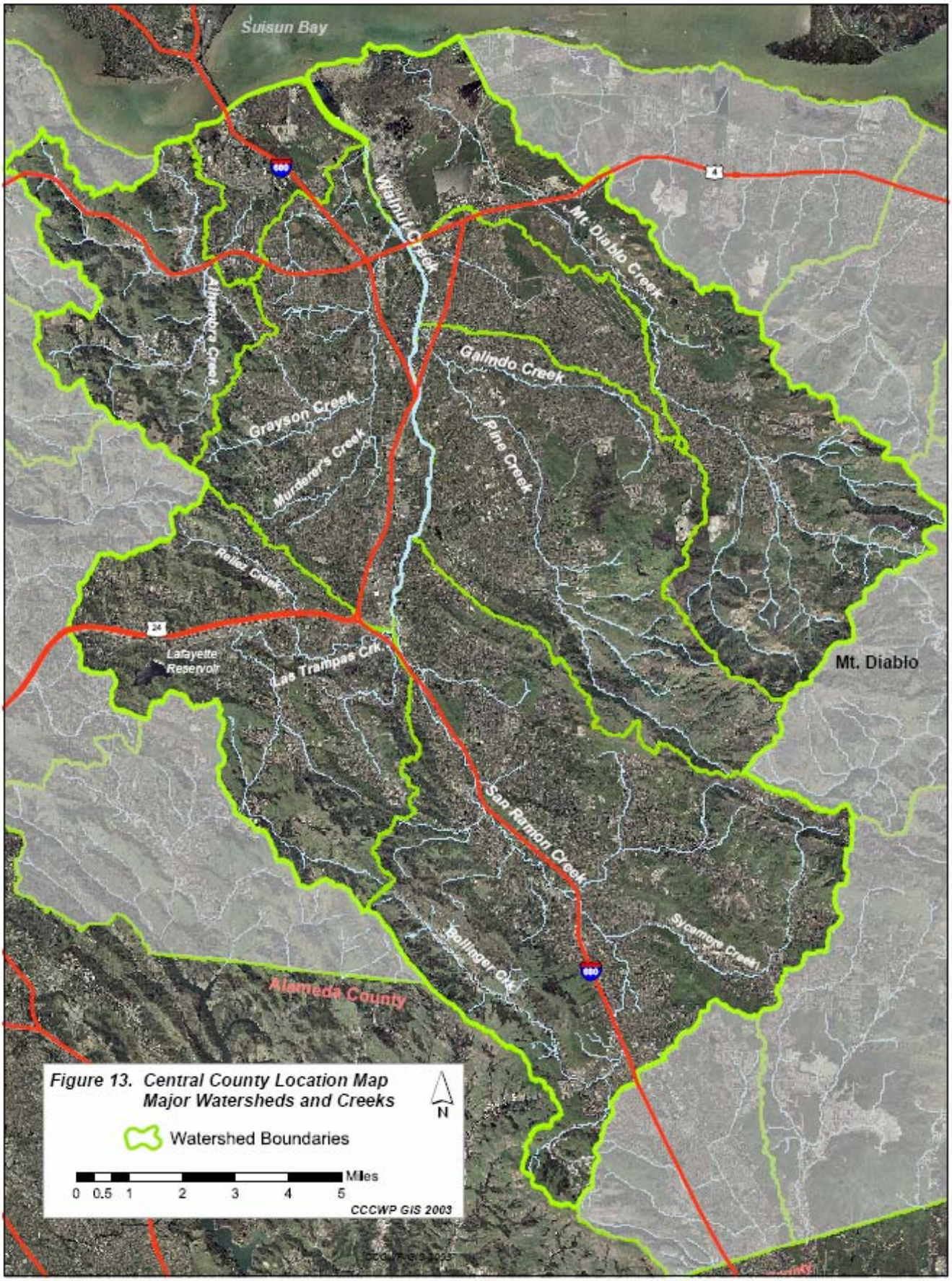
4.21 Alhambra Creek Watershed

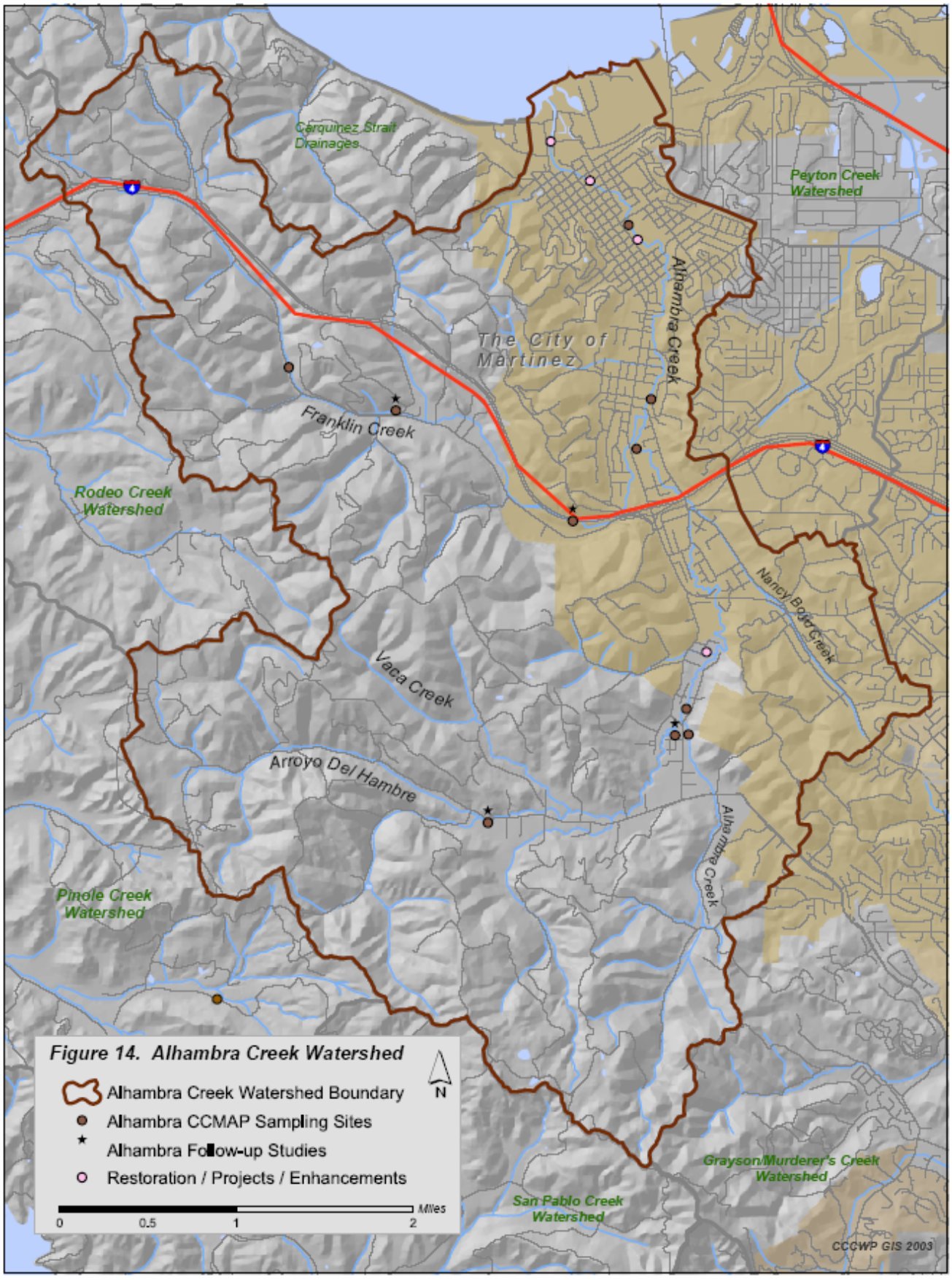
The Alhambra Creek watershed encompasses roughly 16.5 square miles of land area in northern Contra Costa County (Figure 14). The 8.0 mile main stem of Alhambra Creek, is joined by the 5.8 mile tributary Franklin Creek and the 7.4 mile tributary Arroyo Del Hambre, before making its way through the residential and commercial areas of downtown Martinez, eventually reaching the Carquinez Straits.

Alhambra Creek Watershed
General Characteristics

- Elevation of Headwaters – 1470 ft.
- Total Length of Channels– 48.1 miles
- Longest Channel Reach – 8.0 miles
- 79% Incorporated, 21% Unincorporated
- Major Water Bodies:
  - *Alhambra Creek*
  - *Franklin Creek*
  - *Arroyo del Hambre Creek*
  - *Vaca Creek*

The lower watershed retains a rural feeling in its higher elevations, thanks in part to Carquinez Strait Regional Shoreline Park. The lower elevations, defined by the flood plain of Alhambra Creek, steadily urbanized through the late 1800's and following the establishment of the Shell refinery in 1915.


Suisun Bay
Walnut Creek
Mt. Diablo Creek
Galindo Creek
Grayson Creek
Murderer's Creek
Pine Creek
Rellel Creek
Lafayette Reservoir
Las Trampas Crk.
Mt. Diablo
San Ramon Creek
Sycamore Creek
Bollinger Crk.
Alameda County
Figure 13. Central County Location Map
Major Watersheds and Creeks
N
Watershed Boundaries
Miles
0 0.5 1 2 3 4 5
CCCWP GIS 2003


Carquinez Strait Drainages
Peyton Creek Watershed
Alhambra Creek
The City of Martinez
Franklin Creek
Rodeo Creek Watershed
Nancy Boyd Creek
Vaca Creek
Arroyo Del Hambre
Alhambra Creek
Pinole Creek Watershed
Grayson/Murderer's Creek Watershed
San Pablo Creek Watershed
CCCWP GIS 2003
Figure 14. Alhambra Creek Watershed
Alhambra Creek Watershed Boundary
Alhambra CCMAP Sampling Sites
Alhambra Follow-up Studies
Restoration / Projects / Enhancements
N
0
0.5
1
2
Miles

Impervious surfaces are estimated to make up of approximately 15 percent of the land and 87 percent of the channel banks are currently natural, while 10 percent are concrete-lined. Mean daily flow for Rodeo Creek is estimated to be 7.2 cfs.

Briones Regional Park (EBRPD) located at the headwaters of Alhambra Creek, and other tracts of open space, agricultural lands, and semi-rural residential land help the upper watershed retain a rural feeling. Coastal Oak woodlands predominate on the north facing slopes of the upper and middle watershed, while annual grasslands are the predominant plant community throughout the watershed.

Fisheries

Data suggest that Alhambra Creek historically supported a small run of steelhead and continues to be visited by in-migrating steelhead in some years (Leidy et al. 2003). The current distribution of steelhead in the watershed is unknown.

Monitoring Activities

The Contra Costa Clean Water Program initiated the Contra Costa Monitoring and Assessment Plan (CCMAP) to assess the biological integrity of streams and the 'health' of watersheds in Contra Costa County. In 2001, 2002 and 2003, the Program conducted biological and physical habitat assessments, and general water quality monitoring in the Alhambra Creek watershed. Additionally, follow-up studies at four sites in the watershed are planned for 2004. Monitoring site locations and parameters sampled are presented in Figure 14.

4.22 Walnut Creek Watershed

Walnut Creek (8.23 mi.) and its many tributaries cover 145 square miles in the central portion of Contra Costa County. Draining the west side of Mt. Diablo, and the east side of the East Bay Hills, its major tributaries include: San Ramon Creek (12 mi.), Bollinger Canyon Creek (6.72 mi.), Las Trampas Creek (12.37 mi.), Lafayette Creek (3.78 mi.), Grayson Creek (7.49 mi.), Murderer's Creek (4.37 mi.), Pine Creek (12.65 mi.) and Galindo Creek (6.5 mi.). These tributaries constitute important watersheds in their own right, and are therefore discussed separate rather together (see below).

Walnut Creek Watershed General Characteristics	
• Elevation of Headwaters – 3849 ft.	
• Total Length of Channels– 309.8 miles	
• Longest Channel Reach – 28.7 miles	
• 60% Incorporated, 40% Unincorporated	
• Major Water Bodies:	
• *San Ramon Creek*	• *Bollinger Creek*
• *Pine Creek*	• *Galindo Creek*
• *Lafayette Creek*	• *Murderer's Creek*
• *Las Trampas Creek*	• *Grayson Creek*

The Cities of Walnut Creek, Lafayette, Pleasant Hill and Danville lie completely within the boundaries of the watershed, while the Cities of Concord, Martinez, and small areas of Moraga and San Ramon cross the watershed boundary.

The main stem of Walnut Creek has been significantly altered from its original morphology, due to urbanization and the increased need for flood control infrastructure. Various physical factors, most importantly land use, have affected the hydrology and groundwater in Walnut Creek. Urbanization of this popular

residential and commercial area ranges from low density ranchettes (areas of Lafayette) to highly urbanized commercial areas (Concord and Walnut Creek), with varying percentages of impervious surfaces driving the amount of water entering the system throughout the year. An extensive stormwater drainage system reroutes surface waters that once meandered freely across the valley floor that the cities of Concord, Walnut Creek and Danville now occupy.

Fisheries

Historical fisheries research suggests that Walnut Creek and a portion of its tributaries supported a steelhead population that was widely distributed (Leidy et al. 2003). In particular Lafayette, Bollinger Canyon and Pine Creeks were likely spawning grounds for these salmonids. Currently, steelhead regularly enter the lower reaches of Walnut Creek and migrate as far as the drop structure at Willow Pass Road.

Grayson & Murderers Creek Watersheds

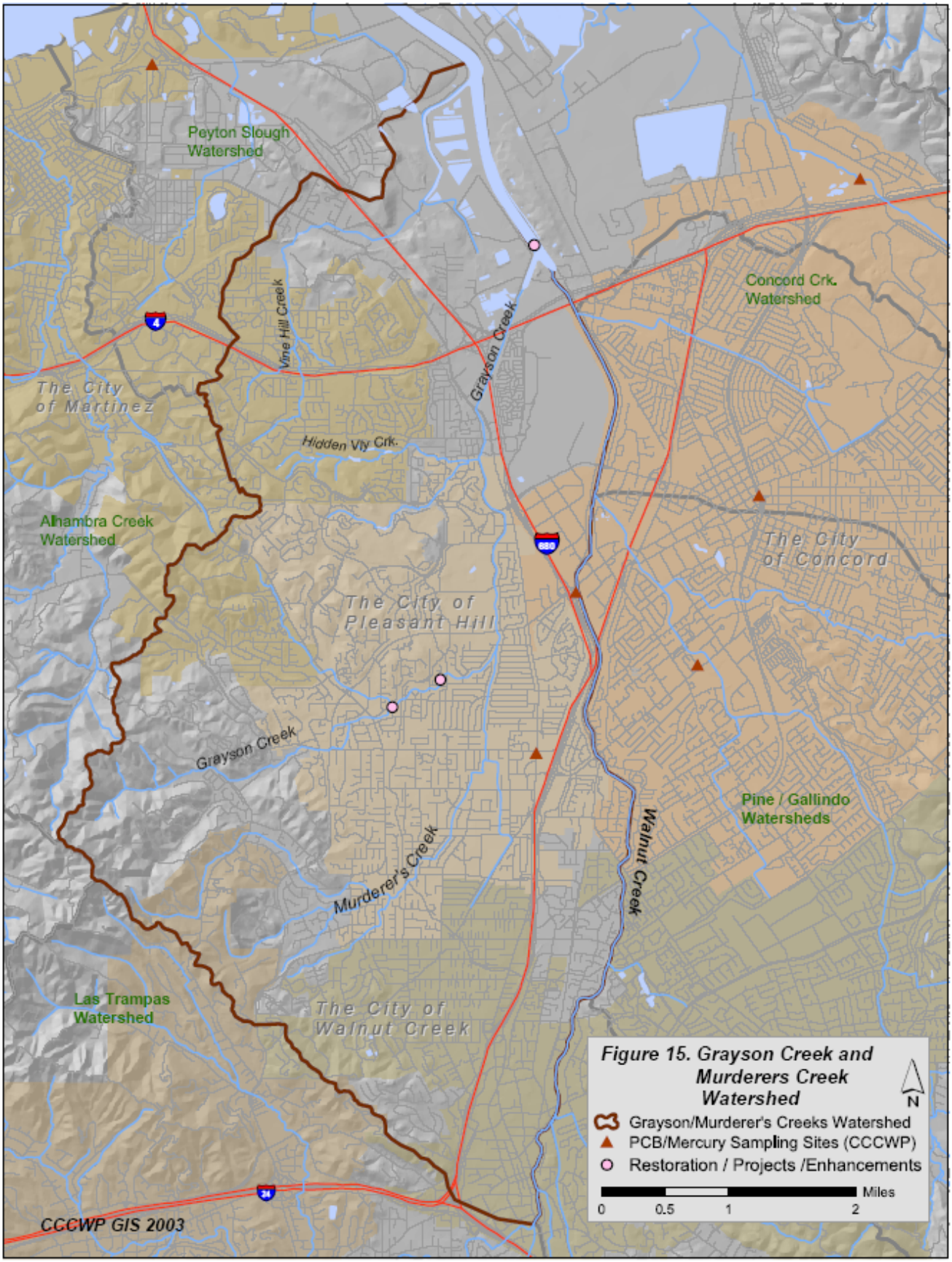
Grayson/Murderers Creeks Watershed General Characteristics
• Elevation of Headwaters – 1483 ft.
• Total Length of Channels– 25.4 miles
• Longest Channel Reach – 8.9 miles
• Major Water Bodies:
• *Vine Hill Creek* • *Hidden Valley Creek*

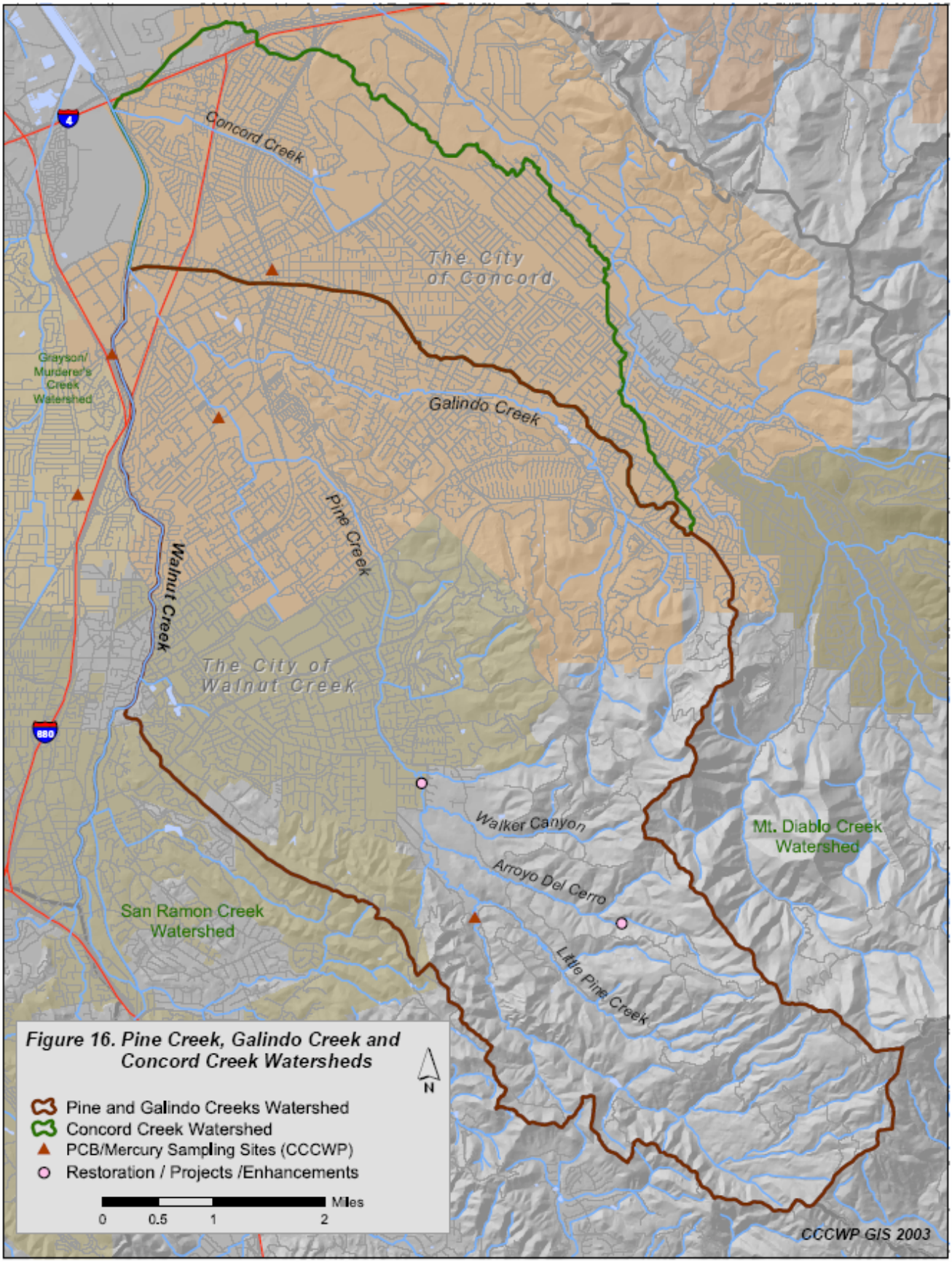
Grayson's Creek is the only major tributary to Walnut Creek that flows from the west. The creek originates in the Briones Hills and runs through the highly urbanized city of Pleasant Hill to join Walnut Creek in its lower reach (Figure 15). Grayson and Murderer's Creek watersheds encompass portions of the cities of Pleasant Hill, Concord, Walnut Creek, Martinez, Lafayette, and the unincorporated County. Much of Grayson Creek is confined within a concrete or earthen channel. Impervious surfaces in Grayson & Murderer's Creek Watersheds are estimated to make up approximately 45 percent of the land area. Mean daily flow for Grayson and Murderer's Creeks is approximately10.6 cfs.

Pine Creek / Galindo Creek Watersheds

Pine/Galindo Creeks Watershed General Characteristics
• Elevation of Headwaters – 3390 ft.
• Total Length of Channels– 60.0 miles
• Longest Channel Reach – 12.7 miles
• Major Water Bodies:
• *Little Pine Creek* • *Arroyo del Cerro*
• *Walker Canyon Creek*

The Pine/Galindo Creek watershed is roughly 31.5 square miles in area. Pine Creek is formed by many small tributaries (Little Pine Creek, Walker Canyon Creek and Arroyo del Cerro) draining the northwest slopes of Mt. Diablo and flows through the Ygnacio Valley, entering Walnut Creek in its lower reach (Figure 16). Galindo Creek is the lowermost tributary to Pine Creek that flows from the southeast and enters the creek approximately one mile above the confluence with Walnut Creek, just east of Highway 242. The lower portion of Pine Creek is mostly channelized by riprap, concrete or modified earthen banks, while Galindo Creek contains mostly natural channels. Impervious surfaces in the Pine/Galindo Creek watersheds are estimated to make up approximately 30 percent of the land area. Mean daily flow for the creeks is approximately14.8 cfs.


Peyton Slough Watershed
Vine Hill Creek
Grayson Creek
Concord Crk. Watershed
The City of Martinez
Hidden Vly Crk.
Alhambra Creek Watershed
The City of Concord
The City of Pleasant Hill
Grayson Creek
Pine / Gallindo Watersheds
Walnut Creek
Murderer's Creek
Las Trampas Watershed
The City of Walnut Creek
CCCWP GIS 2003
Figure 15. Grayson Creek and Murderers Creek Watershed
N
Grayson/Murderer's Creeks Watershed
PCB/Mercury Sampling Sites (CCCWP)
Restoration / Projects /Enhancements
Miles
0
0.5
1
2


Concord Creek
The City of Concord
Grayson/ Murderer's Creek Watershed
Galindo Creek
Pine Creek
Walnut Creek
The City of Walnut Creek
Walker Canyon
Mt. Diablo Creek Watershed
Arroyo Del Cerro
San Ramon Creek Watershed
Little Pine Creek
Figure 16. Pine Creek, Galindo Creek and Concord Creek Watersheds
N
Pine and Galindo Creeks Watershed
Concord Creek Watershed
PCB/Mercury Sampling Sites (CCCWP)
Restoration / Projects /Enhancements
Miles
0
0.5
1
2
CCCWP GIS 2003

Las Trampas Creek Watershed

Las Trampas Creek is formed by several small intermittent tributaries near Las Trampas Peak and flows north and eat to its confluence with San Ramon Creek. The watershed encompasses parts of the cities of Lafayette, Moraga and Walnut Creek and the unincorporated County (Figure 17). Impervious surfaces in the Las Trampas Creek watershed are estimated to make up approximately 25 percent of the land area. Mean daily flow for the creek is approximately15.4 cfs.

Las Trampas Creek Watershed General Characteristics
• Elevation of Headwaters –2020 ft.
• Total Length of Channels– 70.4 miles
• Longest Channel Reach – 12.4 miles
• Major Water Bodies:
• *Hidden Valley Creek* • *Reliez Creek*
• *Happy Valley Creek* • *Grizzly Creek*
• *Lafayette Creek* • *Tice Creek*

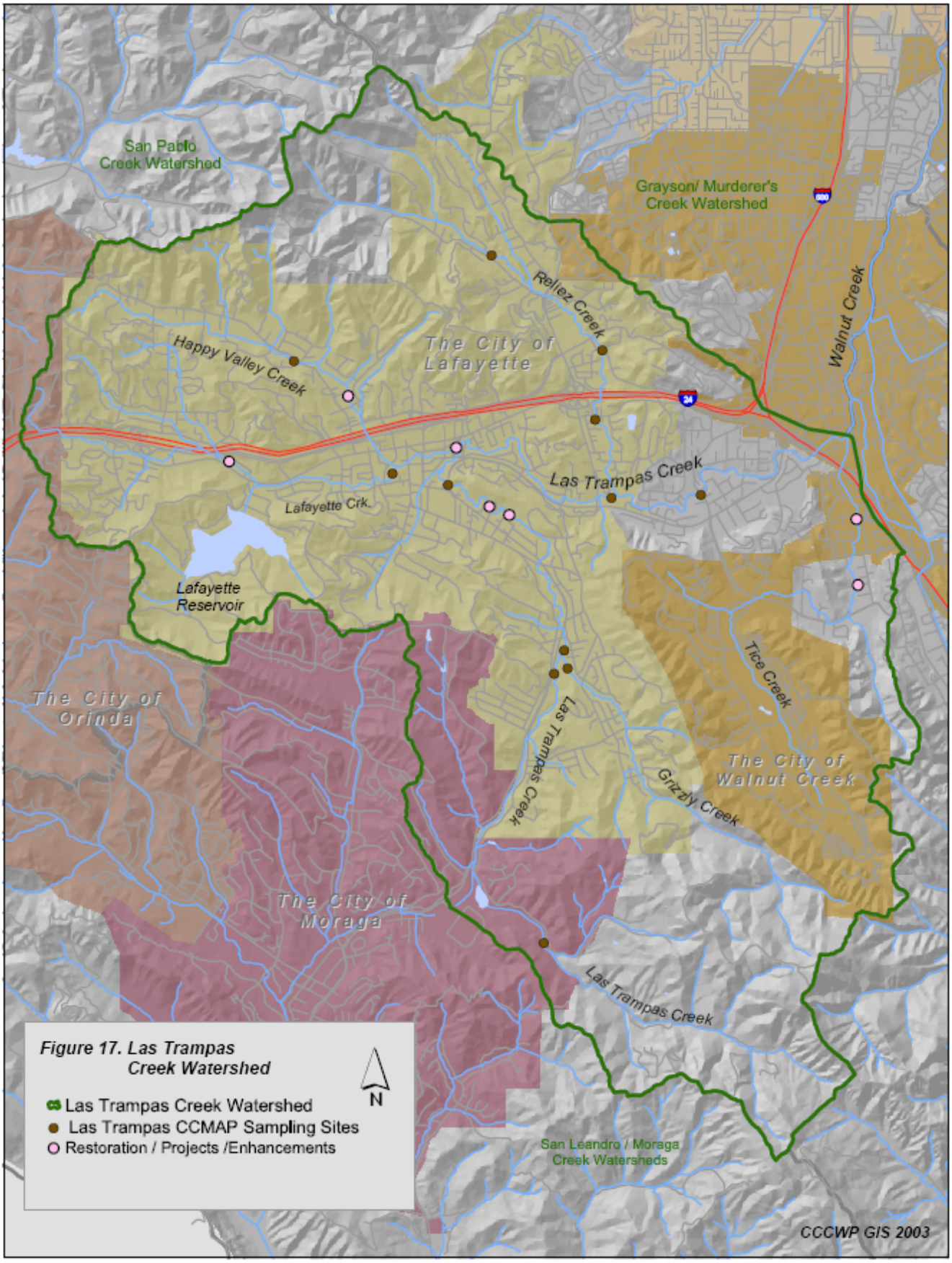
Monitoring Activities

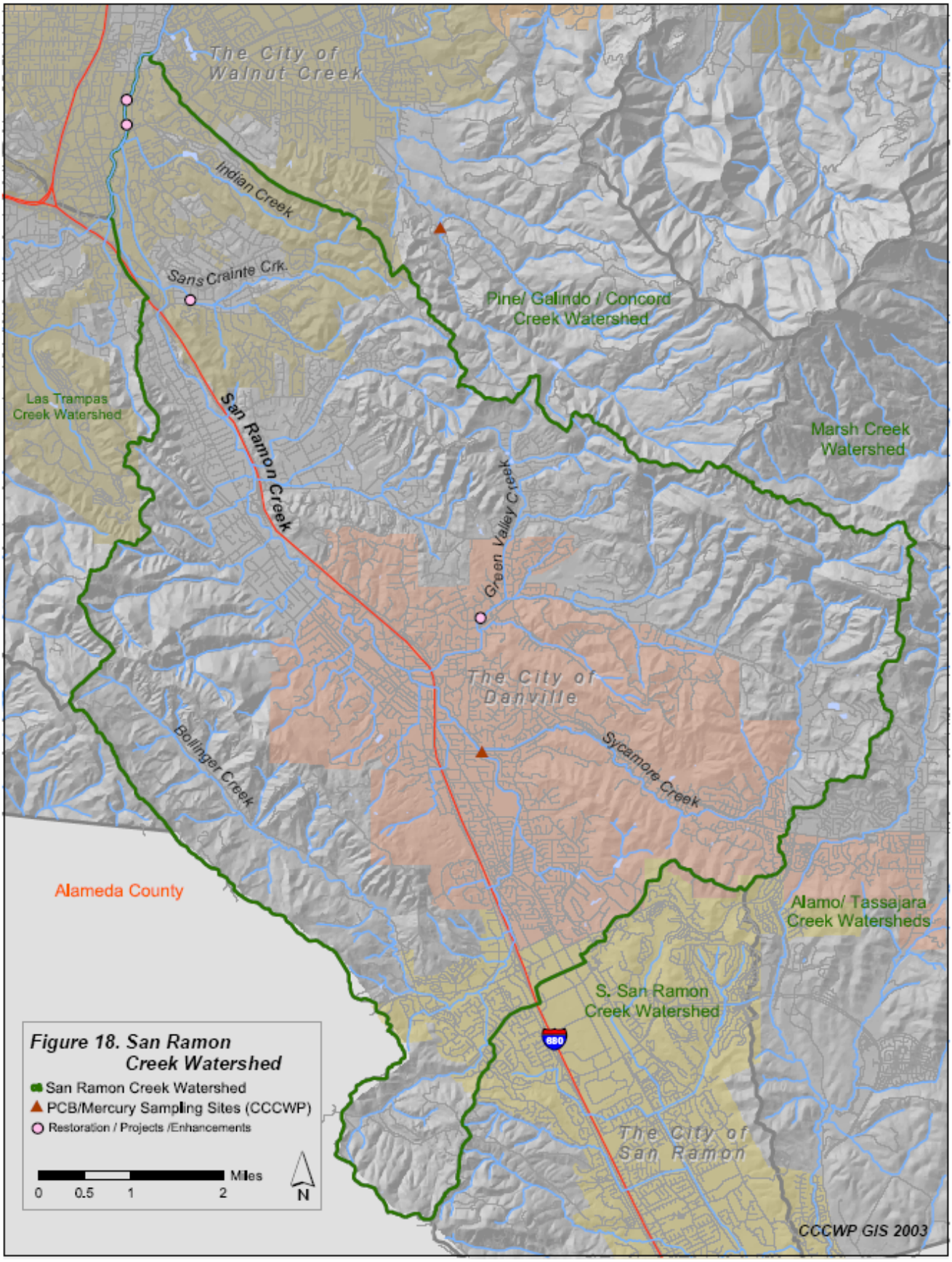
The Contra Costa Clean Water Program initiated the Contra Costa Monitoring and Assessment Plan (CCMAP) to assess the biological integrity of streams and the 'health' of watersheds in Contra Costa County in 2000. In 2003, the Program conducted biological and physical habitat assessments, and general water quality monitoring in the Las Trampas Creek watershed. Monitoring site locations and parameters sampled are presented in Figure 17.

San Ramon Creek Watershed

San Ramon Creek watershed drains an area of approximately 54 square miles. San Ramon Creek flows generally north to its confluence with Las Trampas Creek, where it becomes Walnut Creek. The watershed encompasses parts of the cities of Danville, San Ramon and Walnut Creek and the unincorporated County (Figure 18). Impervious surfaces in the San Ramon Creek watershed are estimated to make up approximately 20 percent of the land area. Mean daily flow for the creek is approximately 27.1 cfs. A large majority of the mainstem banks of San Ramon Creek are constructed earthen channels, while its tributaries are mostly natural.

San Ramon Creek Watershed General Characteristics
• Elevation of Headwaters –2060 ft.
• Total Length of Channels– 136.7 miles
• Longest Channel Reach – 18.9 miles
• 43% Incorporated, 57% Unincorporated
• Major Water Bodies:
• *Bollinger Canyon* • *Green Valley Creek*
• *Sycamore Creek*


San Pablo Creek Watershed
Grayson/ Murderer's Creek Watershed
Reliez Creek
Walnut Creek
Happy Valley Creek
The City of Lafayette
Las Trampas Creek
Lafayette Crk.
Lafayette Reservoir
Tice Creek
The City of Orinda
Las Trampas Creek
The City of Walnut Creek
Grizzly Creek
The City of Moraga
Las Trampas Creek
San Leandro / Moraga Creek Watersheds
CCCWP GIS 2003
Figure 17. Las Trampas Creek Watershed
N
Las Trampas Creek Watershed
Las Trampas CCMAP Sampling Sites
Restoration / Projects /Enhancements


The City of Walnut Creek
Indian Creek
Sans Crainte Crk.
Pine/ Galindo / Concord Creek Watershed
Las Trampas Creek Watershed
San Ramon Creek
Marsh Creek Watershed
Green Valley Creek
The City of Danville
Bollinger Creek
Sycamore Creek
Alameda County
Alamo/ Tassajara Creek Watersheds
S. San Ramon Creek Watershed
680
The City of San Ramon
Figure 18. San Ramon Creek Watershed
San Ramon Creek Watershed
PCB/Mercury Sampling Sites (CCCWP)
Restoration / Projects /Enhancements
Miles
0 0.5 1 2
N
CCCWP GIS 2003

4.23 Mt. Diablo Creek Watershed

Mt. Diablo Creek Watershed General Characteristics
• Elevation of Headwaters – 3849 ft.
• Total Length of Channels– 80.0 miles
• Longest Channel Reach – 17.2 miles
• 36% Incorporated, 64% Unincorporated
• Major Water Bodies:
• *Mt. Diablo Creek* • *Mitchell Creek*
• *Back Creek* • *Donner Creek*

Mt. Diablo Creek flows off the north slopes of Mt. Diablo, and travels north-easterly for 17 miles, before reaching its mouth in Suisun Bay (Figure 19). The Cities of Clayton and Concord are the two jurisdictions found here, with unincorporated County land accounting for approximately 64% of the watershed. The major land owner in this watershed is the United States Government, who operates the approximately 12,800 acre Naval Weapons Station. At the southernmost tip of the watershed, roughly one quarter of Mount Diablo State Park covers the headwaters of Mt. Diablo Creek tributaries Mitchell Creek, Back Creek and Donner Creek.

The upper watershed retains a relatively healthy riparian cover, due to larger lot sizes and local flood control easements on the creek itself. The lower reaches of the creek, however, have lost their riparian cover in many areas and increased erosion in the upper and middle reaches, and subsequent sedimentation is apparent. Where the creek runs through the Naval Weapons Station, intensive testing by the Navy has discovered both water and soil contamination from its operations, and former land use nearby.

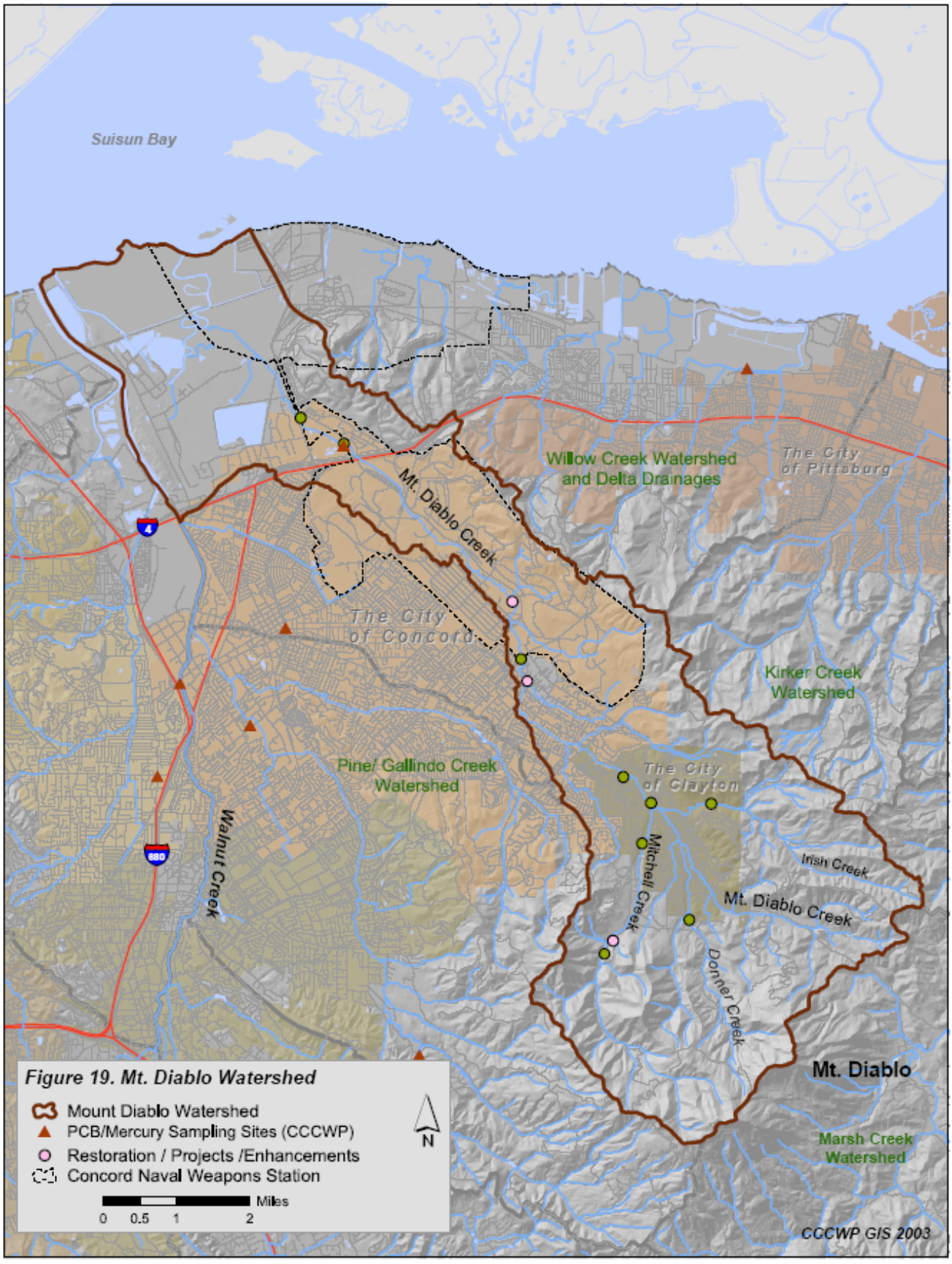
Impervious surface in the Mt. Diablo Creek watershed is estimated to make up approximately 20 percent of the land area. Mean daily flow for the creek is approximately16.5 cfs.

Fisheries

Fisheries research suggests that Mt. Diablo Creek and its tributaries were likely used by steelhead as a migratory corridor and spawning grounds (Leidy et al. 2003). Although not definitive, it also appears that suitable habitat may also be available within Mt. Diablo Creek, suggesting that steelhead may currently migrate and spawn in the watershed.

Monitoring Activities

The Surface Water Ambient Monitoring Program (SWAMP) is a statewide monitoring effort designed to assess the conditions of surface waters throughout the state of California. The SWAMP is directly funded by dischargers such as the Program. Responsibility for implementation of SWAMP activities in Contra Costa County resides with the San Francisco and Central Valley Regional Water Quality Control Boards. In 2002-2003, the SFBRWQCB conducted monitoring in the Mt. Diablo Creek watershed. Sampling site locations and parameters analyzed are presented in Figure 19.


Suisun Bay
Willow Creek Watershed and Delta Drainages
The City of Pittsburg
Mt. Diablo Creek
The City of Concord
Kirker Creek Watershed
Pine/ Gallindo Creek Watershed
The City of Clayton
Walnut Creek
Mitchell Creek
Irish Creek
Mt. Diablo Creek
Donner Creek
Mt. Diablo
Marsh Creek Watershed
CCCWP GIS 2003
Figure 19. Mt. Diablo Watershed
Mount Diablo Watershed
PCB/Mercury Sampling Sites (CCCWP)
Restoration / Projects /Enhancements
Concord Naval Weapons Station
N
Miles
0 0.5 1 2

4.24 Peyton Slough Watershed

Peyton Slough Watershed General Characteristics
• Elevation of Headwaters – 400 ft.
• Total Length of Channels– 8.1 miles
• Longest Channel Reach – 3.6 miles
• 53% Incorporated, 47% Unincorporated
• Major Water Bodies:
• *Peyton Creek* • *Peyton Slough*
• *MacNabney Marsh*

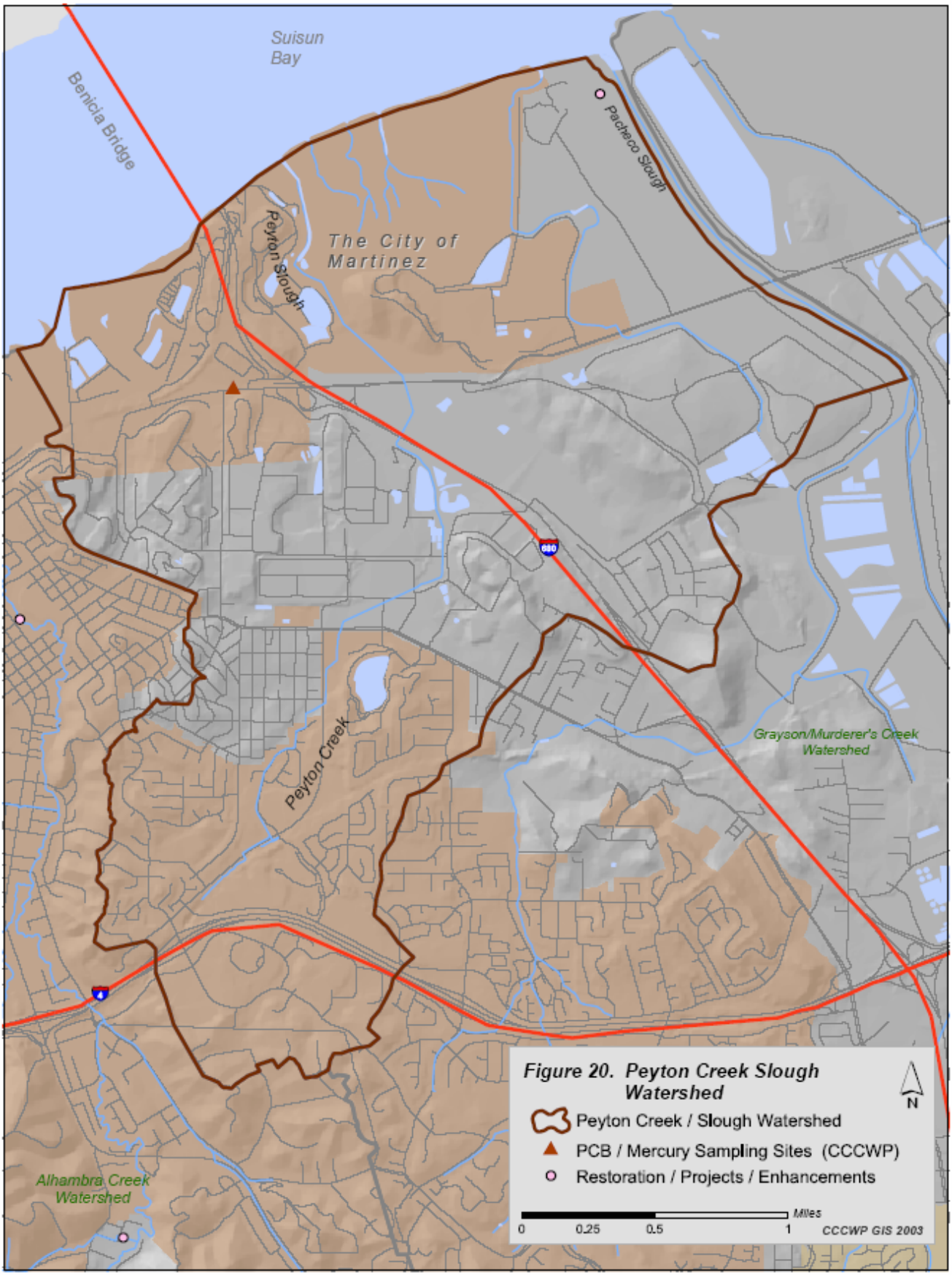
Located east of the Alhambra Creek watershed, this watershed that is 6.5 square miles in area has been subject to over 100 years of industrialization and urbanization. Peyton Creek, just over 1 mile long, is culverted underground for over a third of its length through residential and industrial areas (Figure 20). Over half of the watershed is urbanized, including the entire upper watershed. Early industry in the lower watershed included oil refining, chemical manufacturing and copper smelting, which brought both jobs and environmental concerns to the area. These remain important issues in the watershed today. The City of Martinez and unincorporated Contra Costa County are the two municipalities which lye within the boundaries of this watershed.

The water in the upper watershed is controlled by storm drain systems throughout this predominantly residential area, while the lower watershed, despite obvious industry nearby, retains some marshland habitat that was central to the early history of this area. Native Americans lived and frequented the local low-lying marshes here known for their abundant food sources. MacNabney Marsh, located in the Pacific Flyway, is home to many species of waterfowl and shorebirds, including the American White Pelican and Great Blue Heron.

Impervious surface in the Peyton Slough watershed is estimated to make up approximately 55 percent of the land area. Mean daily flow for Peyton Creek is approximately 3.7cfs.

4.3 East County Watersheds

East County contains eight (8) major watersheds and seven (7) major creeks. Figure 21 illustrates the major watersheds, creeks and political boundaries of the East County area. Each major watershed and its respective area are also listed in Table 5. Major creeks in these watersheds (East and West Antioch Creeks, Marsh Creek, Willow Creek and Kirker Creek) generally flow from south to north, discharging into the Suisun Bay and the San Joaquin River. A series of smaller creeks (Brushy Creek and Kellogg Creek) flow eastward into Old River and the Clifton Court Forebay (eastern border of Contra Costa County), which eventually enter the San Joaquin River. Marsh Creek watershed is approximately one third of the total acreage of East County (29.2 %). Coastal drainages (Kirker, Willow, East and West Antioch) are about 22.5%. The other eastern drainages comprise about 47% of the total area.


Suisun Bay
Benicia Bridge
Pacheco Slough
Peyton Slough
The City of Martinez
680
Peyton Creek
Grayson/Murderer's Creek Watershed
4
Alhambra Creek Watershed
Figure 20. Peyton Creek Slough Watershed
N
Peyton Creek / Slough Watershed
PCB / Mercury Sampling Sites (CCCWP)
Restoration / Projects / Enhancements
Miles
0
0.25
0.5
1
CCCWP GIS 2003

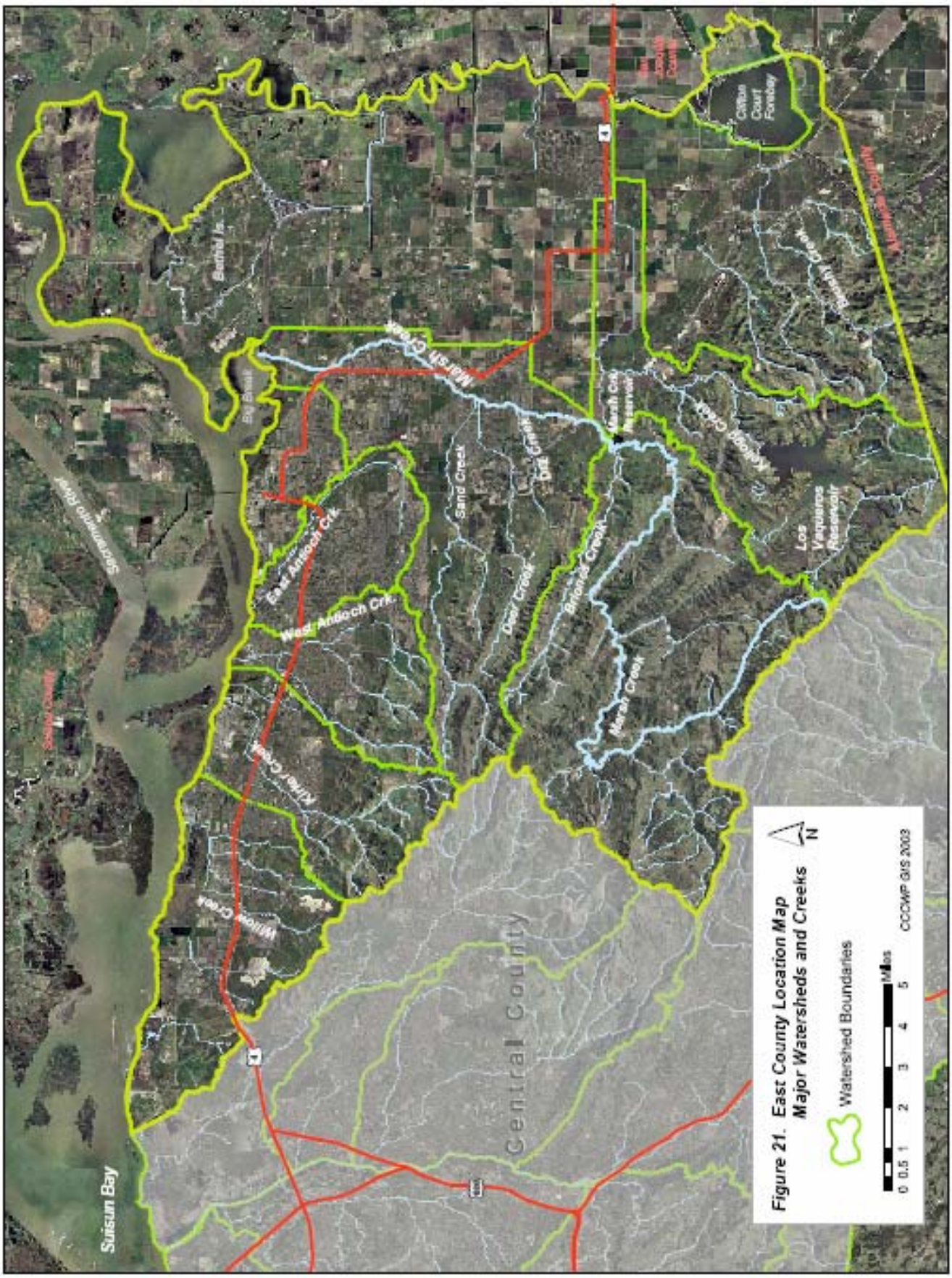

Suisun Bay
Central County
Sacramento River
Suisun Creek
Montezuma Slough
Marsh Creek
Kirker Creek
Willow Creek
West Antioch Crk.
East Antioch Crk.
Sand Creek
Deer Creek
Briones Creek
Marsh Creek
Los Vaqueros Reservoir
Kellogg Creek
Contra Costa County
Alameda County
Figure 21. East County Location Map
Major Watersheds and Creeks
Watershed Boundaries
Miles
0 0.5 1 2 3 4 5
CCCWP GIS 2003
N

Table 5. Major East County watersheds in Contra Costa County (Contra Costa Clean Water Program GIS 2003)		
WATERSHED NAME	**AREA**	
	Acres	**Sq Miles**
Brushy Creek	23724.8	37.1
East Antioch Creek	7261.0	11.4
West Antioch Creek	8182.0	12.8
Kellogg Creek	20867.1	32.6
Kirker Creek	11108.3	17.4
Lower Marsh Creek	27059.2	42.3
Upper Marsh Creek	32930.4	51.5
Willow Creek and Coastal Drainages	15086.7	23.6

4.31 West and East Antioch Creek Watersheds

The 24 square mile (15443 acre) watershed of West and East Antioch Creeks is located in the north-eastern part of Contra Costa County (Figure 22). The watershed drains the north side of the Mt. Diablo Foothills into the Sacramento-San Joaquin River Delta. The majority of the watershed lies within The City of Antioch, with only a small portion of unincorporated County land at the headwaters of West Antioch Creek and its tributaries.

West Antioch Creek Watershed

West Antioch Creek watershed is approximately 12.8 square miles in area. Two major creeks (West Antioch Creek and Markley Creek) and two reservoirs (??) receive the runoff from the watershed. West Antioch Creek is roughly 6.2 miles in length and its tributaries begin at 1530 feet in the Mt. Diablo Foothills, land predominantly owned by the East Bay Regional Park District. Markley Creek also begins in the foothills and joins West Antioch Creek just below Highway 4.

West Antioch Creek Watershed General Characteristics
• Elevation of Headwaters – 1,530 ft.
• Total Length of Channels– 26.53 miles
• Longest Channel Reach – 6.24 miles
• 65% Incorporated, 35% Unincorporated
• Major Water Bodies:
◦ *Markley Creek*

Although channelized in its lower half, West Antioch Creek remains above ground for most of its length, before emptying into the Dow Wetlands Preserve. Two small tributaries between the two creeks have large sections underground in culverts to accommodate single-family housing. An extensive stormwater drainage system funnels stormwater from these relatively low lying residential areas into these four drainages.

Impervious surface in the West Antioch Creek watershed is estimated to make up approximately 35 percent of the land area. Mean daily flow for the creek is approximately 5.2 cfs.

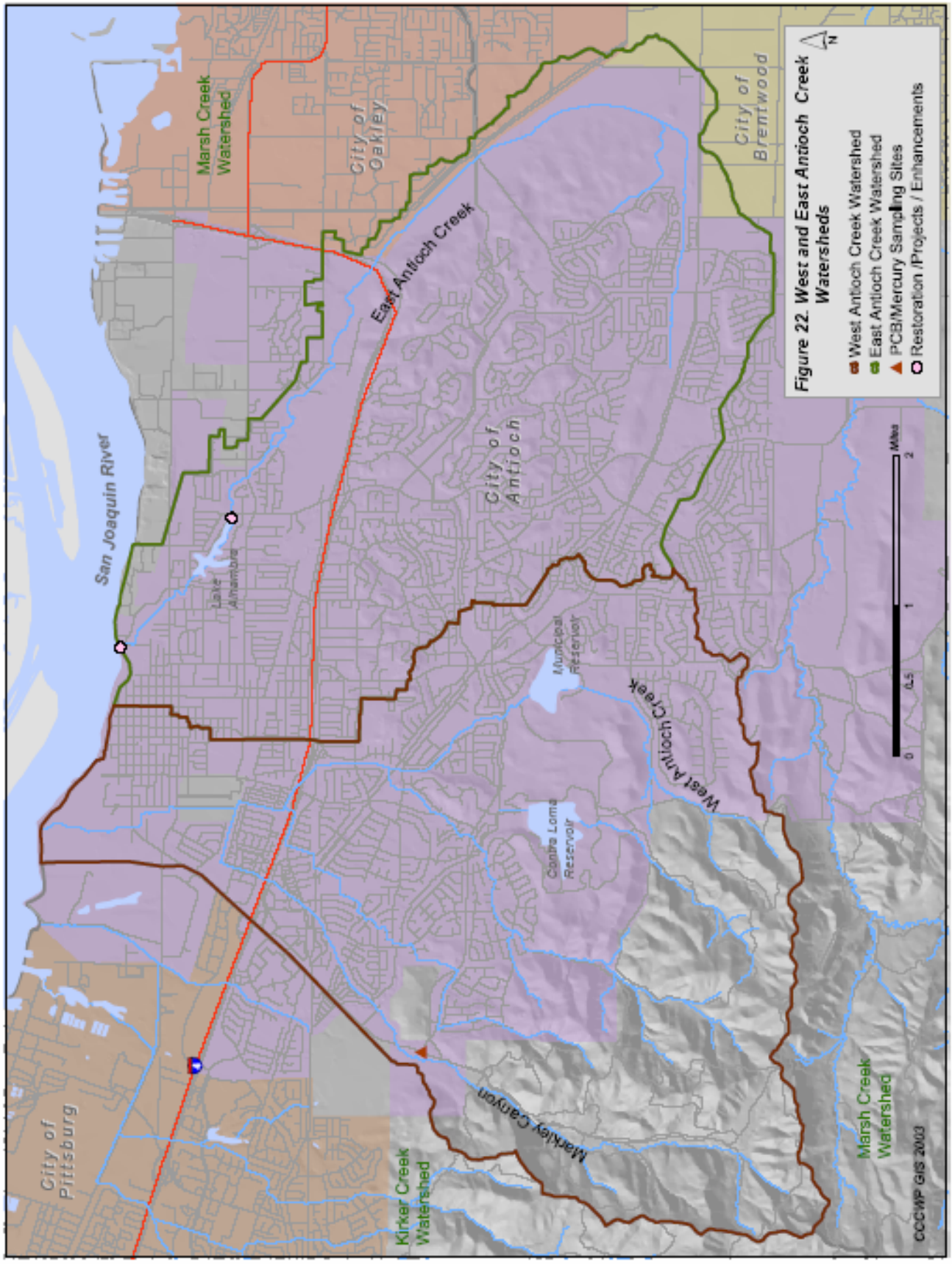


Figure 22. West and East Antioch Creek Watersheds
West Antioch Creek Watershed
East Antioch Creek Watershed
PCB/Mercury Sampling Sites
Restoration /Projects / Enhancements
Miles
0
0.5
1
2
N
Marsh Creek Watershed
City of Oakley
City of Brentwood
East Antioch Creek
San Joaquin River
Lake Alhambra
City of Antioch
Municipal Reservoir
West Antioch Creek
Contra Loma Reservoir
Markley Canyon
Marsh Creek Watershed
Kirker Creek Watershed
City of Pittsburg
CCCWP GIS 2003

East Antioch Creek Watershed

East Antioch Creek watershed is approximately 11.4 square miles in area. East Antioch Creek, a 7.8 mile intermittent stream, flows through low lying topography in the eastern most part of the watershed. The highest elevation in the East Antioch Creek system (located at the edge of the San Joaquin Valley and Mt. Diablo Foothills) is approximately 200 feet.

East Antioch Creek Watershed General Characteristics
• Elevation of Headwaters – 200 ft.
• Total Length of Channels– 8.7 miles
• Longest Channel Reach – 7.9 miles
• 99% Incorporated, 1% Unincorporated

East Antioch Creek runs through an area where soils and the underlying geology have med-high permeability. Various detention basins and levees are located along the length of the reach to allow infiltration, and prevent stormwater from moving into the Marsh Creek drainage area, which it has done historically during flood events. Impervious surface in the East Antioch Creek watershed is estimated to currently make up approximately 35 percent of the land area. Mean daily flow for East Antioch Creek is approximately 6.5cfs.

4.32 Kellogg Creek and Brushy Creek Watersheds

The 70.7 square mile watershed of Kellogg and Brushy Creeks is located in the south-eastern portion of Contra Costa County, bordering Alameda and San Joaquin Counties (Figure 23). Due to the rain shadow effect off Mt. Diablo, average rainfall in the upper watershed averages approximately 20 inches per year, and falls to 10 inches or less in the lower parts of the watershed. Developed areas remain at a minimum here, with all of the land part of Unincorporated Contra Costa County.

Kellogg Creek Watershed

The Kellogg Creek watershed is roughly 32.6 square miles in area, which is entire made up of open space. Additionally, impervious surfaces in the watershed currently make up only five (5) percent of the land. This lack of urbanization is mostly due to the Los Vaqueros Reservoir, a facility owned by the Contra Costa Water District, that can store up to 100,000 acre-ft. of water, pumped to the facility from an intake at Old River near Discovery Bay, and is used to serve 450,000 customers in Contra Costa County during the summer months. Originally known as 'Arroyo de los Posos' the 21 mile Kellogg Creek barely resembles its original course through the area referred to as Poso de los Vaqueros or Cowboy's Spring, during the time of the Mission San Jose. During Mexican rule, the area (and part of Brushy Creek Watershed) was known as 'Los Vaqueros', which it is still referred to by today. Both Kellogg and Brushy Creek were diverted and altered by farmers in the north and eastern parts of the

Kellogg Creek Watershed General Characteristics
• Elevation of Headwaters – 2280 ft.
• Total Length of Channels– 67.6 miles
• Longest Channel Reach – 25.3 miles
• 0% Incorporated, 100% Unincorporated
• Major Water Bodies:
• *Kellogg Creek* • *Los Vaqueros Reservoir*
• *Mallory Creek*

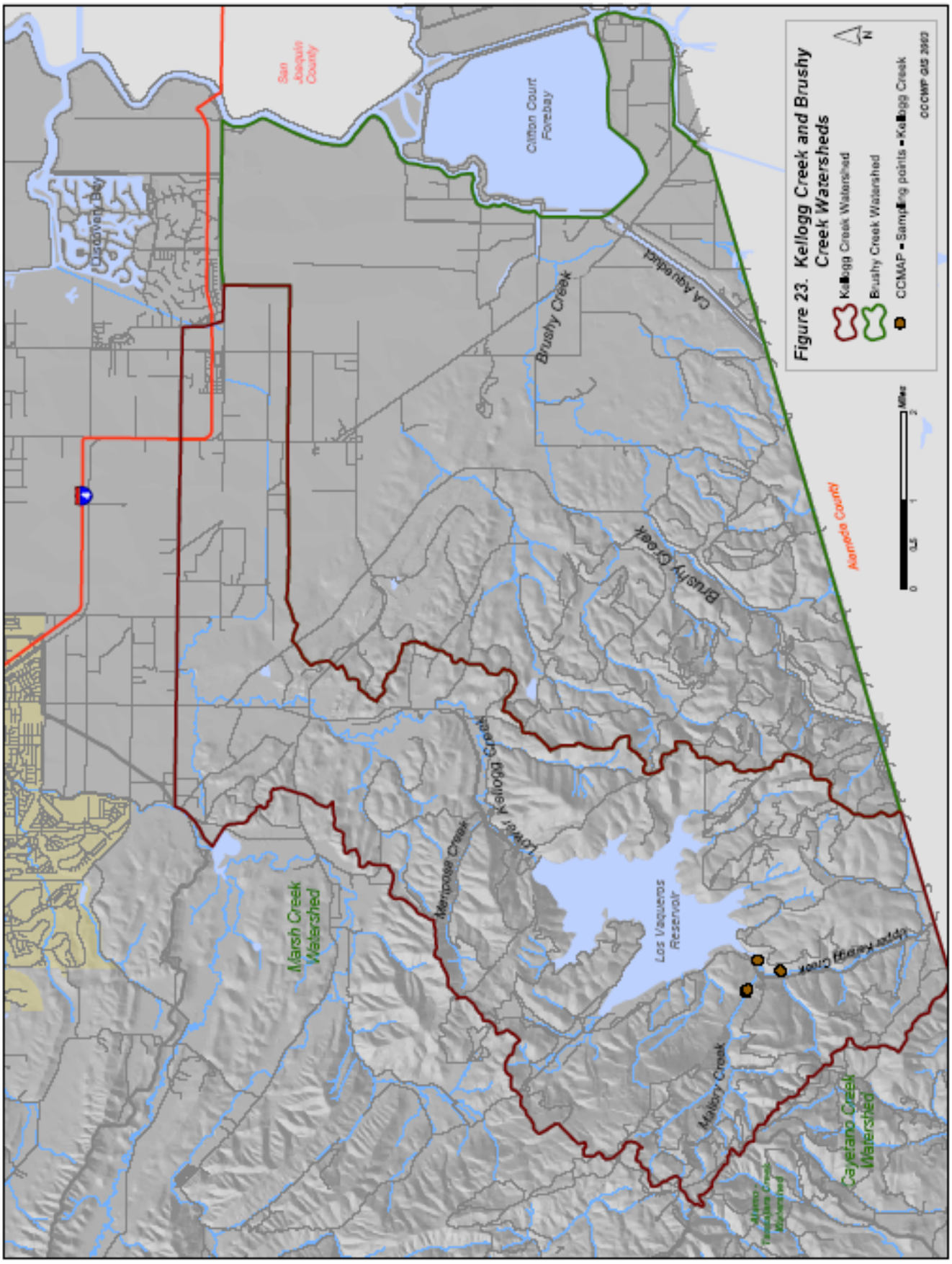


Figure 23. Kellogg Creek and Brushy Creek Watersheds
Kellogg Creek Watershed
Brushy Creek Watershed
CCMAP = Sampling points - Kellogg Creek
CCCMWP GIS 2009
N
Miles
0
0.5
1
2
San Joaquin County
Clifton Court Forebay
Discovery Bay
CA Aqueduct
Brushy Creek
Brushy Creek
Alameda County
Lower Kellogg Creek
Marsh Creek Watershed
Mariposa Creek
Los Vaqueros Reservoir
Upper Kellogg Creek
Marsh Creek
Cayetano Creek Watershed

watershed, where Marsh, Kellogg and Brushy Creeks enter the alluvial plain of the East County (where it now passes through heavily irrigated agricultural lands).

Monitoring Activities

The Contra Costa Clean Water Program initiated the Contra Costa Monitoring and Assessment Plan (CCMAP) to assess the biological integrity of streams and the 'health' of watersheds in Contra Costa County in 2000. In 2002 and 2003, the Program conducted biological and physical habitat assessments, and general water quality monitoring in the Kellogg Creek watershed. Monitoring site locations and parameters analyzed are presented in Figure 23.

Brushy Creek Watershed

Brushy Creek Watershed General Characteristics
• Elevation of Headwaters – 1220 ft.
• Total Length of Channels– 45.9 miles
• Longest Channel Reach – 12.5 miles
• 0% Incorporated, 100% Unincorporated

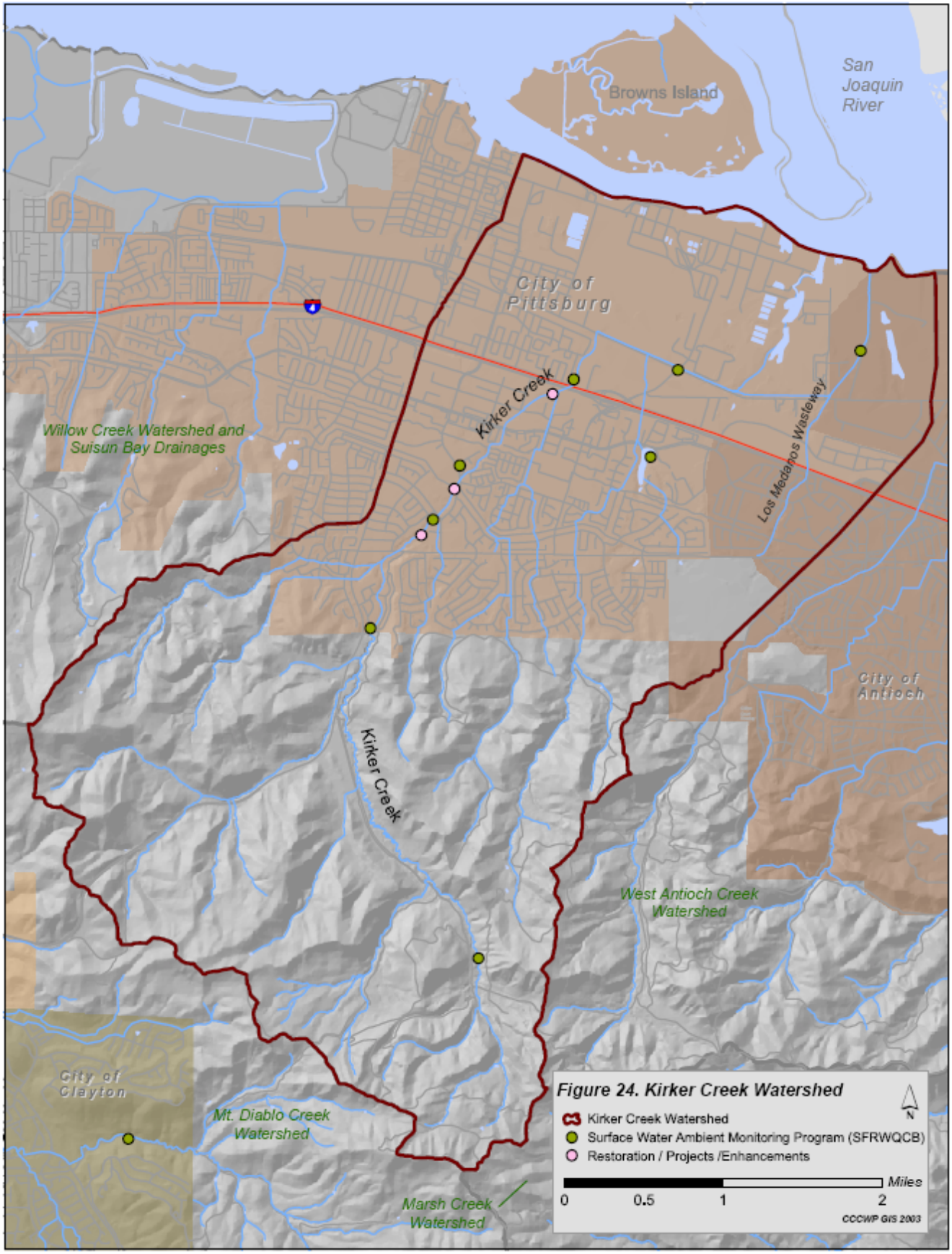
Brushy Creek watershed is approximately 37.1 square miles in area. to surrounding watersheds in the region, the Brushy Creek watershed has seemed to hide from the development that has spread to other parts of the County. The watershed is currently used predominately for agriculture and the eight (8) mile Brushy Creek and its tributaries play an important role in local irrigation efforts of this land. Impervious surfaces currently make up less than 5 percent of the land in the watershed.

4.33 Kirker Creek Watershed

Kirker Creek Watershed General Characteristics
• Elevation of Headwaters – 1900 ft.
• Total Length of Channels– 43.7 miles
• Longest Channel Reach – 9.4 miles
• 42% Incorporated, 58% Unincorporated

The Kirker Creek watershed is located in north-eastern Contra Costa County, bordering West Antioch Creek watershed to the east, and Willow Creek watershed from the west (Figure 24). The main branch of Kirker Creek originates in Black Diamond Mines Regional Preserve, owned by the EBRPD. As it flows from its headwaters (1900 ft.) the creek traverses regional parkland and ranchland in the foothills, suburban residential neighborhoods and commercial areas in the City of Pittsburg, industrial areas on the waterfront, and a wetlands preserve (Dow Chemical) at its mouth. Although interspersed throughout the lower watershed, impervious surfaces currently cover approximately 30 percent of the land.

Because the main source of water in Kirker Creek is precipitation, the intermittent creek flows primarily in the rainy season (November through April) and recedes in the summer. Irrigation and related urban runoff produce some dry-weather flows that keeps areas of the creek wet throughout the year. Mean annual daily flow is estimated to be 6.5 cfs for Kirker Creek, while annual rainfall averages approximately 16.5 inches in the upper reaches.


Browns Island
San Joaquin River
City of Pittsburg
Kirker Creek
Los Medanos Wasteway
Willow Creek Watershed and Suisun Bay Drainages
Kirker Creek
City of Antioch
West Antioch Creek Watershed
City of Clayton
Mt. Diablo Creek Watershed
Marsh Creek Watershed
Figure 24. Kirker Creek Watershed
Kirker Creek Watershed
Surface Water Ambient Monitoring Program (SFRWQCB)
Restoration / Projects /Enhancements
Miles
0
0.5
1
2
CCCWP GIS 2003

Originally flowing 9.4 miles north to its mouth in New York Slough, Kirker Creek was diverted in the 1940's to surpass the U.S. Steel property. Now it is diverted into the Los Medanos Wasteway and Dowest Slough before reaching New York Slough. The lower reaches of the Kirker Creek watershed reflect the historic use of these flat areas for medium and heavy industry. Creek channels throughout this area are diverted and managed in many places, to control flow through residential and industrial areas. Roughly 78 percent of the channels in the watershed remain natural. Heavy industry in the area include: chemical plants, power plants, sanitation districts and recycling centers. The tidal area of the Concord Naval Weapons Station encompasses approximately 3000 acres in the west part of the watershed.

Monitoring Activities

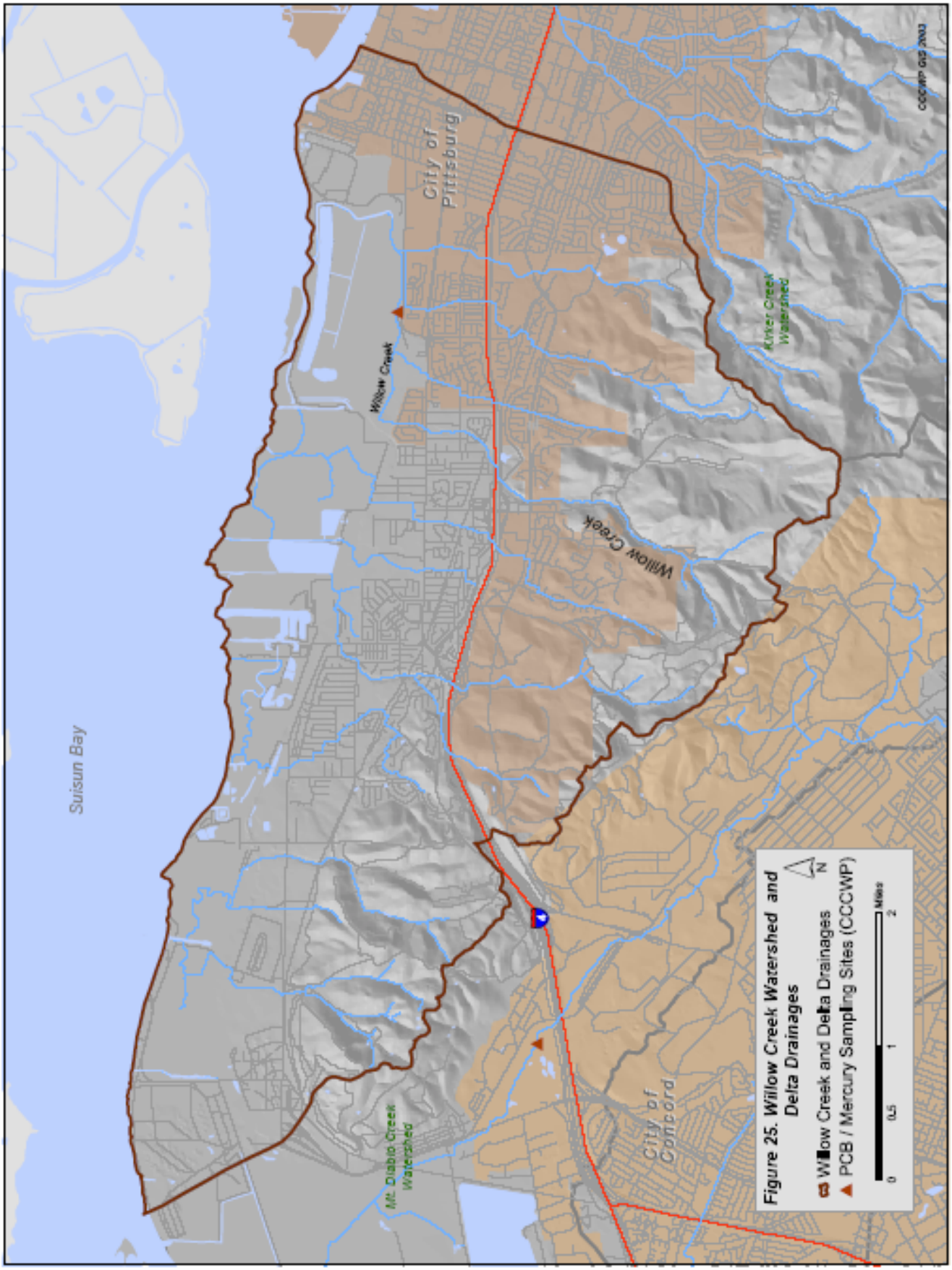
The Surface Water Ambient Monitoring Program (SWAMP) is a statewide monitoring effort designed to assess the conditions of surface waters throughout the state of California. The SWAMP is directly funded by dischargers such as the Program. Responsibility for implementation of SWAMP activities in Contra Costa County resides with the San Francisco and Central Valley Regional Water Quality Control Boards. In 2002-2003, the SFBRWQCB conducted monitoring in the Kirker Creek watershed. Sampling site locations and parameters analyzed are presented in Figure 25.

4.34 Willow Creek Watershed

Willow Creek Watershed General Characteristics
• Elevation of Headwaters – 1438 ft.
• Total Length of Channels– 44.8 miles
• Longest Channel Reach – 6.2 miles
• 36% Incorporated, 64% Unincorporated

Sub-drainages of the north and north-eastern slopes of the Mt. Diablo Foothills drain into the Sacramento-San Joaquin River Delta from Bay Point to Eastern Antioch. In the eastern-most section of these hills, the Willow Creek watershed encompass approximately 23.6 square miles of diverse landscape; from rolling grasslands and restored wetlands to high density industrial complexes. The City of Pittsburg and the community of Bay Point (unincorporated County) are the main population centers here (Figure 25). Impervious surfaces make up approximately 25 percent of the land area in the watershed.

Willow Creek (6 mi.), located in the middle of the watershed, is the largest creek in the watershed with approximately 10 miles of unnamed tributaries joining it in its lower reaches. Most of the lower reaches of these tributaries, including creeks to the east of Willow Creek, are underground in culverts, passing through the single family residential neighborhoods of Bay Point and Pittsburg.


Suisun Bay
City of Pittsburg
Willow Creek
Willow Creek
Kirker Creek Watershed
Mt. Diablo Creek Watershed
City of Concord
CCCWP GIS 2003
Figure 25. Willow Creek Watershed and Delta Drainages
Willow Creek and Delta Drainages
PCB / Mercury Sampling Sites (CCCWP)
N
Miles
0
0.5
1
2

4.35 Marsh Creek Watershed

Marsh Creek Watershed General Characteristics	
• Elevation of Headwaters – 3849 ft.	
• Total Length of Channels– 167.2 miles	
• Longest Channel Reach – 34.6 miles	
• 27% Incorporated, 73% Unincorporated	
• Major Water Bodies:	
• *Curry Canyon*	• *Dry Creek*
• *Sycamore Creek*	• *Sand Creek*
• *Dunn Creek*	• *Marsh Reservoir*
• *Briones Creek*	• *Deer Creek*

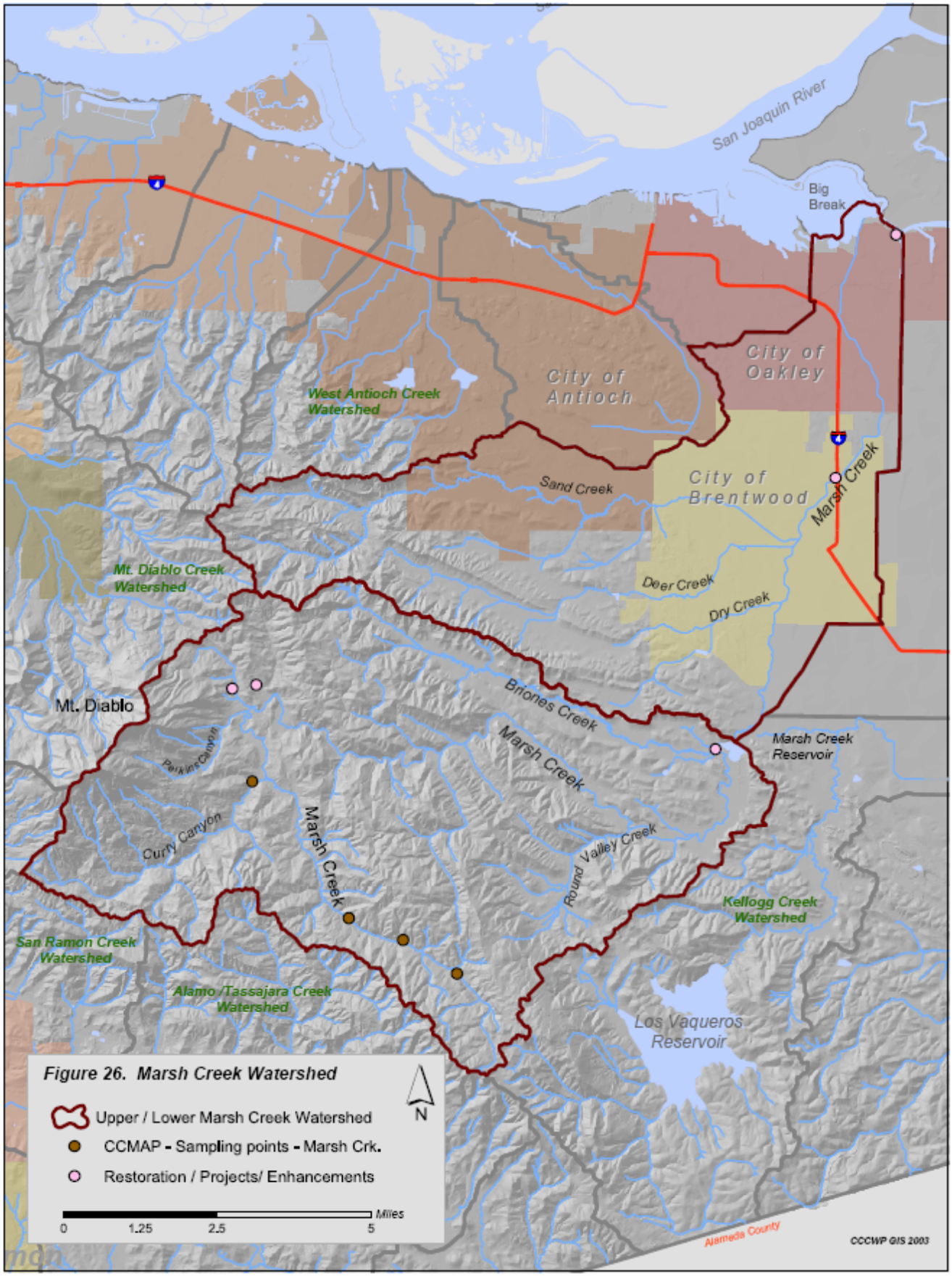
With its headwaters in the Morgan Territory (Mt. Diablo foothills) and off the east and southeast flanks of Mt. Diablo, Marsh Creek flows approximately 34 mi. before exiting into the San Joaquin River Delta at Big Break (Figure 26). The second largest watershed in the County, the watershed encompasses approximately 94 square miles in Eastern Contra Costa County. Tributaries in the Upper watershed include Curry Canyon Creek (5.8 mi.), Sycamore Creek (4 mi.) and Briones Creek (13 mi.), which flows into the Marsh Creek Reservoir. Running southeast and easterly off the Mt. Diablo Foothills, tributaries entering the middle portion of the main stem near and in the City of Brentwood include: Dry Creek (5.8 mi.), Sand Creek (18.74 mi.) and Deer Creek (9 mi.). North of the Marsh Creek Reservoir, Marsh Creek runs through the jurisdictions of the City of Brentwood and The City of Oakley. A small portion of the northern section of the watershed lies in the city limits of Antioch.

Eastern Contra Costa County has been an important agricultural center since the mid-1800's. Early settlers planted orchards in the flat, alluvial plain where the availability of water from Marsh Creek, Old River and the Sacramento River, made the area a perfect choice for growing and shipping fruit and produce. Railroad lines passing through both Brentwood and Oakley secured this region as a major supplier. As a result, hydrology in the eastern portion of the watershed is complex due to the number of irrigation canals and diversions. The eastern watershed boundary for the Marsh Creek watershed was produced with CCC Flood Control drainage inventory and topographical information only.

Marsh Creek goes through a diverse gamut of hydrologic, geologic and topographic changes as it leaves its steep, rocky headwaters and enters the alluvial plain north of the Marsh Creek Reservoir. Historically, Marsh Creek has meandered through this alluvial area unfettered, as witnessed on historic maps from the area. However, since 1856 and the establishment of Rancho Los Meganos, and more drastically after the turn of the century, farmers and flood control authorities have altered the channel and the surrounding landscape dramatically to protect agricultural resources. Building levees, detention basins, dams, and reservoirs, as well as culverting, straightening, and creating concrete-lined channels, led to a severe reduction in riparian habitat and vegetation, as well as the intended alteration of flow. Today, Marsh Creek and its tributaries are managed by flood control structures, and do not resemble the Marsh Creek of the past.

Fisheries

Historically data suggests that steelhead were likely present in the Marsh Creek watershed at least in some years (Leidy et al. 2003). Construction of drop structures and the Marsh Creek Reservoir have likely blocked any existing runs of steelhead from reaching suitable habitat in the headwaters of Marsh Creek.


San Joaquin River
Big Break
City of Oakley
City of Antioch
West Antioch Creek Watershed
Sand Creek
City of Brentwood
Marsh Creek
Mt. Diablo Creek Watershed
Deer Creek
Dry Creek
Mt. Diablo
Briones Creek
Marsh Creek
Marsh Creek Reservoir
Perkins Canyon
Curry Canyon
Marsh Creek
Round Valley Creek
Kellogg Creek Watershed
San Ramon Creek Watershed
Alamo /Tassajara Creek Watershed
Los Vaqueros Reservoir
Figure 26. Marsh Creek Watershed
N
Upper / Lower Marsh Creek Watershed
CCMAP - Sampling points - Marsh Crk.
Restoration / Projects/ Enhancements
Miles
0
1.25
2.5
5
Alameda County
CCCWP GIS 2003

Monitoring Activities

The Contra Costa Clean Water Program initiated the Contra Costa Monitoring and Assessment Plan (CCMAP) to assess the biological integrity of streams and the 'health' of watersheds in Contra Costa County in 2000. In 2002 and 2003, the Program conducted biological and physical habitat assessments, and general water quality monitoring in the Upper Marsh Creek watershed. Monitoring site locations and parameters analyzed are presented in Figure 26.

Contra Costa County conducted a study in 1995 to assess sources of mercury in the Marsh Creek watershed. Water, suspended sediments and flow were analyzed at 18 sites throughout Marsh Creek watershed to estimate relative mercury loadings into Marsh Creek and Marsh Creek Reservoir from tributaries. Additionally, multiple groups of aquatic invertebrates and fish were sampled from stream and reservoir locations.

4.4 South County Watersheds

The watersheds of the South County encompass approximately 11 percent of Contra Costa County. These watersheds comprise small areas of the upper watersheds of major creek systems to the south, which includes the Alameda Creek and the San Leandro Creek systems (Figure 27).

A total of four watersheds are discussed. Each major watershed and its respective area are listed in Table 6. Major creeks in these watersheds include: South San Ramon Creek, San Leandro/Moraga Creeks, Alamo/Tassajara Creeks and Cayetano Creek. It is important to note that only the watershed areas that lie within Contra Costa County are discussed.

Table 6. Major South County watersheds in Contra Costa County (Contra Costa Clean Water Program GIS 2003)

WATERSHED NAME	AREA	
	Acres	Sq Miles
Upper Alameda Creek Watershed		
Upper South San Ramon Creek	8365.2	13.1
Cayetano Creek	4407.5	6.9
Alamo Creek / Tassajara Creek	26392.1	41.2
San Leandro / Moraga Creek Watershed	13196.9	20.6

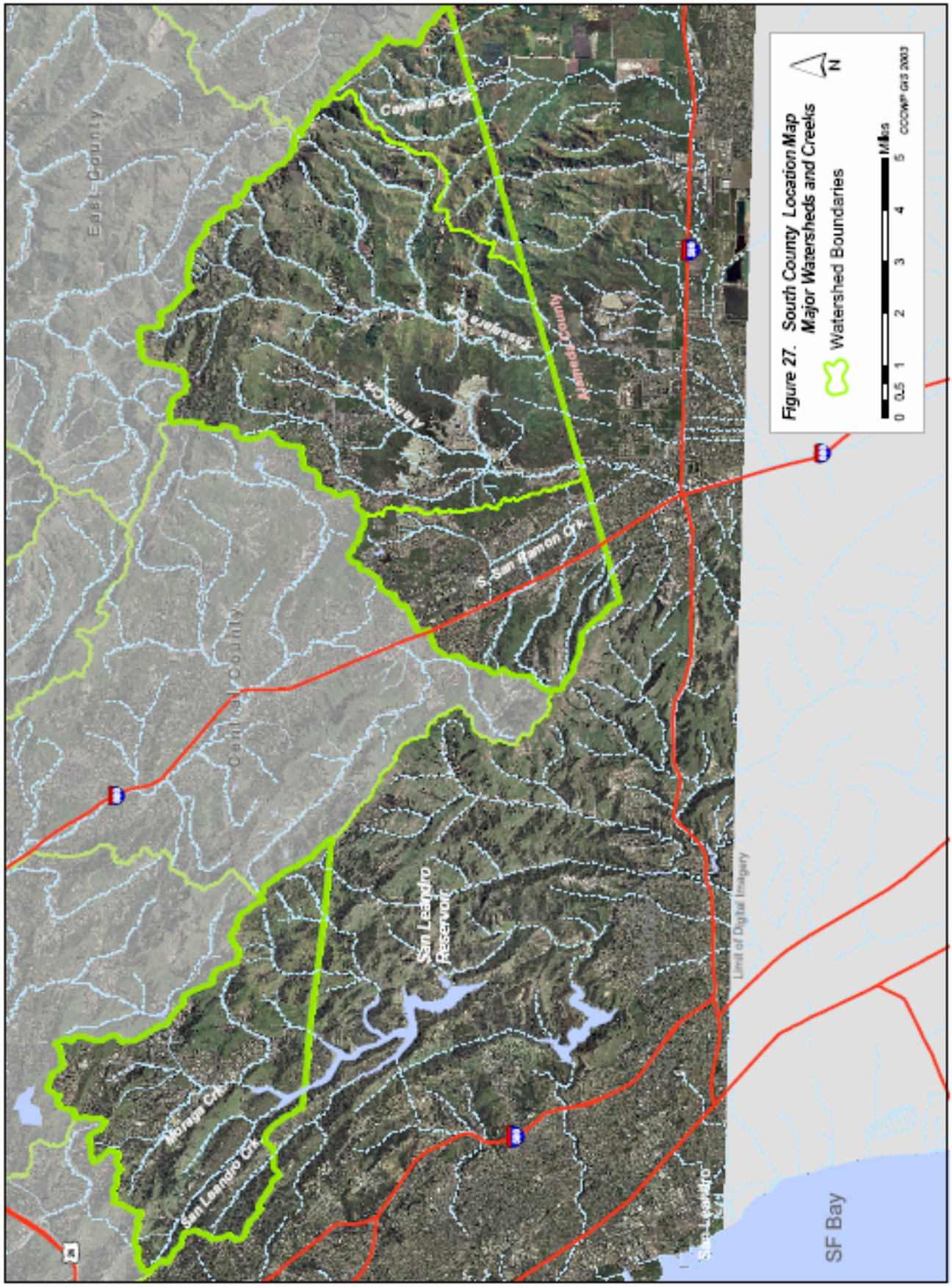


Figure 27. South County Location Map
Major Watersheds and Creeks
Watershed Boundaries
N
Miles
0 0.5 1 2 3 4 5
CCCWP GIS 2003
Alameda County
Contra Costa County
Cayetano Crk.
Tassajara Crk.
Arroyo Crk.
S. San Ramon Crk.
San Leandro Reservoir
Moraga Crk.
San Leandro Crk.
Limit of Digital Imagery
SF Bay

4.41 Upper Alameda Creek Watershed

Alamo/Tassajara Creeks Watershed General Characteristics
• Elevation of Headwaters – 2581 ft.
• Total Length of Channels– 111.0 miles
• Longest Channel Reach – 10.3 miles
• 6% Incorporated, 94% Unincorporated

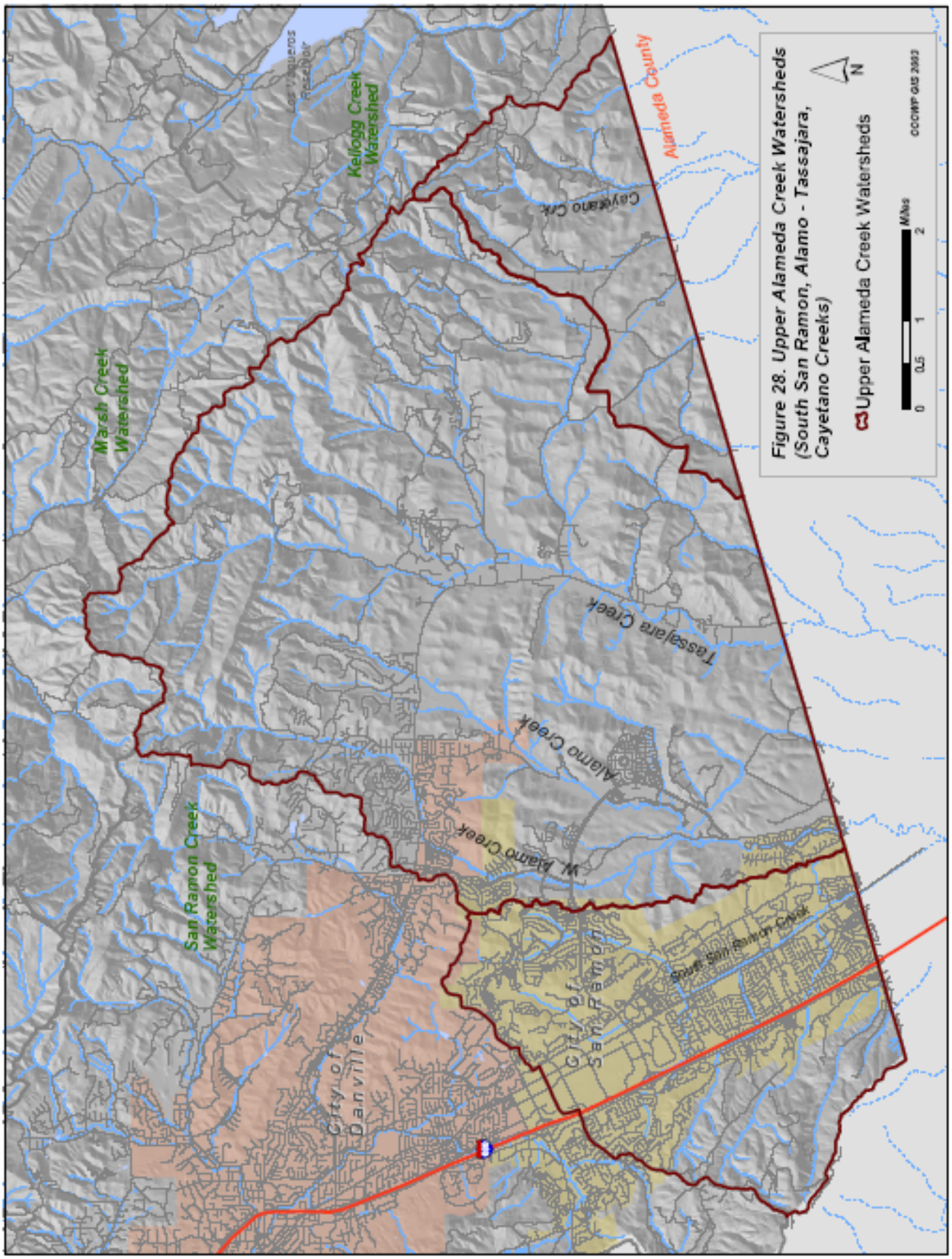
This 61 square mile (39164 acres) area located in Contra Costa County is a small portion of the headwaters of the massive 633 square mile Alameda Creek watershed to the south, in Alameda County (Figure 28). One of the most important watersheds in the Bay Area, the Alameda Creek watershed stretches from the Mt. Diablo Foothills in the north, to Mt. Hamilton in the south, supplying water to local residents of the area as well as those in San Francisco. The mouth of the creek is located in the City of Fremont, near the Coyote Hill Regional Park (EBRPD) and the San Francisco Bay National Wildlife Refuge. The creeks in the Contra Costa County portion of the watershed, include South San Ramon Creek (2.4 mi.), West Alamo and Alamo Creek (17 mi.), Tassajara Creek and its tributaries (65 mi.), and Cayetano Creek(10 mi.).

Cavetano Creek Watershed General Characteristics
• Elevation of Headwaters – 2060 ft.
• Total Length of Channels– 14.1 miles
• Longest Channel Reach – 3.4 miles
• 0% Incorporated, 100% Unincorporated

The City of San Ramon and a very small area of the City of Danville are located in the western-most part of the area, while Unincorporated County land makes up the majority of the land to the east. Rainfall here ranges from 18 – 21.25 inches per year. Land use ranges from single/multi-family residential and commercial in the San Ramon Valley area, to rural and open range lands in the Tassajara Creek and Cayetano Creek areas in the east.

(Upper) South San Ramon Creek Watershed General Characteristics
• Elevation of Headwaters – 1739 ft.
• Total Length of Channels– 26.2 miles
• Longest Channel Reach – 4.7 miles
• 75% Incorporated, 25% Unincorporated
• Major Water Bodies:
• *Watson Canyon Creek* • *Oak Creek*
• *Big Canyon Creek* • *Norris Creek*
• *Coyote Creek*

The valley floor area of San Ramon, the western-most area of the watershed, is highly urbanized and continues the recent trend of urbanization of the I-680 corridor from the City of Danville to the north, to the City of Dublin to the south. Interstate 680 runs parallel to the valley here, and surface waters of South San Ramon Creek are channelized and often times, underground, to accommodate residential and commercial areas. New development in the Dougherty Valley area, east of San Ramon in Unincorporated County, required re-engineering of West Alamo Creek to satisfy surface water outflow requirements to Alameda County. Areas in the east part of the watershed remain mostly rural and rangelands. East Bay Regional Parks and the State of California own land in the upper reaches of the Tassajara sub-basin.


Kellogg Creek Watershed
Marsh Creek Watershed
San Ramon Creek Watershed
Alameda County
Cayetano Crk
Tassajara Creek
Alamo Creek
W. Alamo Creek
City of Danville
City of San Ramon
Figure 28. Upper Alameda Creek Watersheds (South San Ramon, Alamo - Tassajara, Cayetano Creeks)
Upper Alameda Creek Watersheds
Miles
0
0.5
1
2
N

4.42 Upper San Leandro/ Moraga Creeks Watershed

Upper San Leandro/Moraga Creeks Watershed General Characteristics	
• Elevation of Headwaters – 2024 ft.	
• Total Length of Channels– 53.81 miles	
• Longest Channel Reach – 4.8 miles	
• 47% Incorporated, 53% Unincorporated	
• Major Water Bodies:	
• *Moraga Creek*	• *Redwood Creek*
• *San Leandro Creek*	• *Rimer Creek*
• *Laguna Creek*	• *Buckhorn Creek*

The upper watershed of San Leandro Creek and Moraga Creek located within Contra Costa County's border constitutes a 20.6 square mile piece of the larger San Leandro Creek watershed in Alameda County, to the south (Figure 29). The creeks in this area include Moraga Creek (4.7 mi.), San Leandro Creek (4.8 mi.), Laguna Creek (3.2 mi.), Redwood Creek (1.8 mi.), Indian Creek (1.8 mi.), Rimer Creek (3.14 mi.), Buckhorn Creek (2.1), and Callahan Creek (1.3 mi.). The southern extent of the City of Orinda, and a major portion of the City of Moraga are the local jurisdictions here.

Unincorporated County lands, including Redwood Park of the East Bay Regional Park District and the protected watershed lands of East Bay Municipal Utility District (that buffer the Upper San Leandro Reservoir) are located in the watershed. Ranchettes and single family residences create most of the developed area of the watershed. Impervious surface make up only 15 percent of the watershed land. Ranch lands, parks, open space lands and the semi-developed land at St. Mary's College keep this watershed at approximately 25% developed. This is comparable to the San Pablo watershed, to the north, which also has a substantial amount of protected watershed area (EBMUD and EBRPD lands) in its upper watershed.

Because of the rain shadow off the East Bay Hills, annual rain fall in this area is some of the highest in the County, ranging from 28 to 33 inches per year. Surface water management practices by residents in this important area of the upper watershed effects water quality at the San Leandro Reservoir and in the lower more populated area of the San Leandro watershed. Trails along Redwood Creek in Redwood Park are part of a Resource Protection Area, created to keep people and dogs out of the creek and off its banks to protect native trout populations and water quality. Hiking in nearby EBMUD land is restricted, and by permit only.

Fisheries

Fisheries data suggests that coastal steelhead were originally isolated in the Upper San Leandro Creek watershed when Chabot Dam was constructed in 1875 (Leidy et al. 2003), and further isolated after the construction of Upper San Leandro Reservoir in 1926. Currently, adult isolated steelhead migrate out of the Upper San Leandro Reservoir to spawn in several streams including Moraga and Upper San Leandro.

Monitoring Activities

The Surface Water Ambient Monitoring Program (SWAMP) is a statewide monitoring effort designed to assess the conditions of surface waters throughout the state of California. The SWAMP is directly funded by dischargers such as the

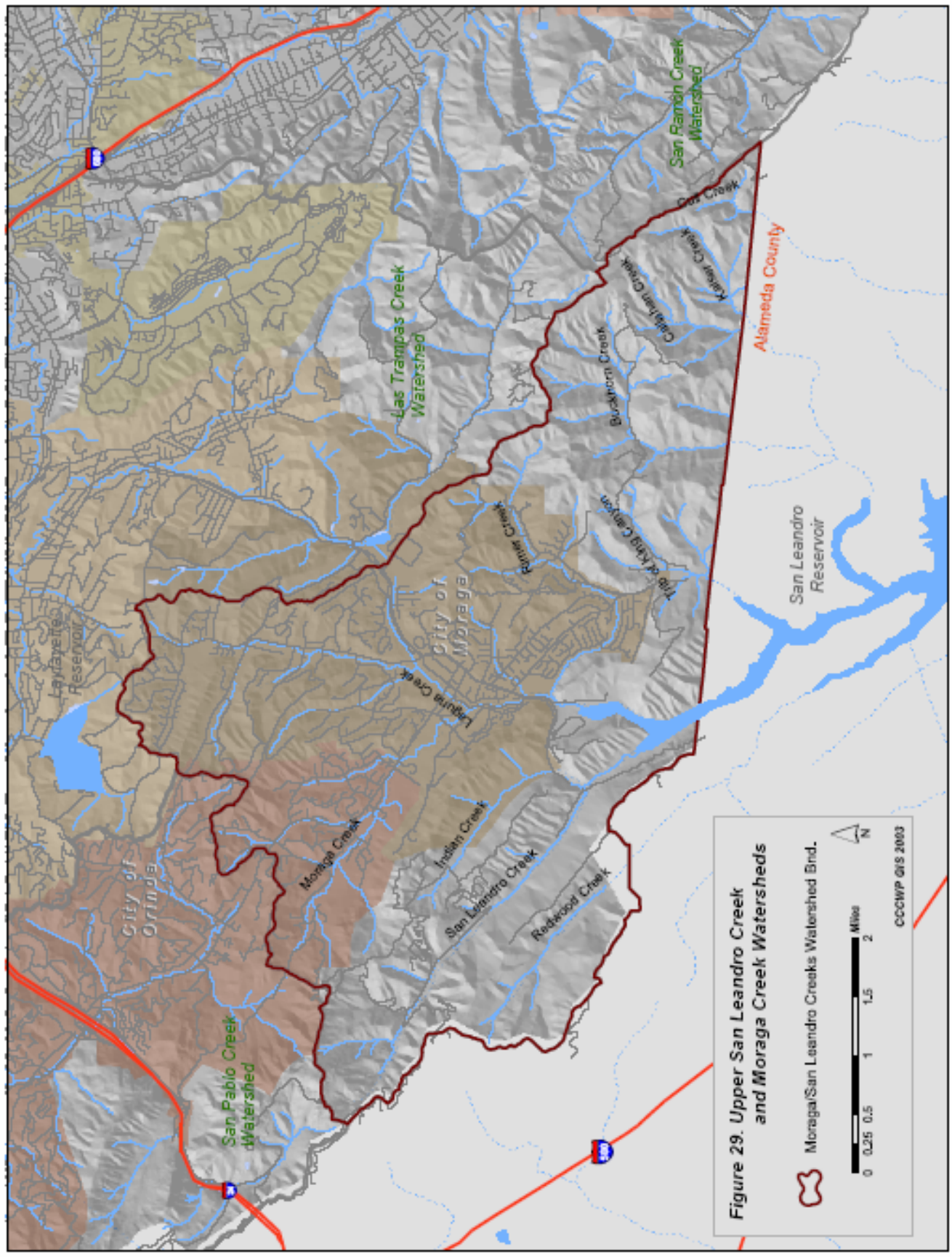


Figure 29. Upper San Leandro Creek and Moraga Creek Watersheds

Program. Responsibility for implementation of SWAMP activities in Contra Costa County resides with the San Francisco and Central Valley Regional Water Quality Control Boards. In 2001, the SFBRWQCB conducted monitoring in the upper San Leandro Creek and Moraga Creek watersheds. Sampling site locations and parameters analyzed are presented in Figure 29.

5.0 REFERENCES

Contra Costa Clean Water Program (2000). *Contra Costa Monitoring and Assessment Plan (CCMAP)*. Martinez, CA.

Contra Costa County (1995). *Contra Costa County General Plan*. Community Development Department. Martinez, CA.

Contra Costa County (2003a). *Contra Costa County Watershed Atlas*. Community Development and Public Works Departments. Martinez, CA.

Contra Costa County (2003b). Rainfall volumes and ioshyetals for Contra Costa County. Public Works Department, Hydrology Section. Martinez, CA.

KLI, Inc. and EOA, Inc. (2000). *Joint Stormwater Agency Project to Study Urban Sources of Mercury and PCBs.* Santa Cruz, CA.

KLI, Inc. and EOA, Inc. (2001). *Joint Stormwater Agency Project to Study Urban Sources of Mercury, PCBs, and Organochlorine Pesticides.* Santa Cruz, CA.

Liedy, R.A., G. Becker and B. Harvey (2003). *Historical Status of Current Distribution of Steelhead, Coho Salmon and Chinook Salmon in Stream of the San Francisco Estuary, California*. San Francisco, CA.

San Francisco Bay Regional Water Quality Control Board (1995). *Water Quality Control Plan, San Francisco Bay Basin (Region 2*). Oakland, CA.

San Francisco Estuary Institute (2001). *Wildcat Creek Watershed: A Study of Physical Processes and Land Use Effects*. Oakland, CA.

United States Environmental Protection Agency (2002). *Watershed Protection Approach*. http://www.epa.gov/owow/watershed/index2.html

United States Geological Survey (1994). *Preliminary Geological Map emphasizing bedrock formations in Contra Costa County, California: A digital database*. Compiled by R.W. Graymer, D.L. Jones and E.E. Brabb. Open-file report 94-622. Menlo Park, CA.

United States Geological Survey (1997). *Summary Distribution of Slides and Earth Flows in Contra Costa County, California*. By C.M. Wentworth, S. E. Graham, R. J. Pike, G.S. Beukelman, D. W. Ramsey and A. D. Barron. Open-file report 97-745C. Menlo Park, CA.

Appendix A

CONTRA COSTA CLEAN WATER PROGRAM

Final Reasonable Potential Analysis (RPA) and
Creeks Inventory Work Plan

March 19, 2002

Background:

The Contra Costa Clean Water Program (Program) was issued a Notice of Violation (NOV) by the San Francisco Bay Regional Water Quality Control Board (Board) on November 26, 2001. The NOV was directly related to the Program's Joint Municipal NPDES Permit (Permit) Provisions C.2., Reasonable Potential Analysis (RPA), and C.8., Creeks Inventory. The violations included:

Reasonable Potential Analysis (RPA)

1. Failure to submit an interim draft report by the required deadline;
2. Failure to submit a final report by the required deadline;
3. Failure to address full list of required constituents;
4. Failure to adequately identify sources;
5. Insufficient detail of current and future BMPs;
6. Insufficient characterization of representative drainage areas; and
7. Lack of sufficient detail in the pollution prevention and control measures plan.

Creeks Inventory

1. Lack of sufficient information in Creek Inventory submittal.

To fully comply with the Board's NOV, the Program has created a Draft RPA and Creeks Inventory Draft Work Plan. The following draft work plan contains a brief overview of Permit Provisions C.2. and C.8., followed by a description of how the RPA and Creeks Inventory will be integrated into the Program's Monitoring Program Plan, and a detailed description of tasks, sub-tasks, timelines, deliverables, and report preparation.

Reasonable Potential Analysis (Provision C.2.):

The Program was re-issued a Joint Municipal NPDES Permit on July 21, 1999 by the Board. Finding 12 of the Permit states "the Regional Board finds that there is a "reasonable potential" municipal stormwater agencies are causing or contributing to an excursion above water quality standards for: a) copper, nickel, mercury, chlordane, DDT, dieldrin, diazinon, dioxin, and PCBs in Central San Francisco Bay, Carquinez Strait, San Pablo Bay, Sacramento-San Joaquin Delta; and b) diazinon in Mt. Diablo Creek, Pine Creek, Pinole Creek, Rodeo Creek, San Pablo Creek, Wildcat Creek, and Walnut Creek." These contaminants are considered pollutants of concern (POC).

In response to this Finding, Provision C.2 of the Permit requires that "the Dischargers shall submit a technical report that shall include, but need not be limited to, the following:

a) Identification of potential sources for POC that are found in stormwater discharges;

b) Evaluation of effectiveness of BMPs that are currently being implemented and additional BMPs that will be implemented to prevent or reduce the above listed pollutants that are causing or contributing to the exceedance of WQS;

c) Characterization of representative drainage areas and stormwater discharges, including land-use characteristics, pollutant concentrations and forms;
d) A control measures plan for pollutants listed above that is acceptable to the Executive

Officer, which assigns responsibilities, and establishes time schedules to implement pollutant reduction and control measures beginning no later than July 1, 2001. Upon approval by the Executive Officer, the revised control measures plan shall be incorporated into the Stormwater Management Plan."

The original schedule for responding to this provision was as follows:

- A draft scope of work, report outline, and budget for the report(s) shall be submitted by November 1, 1999.
- An interim draft report shall be submitted by April 1, 2000;
- A final report shall be submitted by September 1, 2000, and,
- The reports will include a control measures plan whose implementation would begin no later than July 1, 2001.

On November 1, 1999 the Program submitted a draft scope of work and report format. The Program received comments from the Board regarding the November 1, 1999 submittal on May 3, 2001, a month after the interim draft report was due. On February 5, 2001 the Program submitted an interim draft report. The final report was submitted on March 2, 2001. There was no correspondence by the Board regarding this matter until the Program received the previously mentioned NOV.

Creeks Inventory (Provision C.8.):

Provision C.8. of the Program's Joint Municipal NPDES Permit requires the Program to develop a technical report, acceptable to the Regional Board Executive Officer, on a Creek Inventory Project. A report on existing creek inventory efforts was submitted to the Board in the Program's FY 1998/99 Annual Report. During FY 1999/2000 the Program created individual watershed maps, detailing creek locations, watershed and sub-watershed boundaries, culverts greater than 36 inches, and jurisdictional boundaries for all areas of Contra Costa County. In the Program's FY 1999/00 Annual Report, a Creek Inventory Work Plan was submitted. On January 11, 2001 the Program submitted the previously mentioned watershed maps to the Board, during a meeting with Board staff. There was no correspondence by the Board regarding this matter until the Program received the previously mentioned NOV.

<u>RPA & Creeks Inventory Revised Schedule</u>

To fully comply with Permit Provisions C.2. and C.8., and the previously mentioned NOV, the Program will adhere to the following schedule:

- By February 1, 2002, the Program will submit a tentative RPA and Creeks Inventory Work Plan, establishing milestones for each remaining year of the Permit, with a final completion date for the work plan of January 1, 2004;

- By April 1, 2002, the Program will submit a Final RPA and Creeks Inventory Work Plan, acceptable to the Regional Board Executive Officer;

- Progress reports on the status of achievement of milestones established in the Final RPA and Creeks Inventory Work Plan will be submitted with each Annual Report, within the Monitoring and Special Studies Section (8), through the end of the Permit cycle;

- By November 1, 2003, the Program will submit a Draft RPA and Creeks Inventory Report; and,

- By January 1, 2004, the Program will submit a Final RPA and Creeks Inventory Report, acceptable to the Regional Board Executive Officer.

Integration of RPA and Creeks Inventory into the Program's Monitoring Program Plan:

It is the Program's intent to integrate the RPA and Creeks Inventory into the Program's Monitoring Program Plan, the Contra Costa Monitoring and Assessment Plan (CCMAP). CCMAP is a concise user-friendly monitoring plan used to assess watersheds and water quality within Contra Costa County. CCMAP's initial goals include collecting baseline information necessary to identify and inevitably reduce/eliminate major sources of pollutants; developing a geographical information system (GIS); and, providing a method to evaluate the effectiveness of control measures and Best Management Practices (BMPs). CCMAP entails the characterization of watersheds and sub-watersheds, and the development of strategically placed "fixed" monitoring stations where physical, biological, and basic chemical data will be collected and analyzed. Deliverables from the RPA and Creeks Inventory will aid the Program in implementing CCMAP and inevitably in determining sources of POC.

RPA & Creeks Inventory Draft Work Plan Tasks and Subtasks:

Below are descriptions of tasks and subtasks the Program will perform to demonstrate full compliance with Permit Provisions C.2. and C.8, and the previously mentioned NOV. The work plan contains both RPA and Creeks Inventory related tasks and subtasks. Associated timelines, responsible persons, and deliverables are included in Attachment A.

Task 1: Identification of potential sources of pollutants of concern (POC) that are found in stormwater discharges.

Subtask 1.1 - Develop a list of potential sources of POC

Using the most up to date information, the Program will develop a list of potential sources of POC. Such information will include source identification work performed by:

- Santa Clara Valley Urban Runoff Pollution Prevention Program (WCC, 1997);
- Brake Pad Partnership (2001);
- Source identification and pollution prevention guidance developed for the City of Palo Alto (Larry Walker & Associates, 1997)
- Source identification work being conducted by the Board;
- City of San Jose (various pollution prevention reports);
- San Mateo Countywide Pollution Prevention Program - Pollution Prevention and Control Measures Plan (2001); and,
- Additional publications and information.

Source categories will likely include atmospheric, natural background, transportation related, industrial, residential, and construction related sources.

Subtask 1.2 - Develop, distribute, and collect a survey designed to gather information on potential sources of POC in Contra Costa County (CCC)

Using the information collected in Subtask 1.1, a survey requesting specific potential sources of POC in Contra Costa County will be developed and distributed to Program Co-permittees. The survey will request the names, types of facilities/areas, and locations of potential sources of POC. Program staff will collect and analyze the survey results, in preparation of conducting Subtask 1.3.

Subtask 1.3 – Develop a list of potential sources of POC for each watershed within CCC

Using the information gathered in Subtask 1.2, the Program will develop a list of potential sources of POC for each watershed in CCC. In combination with CCMAP results, the list will aid the Program in determining potential areas of concern, prompting further focused investigation of potential adverse effects caused by POC.

Task 2: Evaluate effectiveness of currently implemented Best Management Practices (BMPs) and additional BMPs that will be implemented to prevent or reduce POC from contributing to exceedances of WQSs.

Subtask 2.1 – Develop list of Program Performance Standards for each POC

The Program will develop a list of currently implemented BMPs and Performance Standards designed to reduce/eliminate POC from entering the municipal separate storm sewer system (MS4). As documented in Phase 1 Pollutant Control Study (STOPPP 2000), many criteria may used to evaluate the effectiveness of existing and proposed controls (once implemented), including:

- The effectiveness of a measure at preventing a pollutant from entering stormwater runoff, or removing a pollutant from or reducing the toxicity of a stormwater discharge;
- The effect that reducing a pollutant from entering stormwater runoff has on a receiving water (e.g. beneficial uses); and,
- The cost-effectiveness of a measure.

Although insufficient data exist to conduct a quantitative assessment of the effectiveness of BMPs, a qualitative evaluation of the effectiveness of currently implemented BMPs will be conducted, where possible. It is the Program's belief an evaluation of effectiveness of yet to be implemented BMPs is not possible. However, the Program will attempt to make a qualitative estimate of BMP effectiveness during the development of a pollution prevention and control measures plan for POC in CCC (see Task 4).

Subtask 2.2 – Conduct rapid bioassessments in Contra Costa watersheds to determine long-term effectiveness of stormwater related BMPs and biological integrity

Current and future long-term water body assessment efforts, in particular rapid bioassessments conducted under CCMAP, will aid the Program in determining BMP effectiveness through an assessment of biotic integrity or health of CCC watersheds (CCCWP, 2001). The Program is

currently implementing a long-term assessment program for CCC watersheds using benthic macroinvertebrate based rapid bioassessments. Rapid bioassessments results will contribute to determining levels of BMP and Program effectiveness (Center for Watershed Protection, 1996).

The Program intends to assess four (4) CCC watersheds, Alhambra Creek, Pinole Creek, Kellogg Creek, and upper Marsh Creek, in spring 2002. Additional watersheds will most likely be assessed in future years, increasing our knowledge of biotic integrity in CCC watersheds and the effectiveness of implemented BMPs. Through volunteer collaborative efforts of the Program, Regional Board, and volunteer monitors, up to 12 watersheds will possibly be assessed annually by 2004. Additionally, bioassessment results may help the Program in determining geographical areas where additional BMPs are needed.

The Program intends to extrapolate results from bioassessments conducted in selected watersheds, to additional CCC watersheds. Analysis of correlations between land use types, levels of imperviousness, climate, precipitation, stream and watershed physical characteristics, potential pollutants and biotic integrity will aid in this extrapolation.

Task 3: Characterize representative drainage areas and stormwater discharges, including land-use characteristics, pollutant concentrations and forms, and loadings.

Subtask 3.1 – Incorporate existing GIS data layers and CCC land use data layer into Program's GIS

Working with Contra Costa County's Mapping Services and the Contra Costa County Community Development Department (CDD), the Program will develop a comprehensive Geographic Information Systems (GIS) system that will allow hydrological features, land use data, beneficial use information, topography, soil characteristics, impervious surfaces, typical concentration values, County parcels, monitoring site locations, and data to be spatially visualized (CCCWP, 2001). Additionally, CDD made great strides in developing a GIS based land use data layer for the entire county in 2001. The Program intends to incorporate the CDD land use layer into the Program's GIS, which will aid in watershed characterization and spatial analyses of land use in CCC.

Subtask 3.2 – Re-delineate watershed and sub-watershed boundaries using existing data

During FY 1999/2000 the Program created individual watershed maps, detailing creek locations, watershed and sub-watershed boundaries, culverts greater than 36 inches, and jurisdictional boundaries for all areas of CCC. In FY 2000/01, the Program jointly funded a project that produced digital orthophotographs at 1:200' resolution for areas inside the urban limit lines, 1:400' resolution for the entire County, and contours at 10' intervals for the entire County. This higher resolution data prompts the need for the re-delineation of watershed and sub-watershed boundaries in CCC. The Program will collaborate with the Contra Costa Flood Control and Water Conservation District (District) to develop consistent watershed boundaries for all watersheds within CCC, allowing the framework for further watershed characterization to occur.

Subtask 3.3 – Create a matrix of watershed characteristics for all CCC watersheds

To better characterize watersheds in CCC, a matrix of watershed characteristics for each watershed will be developed. Using available GIS based data layers, described in Subtask 3.1, the Program will determine the following for each watershed:

- Watershed and sub-watersheds area;
- Stream length;

- Stream tributaries and associated water bodies;
- Percentages and areas of various types of land uses;
- Designated beneficial uses;
- Average precipitation;
- High and low elevation;
- Number and location of assessment locations;
- Habitat conditions at assessment locations; and,
- A potential pollutant list.

Additionally, the Program will include the following, when and if the information is available:

- Locations of culverts;
- Locations of engineered banks; and,
- Locations of drop structures and check dams.

Subtask 3.4 – Determine loadings of POC from urban runoff for each watershed in CCC

It is the Program's understanding a special study estimating loadings of POC from stormwater will be conducted under the Bay Area's Water Quality Attainment Strategy (WQAS). The Program intends to work in collaboration the WQAS Coordinator, BASMAA Monitoring Committee, and the San Francisco Estuary Institute (SFEI) in this effort. If adequate, the methodology used in this effort will be used by the Program to determine loadings of POC from CCC watersheds.

Task 4: Develop a pollution prevention and control measures plan for POC, which assigns responsibilities and establishes time lines for implementation

Subtask 4.1 – Review suggested pollution prevention practices and develop a comprehensive list of potential pollution prevention and control measures for each POC

The Program will research documented pollution prevention and control practices, designed to reduce POC from entering the municipal separate storm sewer system. Information may come from a variety of sources, including:

- San Mateo Countywide Pollution Prevention Program - Pollution Prevention and Control Measures Plan (2001);
- Alameda Countywide Clean Water Program – Draft Stormwater Management Plan (2001);
- City of Palo Alto – Mercury and Dioxin Elimination Policy (2000);
- City of Palo Alto – Dioxins Pollution Prevention Plan (1997);
- City of Palo Alto – Mercury Pollution Prevention Plan (1997);
- BASMAA – Organophosphate Pesticide Reduction Strategy (1999);
- Contra Costa Clean Water Program – Organophosphate Pesticide Reduction Work Plan (2001);
- City of San Jose – Copper & Nickel Action Plans (2001);

Subtask 4.2 – Develop a pollution prevention and control measures plan for POC reduction in CCC

Using information gathered in Subtask 4.4, the Program will develop a pollution prevention and control measures plan acceptable to the Board's Executive Officer. The plan will contain BMPs

designed to reduce/prevent POC from entering the MS4 in CCC and an associated implementation schedule. The plan will also identify three categories of responsible parties; responsible parties that are a part of the Program, responsible parties (e.g. local industries) that the Program will coordinate with, and responsible parties (e.g. state agencies such as the Air Resources Board) that the Program feels would best be addressed by the Board.

Subtask 4.3 –Implement a pollution prevention and control measures plan for POC reduction in CCC

Once the Board has notified the Program the Final RPA and Creeks Inventory Report (Subtask 5.2) is acceptable, the Program will begin implementing the pollution prevention and control measures plan for POC in CCC. The deadline to begin implementation is October 31, 2004.

Task 5: Develop an RPA and Creeks Inventory Report

Subtask 5.1 – Develop a Draft RPA and Creeks Inventory Report

The Program will compile information gained from Tasks 1.0 – 4.0 and develop a Draft and RPA and Creeks Inventory Report. A draft report outline will be included with the Final RPA and Creeks Inventory Work Plan submittal.

Subtask 5.2 – Develop a Final RPA and Creeks Inventory Report

After meeting with Board staff to discuss revisions to the Draft RPA and Creeks Inventory Report, the Program will develop a Final RPA and Creeks Inventory Report. The final report will include information and deliverables from Tasks 1.0 – 5.1.

Appendix B

Watershed	Area (Sq. Mi.)	Ave. Rainfall (in/yr)	Mean Daily Flow (cfs)	Percent Imperv.	Planned Land Use (%)						Channel Type (%)				
					Ag	Com	Ind	Res	Mixed	Open	Nat	Concrete	Earth	Rip	Culverted
Alamo Creek/Tassajara Creek	41.2	19	N/A	10	50	0	0	14	4	32	97	1	2	0	0
Alhambra Creek	16.7	22	7.2	15	44	1	0	17	5	33	87	10	3	0	9
Baxter Creek	18.5	22	8.2	65	0	6	12	58	12	10	41	57	2	0	56
Brushy Creek	37.1	13	N/A	5	81	0	0	1	10	4	100	0	0	0	0
Cayetano Creek	6.9	17	N/A	5	N/A	N/A	N/A	N/A	N/A	N/A	100	0	0	0	0
Cerrito Creek	2.1	22	N/A	65	0	3	0	75	13	9	30	54	16	0	54
East Antioch Creek	11.4	13	6.5	35	0	12	2	59	14	13	87	13	0	0	13
East County Delta Drainages (Oakley area)	7.2	11	N/A	10	67	1	3	8	9	6	N/A	N/A	N/A	N/A	N/A
Garrity Creek	6.2	20	5.4	60	0	12	10	45	13	19	40	35	15	11	30
Grayson Creek/Murderers Creek	24.0	20	10.6	45	3	7	1	58	12	19	15	6	5	0	3
Kellogg Creek	32.6	16	N/A	5	21	0	0	0	1	5	100	0	0	0	0
Kirker Creek	17.4	16	6.5	30	39	10	9	19	6	17	78	19	4	0	17
Las Trampas Creek	26.9	26	15.4	25	17	2	0	53	5	17	79	14	6	1	12
Marsh Creek	93.8	17	28.3	15	44	1	1	18	4	32	94	1	0	5	1
Mt. Diablo Creek	38.2	18	16.5	20	20	0	8	12	22	37	90	8	1	0	8
Peyton Slough	6.4	17	3.7	55	0	3	41	20	10	24	51	17	32	0	17
Pine Creek/Galindo Creek	31.5	18	14.8	30	15	4	1	34	6	40	81	12	6	1	5
Pinole Creek	15.2	23	10.4	15	31	0	0	17	2	11	92	5	3	0	4
Refugio Creek	4.9	19	4.2	50	4	12	7	36	13	28	83	15	3	0	15
Rheem Creek	2.8	22	2.3	50	0	0	7	42	30	23	23	44	32	1	32
Rodeo Creek	10.4	21	7	20	4	12	7	36	13	28	91	4	5	0	17
San Leandro Creek/Moraga Creek	20.6	28	N/A	15	17	1	0	24	5	22	94	6	0	0	6
San Pablo Creek	43.6	27	32.1	20	2	1	2	28	5	23	89	9	2	0	7
San Ramon Creek	54.0	21	27.1	20	16	3	0	40	3	38	74	16	10	0	15
South San Ramon Creek	13.1	21	N/A	35	18	6	1	36	8	31	73	27	0	0	18
West Antioch Creek	12.8	15	5.2	35	5	5	1	33	8	47	80	20	0	0	20
Wildcat Creek	11.0	24	7.7	20	1	0	10	13	6	68	90	2	8	1	1
Willow Creek and Coastal Drainages	23.6	14	N/A	25	8	2	16	24	22	27	77	22	1	0	22