Final

TUOLUMNE COUNTY

Water Quality Plan

Prepared for:
Tuolumne County

February 2007

ESA

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Final Water Quality Plan

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Abbreviations and Acronyms

Assessment	Tuolumne County Foothill Watershed Assessment
Basin Plan	Water Quality Control Plan for the Sacramento River and San Joaquin River Basins
BMP	best management practices
Board	Tuolumne County Board of Supervisors
CEQA	California Environmental Quality Act
County	Tuolumne County
CVRWQCB	Central Valley Regional Water Quality Control Board
CWA	Clean Water Act
CWE	Cumulative Watershed Effects
Delta	Sacramento-San Joaquin Delta
DO	Dissolved Oxygen
DSA	Disturbed soil area
ft/sec	feet per second
ft	feet
GIS	geographic information systems
MEP	Maximum Extent Practicable
mgd	million gallons per day
MS4	small municipal separate storm sewer systems
NPDES	National Pollution Discharge Elimination System
NPS	Nonpoint Source
PSA	Primary Study Area
QAPP	Quality Assurance Project Plan
RCD	Resource Conservation District
RWQCB	Regional Water Quality Control Board
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TCGP	Tuolumne County General Plan
TCOC	Tuolumne County Ordinance Code
TDS	total dissolved solids
TSS	total suspended solids
TUD	Tuolumne Utilities District
UC	University of California
USC	U.S. Code
USEPA	United States Environmental Protection Agency
USTs	Underground Storage Tanks
VOCs	Volatile Organic Compounds
WQP	Water Quality Plan

CHAPTER 1
Introduction

1.1 Plan Overview

Tuolumne County's (County) Water Quality Plan (WQP) contains a comprehensive program that addresses a wide range of water quality concerns within the County. This WQP emphasizes surface (e.g., lakes, streams) water quality, factors affecting surface water quality, and mechanisms for maintaining and improving surface water quality. Subsurface water quality (e.g., wells) is currently addressed through state regulatory programs, and locally through the County Health Department's Division of Environmental Health. The WQP focuses on two primary objectives:

(1) responding to existing State and Federal regulations and new regulations as they become mandated; and

(2) addressing existing and future water quality issues relevant to Tuolumne County waterways as identified in the County's Foothill Watershed Assessment (Assessment).

The WQP includes both regulatory and non-regulatory components. The regulatory component builds upon many existing environmental programs and activities implemented by various County departments and focuses on land development activities subject to the County's permitting requirements and on County public works projects. The non-regulatory stewardship component of the WQP encourages voluntary community participation in maintaining and improving the County's water quality.

Using this two-pronged approach, the WQP addresses the six program elements of the U.S. Environmental Protection Agency's (USEPA) Phase II National Pollution Discharge Elimination System (NPDES) Program. Within the regulatory component, the WQP addresses:

- Illicit Discharge Detection and Elimination
- Construction and Post-Construction Activities
- New Development and Planning
- County Operations

Within the volunteer watershed stewardship component, the WQP addresses:

- Public Outreach and Education; and
- Community Involvement and County Stewardship Priorities

This WQP is also intended to assist CALFED in achieving its primary mission by protecting major sources of drinking water for the Sacramento-San Joaquin Delta (Delta) and the San Francisco Bay; and addressing cumulative causes of water quality degradation within the County's jurisdiction. Full implementation of the WQP will be a long-term process, over a 20-year planning horizon, and its effectiveness will be evaluated every five years. The WQP will be revised as necessary to address areas identified as deficient during the evaluation process, which is outlined in Chapter 2, Approach to Water Quality Planning.

The WQP is organized as follows:

Chapter 1, Introduction. Chapter 1 lays out the major elements of the WQP, provides the general history of the WQP, describes agencies responsible for plan implementation, provides an overview of the community's role, and explains the legal context for the WQP. This chapter outlines how the WQP is designed to be consistent with Tuolumne County General Plan Water Resources Goals, Policies, and Implementation Programs (Chapters IV, VI, and VII of the General Plan), CALFED Goals and Objectives, and State and Federal NPDES Phase II requirements.

Chapter 2, Approach to Water Quality Planning. Chapter 2 introduces the County's Project Study Area (PSA), describes existing conditions, and outlines the County's overall approach to water quality planning. Major emphasis is placed on strategies for watershed-scale planning and long-term evaluation of management practices through the continued acquisition of surface water quality data and implementation of this information through adaptive management.

Chapter 3, County-Based Programs. Chapter 3 describes the County's approach to maintaining and improving surface water quality with an emphasis on addressing non-point sources (NPS) of pollution that are thought to originate from various land uses within the County's jurisdiction. The WQP includes a set of suggested recommended best management practices (BMPs) with the intent of reducing the concentration of pollutants in urban runoff to the "maximum extent practicable" (MEP). For the purposes of this WQP, MEP emphasizes pollution prevention and source control BMPs.

These control programs address categories of NPS pollution including urban runoff, grading and construction, mining, hydromodification, onsite disposal systems, marina operations, mine site runoff, certain agricultural and forestry practices, and public works projects. Each control measure consists of recommended BMPs, as applicable. Measurable goals for modifying or developing new BMPs are designed to address regulatory requirements or sources of pollutants that are not adequately addressed through existing activities.

Regulatory issues are the main focus of this chapter and include four of the USEPA's six required elements to address NPS pollution:

- Illicit Discharge Detection and Elimination;
- Construction and Post-Construction Activities;
- New Development and Planning; and
- County Operations.

Additional County-based programs contingent upon acquiring additional grant funding include:

- Best Management Practice Evaluation and Guidelines Program;
- Roadway Drainage and Erosion Survey, Recordation, Treatment, and Tracking Program; and
- Drainage Planning Program.

Chapter 4, Community and Voluntary Watershed Stewardship Programs. Chapter 4 describes community-based programs or other programs expected to occur outside of the County's jurisdiction. Programs of a primarily voluntary stewardship context are addressed in this chapter and include two of the six USEPA required elements to address NPS pollution:

- Public Outreach and Education; and
- Community Involvement and County Stewardship Priorities.

Additional programs likely to occur outside the jurisdiction of the County include:

- Landowner Technical Assistance Program;
- Wastewater Regionalization and Connection Study; and
- Pursuing a Watershed Coordinator.

Chapter 5, Grant Funding Opportunities. Chapter 5 lists and describes potential sources and methods for funding the programs identified in Chapters 3 and 4.

Chapter 6, References. Chapter 6 identifies references used in the preparation of the WQP.

1.2 Background and Public Involvement

1.2.1 Background

The WQP is the product of a larger CALFED grant-funded project, which encourages a watershed-based approach to address NPS pollution and involves four primary steps:

(1) assessing and determining if there is a problem,
(2) developing a program to address the problem,
(3) implementing the program as designed, and
(4) evaluating its effectiveness.

The preparation of the County's Assessment report and the WQP denotes the first two steps of this process. Steps 3 and 4 will occur in conjunction with the adoption and implementation of this WQP.

The County Board of Supervisors (Board) authorized the financial commitment and inter-departmental cooperation for the grant-funded project by Resolution 8-02, adopted on January 22, 2002, to support CALFED's objective for long range management. This WQP was prepared under the auspices of the County, with funding provided by the California State Water Resources Control Board (SWRCB) and CALFED through a Proposition 13 grant (Agreement No. 39 -

Costa-Machado Water Act of 2000[1]). Funding allocated from the 2000 Water Bond requires that projects include a broad-based NPS component; capable of sustaining water quality benefits for a period of 20 years. In response to this requirement, the WQP was developed to not only implement BMPs, but to also implement a watershed-based planning framework as directed by Policy 4.L.a of the County's General Plan. This framework includes a set of measurable goals to enable County staff to evaluate the WQP's effectiveness in protecting water quality over the 20-year planning horizon.

Prior to the preparation of the Assessment and WQP and in order to support CALFED's objective for a scientific basis for water quality determinations, the County submitted a monitoring and reporting plan (MRP) and Quality Assurance Project Plan (QAPP) to the SWRCB and CALFED consistent with State watershed goals. The MRP and QAPP were prepared in accordance with USEPA requirements for QAPPs developed for Environmental Data Operations and were approved by the Central Valley Regional Water Quality Control Board's (CVRWQCB) Quality Assurance Officer prior to the implementation of baseline monitoring activities in support of the Assessment. Additionally, the QAPP and MRP were prepared under the oversight of a Water Quality Committee (WQC), which consists of County staff from individual departments and representation from the University of California (UC) Cooperative Extension. The WQC has helped to guide the focus of baseline studies and review draft documents consistent with CALFED requirements (see Chapter 6 for the WQC's membership and references for the WQPs supporting documents).

1.2.2 Public Involvement

To meet CALFED's objective for stakeholder involvement, in addition to the 50,000 plus residents within the County, 98 regulatory agencies, local agencies, and organizations were identified as having an interest or stake in the development of the WQP. At the onset of the grant-funded project, public notices were published in the Union Democrat and announced on the radio to encourage all stakeholders, including the owners of the 45,500 parcels in the County to participate in public meetings during the Water Quality Planning project. Prior to the preparation of the MRP, three public scoping sessions were held in early to mid-2005 to solicit public and agency input on current water quality problems within the County, their spatial occurrence, and the constituents observed to be a concern (e.g., sediment). Information obtained during these meetings was used to identify the seven monitoring locations sampled during Phase 1 of the MRP.

Following the completion of Phase 1 of the MRP, the analytical results and initial findings of the Assessment were shared with interested members of the community at three additional public information meetings in early 2006. At the same time, the County has been actively soliciting interested community members to participate in its citizen water quality monitoring program in order to implement Phase 2 of the MRP. Staff with the UC Cooperative Extension and the newly formed Resource Conservation District (RCD) may provide management oversight under Phase 2.

[1] In March 2000, California voters approved Proposition 13, the Costa-Machado Water Act of 2000 (2000 Water Bond), authorizing the state to sell $1.97 billion in general obligation bonds to support safe drinking water, flood protection, and water reliability projects throughout the State.

In addition to these activities, the County recently circulated a public informational survey through several different venues (e.g., Home & Garden Shows, schools, etc.) to seek further input from the community regarding the County's water resources. The survey sought input regarding the current conditions of the County surface water resources, significant threats to water quality, strategies for protecting and improving water quality, and ways to encourage public participation. Based on the results of the survey, 65 percent of those who participated thought that water quality will get worse in the future. Over half of those who participated thought that the most significant threats to water quality were from stormwater runoff from urban uses, septic systems, contaminated sites, and soil erosion. In responding to these threats, those surveyed (75 percent) overwhelmingly indicated that a mix of voluntary and mandatory approaches were necessary to improve water quality. For those surveyed, the most popular strategies for protecting water quality included improving educational opportunities, increasing enforcement actions, expanding the implementation of BMPs, reducing the application of chemicals, and improving water quality monitoring.

As part of the WQP, informational exchange will continue to be accomplished primarily through staff coordination and a link located on the County's website. The WQP, Assessment, and resulting programs will be available for review and download from the County's website.[2]

1.3 Plan Implementation

1.3.1 Tuolumne County Participation and Coordination

The County Board is the policy and budget setting authority for the County. Under the Board, the County's Public Works Department, Administrator's Office, Fire Prevention Bureau, Agricultural Commissioner's Department, Community Development Department, and the Health Department's Environmental Health Division each play a key role in implementing the County's WQP.

Each of the key departments has the primary responsibility for day-to-day implementation of the WQP. The County's lead department for managing the WQP is the Public Works Department (Public Works). The County's Water Quality Plan Administrator (WQP Administrator) is appointed by the department head from within Public Works. Individual department and personnel responsibilities for implementation and enforcement are addressed within Chapter 3.0, County-Based Programs for the County's design/construction and maintenance programs.

Public Works Department

Public Works is responsible for implementing and/or overseeing all improvements and maintenance activities undertaken on County roads and drainage facilities. Further, Public Works is responsible for administering the County's Grading Ordinance (County Code Chapter 12.20) that regulates grading on private property and establishes and enforces standards for the construction of new roads for new development. The Solid Waste Division is housed within

[2] http://www.co.tuolumne.ca.us. Go to "Shortcuts to popular pages" menu (on the left) and select "Public Works Administration," which will bring you to the Public Works menu and "Public Works WQP Info."

Public Works. Its primary mission is to ensure that the County has cost effective solid waste disposal services that comply with State and Federal mandates for integrated waste management and the protection of public health and the environment. The County Surveyor's Office also is within the Public Works Department. The Surveyor's Office is responsible for oversight of Title 16 of the County Ordinance Code (Subdivision Ordinance).

Community Development Department

The Community Development Department is composed of four divisions: Planning, Building and Safety, Code Compliance, and Geographic Information Systems (GIS). The Planning Division is responsible for coordinating the review and approval processes for all proposed land development and ensuring consistency with the County's land development regulations, such as the Zoning Ordinance (Title 17). The Planning Division also is responsible for conducting environmental assessments of new development including analysis of impacts to surface waters. The Building and Safety Division is responsible for overseeing the construction of residential, commercial, and industrial structures. The Code Compliance Division is responsible for receiving all alleged complaints of a violation of any ordinance that the Community Development Department has authority to enforce with emphasis placed on land development. The GIS Division generally supports planning functions, including environmental analysis, through map development, database creation, and spatial analysis for such factors including fire hazard, land use, access, roads, slope, geotechnical hazards, cultural resources, and related environmental issues.

Health Department - Environmental Health Division

The Environmental Health Division is responsible for administering the requirements of Title 13 of the County Ordinance Code as it relates to the approval of parcel or subdivision maps with Private Sewage Disposal Systems (Chapter 13.04), On-Site Sewage Treatment and Disposal (Chapter 13.08), Water Wells (Chapter 13.16), Groundwater Management (Chapter 13.20), and Hazardous Materials Management (Chapter 13.24). Additionally, the Environmental Health Division is responsible for conducting compliance inspections for restaurants, underground storage tanks, and hazardous waste facilities, managing the County's vector control program, and responding to housing health complaints.

Fire Prevention Bureau

The Fire Prevention Bureau is responsible for enforcing fire codes; conducting fire and life safety plan reviews; providing fire safety education; and inspecting and abating existing and potential fire hazards through public education and code enforcement. The Fire Prevention Bureau also is responsible for assessing the adequacy of new roads to support emergency services.

County Administrator's Office

The County Administrators Office, Facilities Management Division is responsible for implementing and/or overseeing all improvements and maintenance activities undertaken on County facilities or property other than County roads. Additionally the Facilities Management Division is responsible for overseeing all leases of County properties.

Agricultural Commissioner's Department

The Agricultural Commissioner has the mission to protect, enhance, and promote the preservation of agriculture and the environment while sustaining the public health, safety, and welfare of all citizens. This Department is responsible for implementing the weights and measures program, Williamson Act program, invasive/noxious species control program, air pollution control program, and pesticide use program.

Water Quality Committee (WQC)

During 2004, the County established a Water Quality Committee to assist the County in developing the WQP. This committee meets at least annually and has representatives from each of the key responsible departments (Community Development, Public Works, Environmental Health, Agricultural Commissioner, and Administrator Office) and from stakeholder agencies (e.g., UC Cooperative Extension).

1.2.3 Non-County Organizations

In addition to participation on the WQC by the UC Cooperative Extension, the County anticipates participation in WQP implementation by multiple organizations and agencies outside of the County. For example, the recently formed Tuolumne County Resource Conservation District has been identified to possibly oversee the WQP's citizen water quality monitoring program (i.e., Phase II WQP Monitoring).

In addition, numerous local districts are involved in monitoring the County's water quality and in maintaining facilities that affect the County's water quality. These include, but are not limited to: the Tuolumne Utilities District, Groveland Community Services District, and Twain Harte Community Services District. The County will continue to use water quality data available from these entities and share BMPs, as appropriate, to the implementation of the WQP.

1.3.3 Public Participation

Citizen groups, organizations, and individuals representing the Master Gardner's, Columbia Community College, local high schools, the California Native Plant Society, Phoenix Lake Golf Course and Phoenix Lake County Club Estates Homeowners Association already have volunteered to assist in the WQP's citizen water quality monitoring program.

Programs aimed at increasing public education and participation in the WQP are further described in Chapter 4, Community and Voluntary Watershed Stewardship Programs.

Public information related to the implementation of the WQP will be distributed through the following media sources:

- The water quality link on the County's website;
- Local newspapers;
- Contacts with local civic organizations;

- Local radio stations;
- Participation at County events (e.g., Home and Garden Show); and
- Other mechanisms, as appropriate.

1.4 Regulatory Setting

To understand how current regulatory goals and standards apply to this WQP, it is critical to understand the basic premise of water resources, which as a public trust resource are subject to an extensive legislative and regulatory history within California. The basis for water quality regulation within the United States is the Federal Pollution Control Act Amendments of 1972 and 1986, known as the Clean Water Act (CWA)(33 USC 1251-1376). The objective of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." California's Porter-Cologne Water Quality Control Act (Porter-Cologne Act, California Water Code Section 13000 et seq.) in conjunction with the CWA provides the basis for water quality regulation within California. The Porter Cologne Act requires a "Report of Waste Discharge" for any point discharge of waste (liquid, solid, or otherwise) to land or surface waters that may impair a beneficial use of surface or groundwater of the state. In practice, these requirements are typically integrated with the CWA Section 402 NPDES permitting process[3] and implemented at the regional level by the Regional Water Quality Control Boards (RWQCB) and overseen by the SWRCB and the USEPA. The County is within the jurisdiction of the Central Valley (Region 5) RWQCB (CVRWQCB).

In 1987, amendments to the CWA established a two-phase program to regulate 13 classes of stormwater discharges. Under Phase I, which began in 1990, the RWQCBs adopted NPDES stormwater permits for medium (serving between 100,000 and 250,000 people) and large (serving 250,000 people) municipalities or metropolitan areas (e.g., Sacramento Metropolitan Area). As part of Phase II, the SWRCB adopted a General Permit for the Discharge of Stormwater for Small Municipal Separate Storm Sewer Systems (MS4s) (WQ Order No. 2003-0005-DWQ or General Permit) to provide permit coverage for smaller municipalities, including non-traditional small MS4s (e.g., public campuses). The MS4 permit requires a discharger (e.g., the County) to develop and implement a Stormwater Management Plan/Program with the goal of reducing the discharge of pollutants to the maximum extent practicable (MEP).

As previously indicated, although the County is not currently identified as a small MS4, the WQP represents a proactive approach by the County to address pre-existing water quality issues in terms of the State General Permit. Consistent with the requirements for small MS4s, the WQP provides a framework for consistent, effective, and efficient implementation of stormwater management practices for discharges entering drainage conveyance systems.[4] To this end, regulatory requirements contained in the WQP were developed consistent with the Tuolumne

3 Section 402 establishes the National Pollutant Discharge Elimination System (NPDES), a permitting system for the discharge of any pollutant (except for dredge or fill material) into waters of the United States. This permit program is administered by the U.S. Environmental Protection Agency (USEPA) in most states (not in California) and on Native American lands.

4 Drainage conveyance systems include roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains under County ownership.

County General Plan Goal 4.L, which directs the County to maintain and conserve the quality and quantity of the County's water resources, while protecting the rights of the land owners. The goal is intended to apply to all of the County's unincorporated lands. More specifically, the WQP implements the requirements of General Plan Policy 4.L.a, which directs the County to develop a conservation program for water resources that includes the following:

1. Provide for the continued implementation of the NPDES permitting program when required by the CVRWQCB.

2. Maintaining vegetative filters and/or buffers adjacent to water resources to assist in reducing the introduction of sediments and pollutants into surface water resources.

3. BMPs for grading on steep slopes, maintaining sediments onsite, preserving adjacent parcel owner property values by avoiding or reducing substantial runoff over neighboring properties and revegetating and/or terracing on large cut and fill slopes.

4. Flexible development standards for reducing grading, where appropriate.

5. Methods for avoiding and maintaining water resources throughout the construction process for those water resources to be preserved on site and throughout the life of the project.

6. Assignment of responsibility for the maintenance of sedimentation control facilities and revegetating graded areas that are abandoned during construction.

In addition to providing a regulatory compliance framework, the WQP also was developed to assist CALFED in achieving its primary mission of protecting major sources of water for the Delta and San Francisco Bay. This approach is consistent with General Plan Policy 4.L.8, which directs the County to participate in the State and Federal sponsored CALFED program to develop comprehensive and long-term solutions to the water quality conditions within the Delta. The WQP supports CALFED drinking water quality objectives by continuing to assess source water quality over the long term and providing a dynamic planning framework that responds to the assessed conditions.

In addition to the regulatory context established under the County's General Plan, CALFED, and the CWA, the WQP describes the procedures and practices used to reduce the discharge of pollutants from drainage conveyance systems owned or operated by the County. In various unincorporated areas of the County, waters of the United States or waters of the State pass through, over, or under the County's property and facilities. Those waters may already contain pollutants at the point at which they enter local waterways. This WQP emphasizes approaches to minimizing and preventing the discharge of non-point source pollutants into contributing drainages of local waterways. The following regulatory mechanisms will assist the County in achieving that goal.

1.4.1 State Codes

The California Government Code, Sections 23000-23027, authorizes the County to own and manage property for public purposes. The California Streets and Highways Code provides the County Board jurisdiction over and responsibility for control and operation of the County Highways.

The County possesses adequate legal authority to disconnect or prohibit point source illicit connections to its storm drain systems pursuant to Streets and Highways Code Section 1450. Thus, illicit connections to the County's storm drainage system are considered encroachments. Streets and Highways Code Section 1460 prohibits placing, changing, or renewing an encroachment without a permit. Any person placing an encroachment without the authority of a permit is guilty of a misdemeanor. Generally, a permit granting an encroachment on a highway constitutes a mere revocable license that may be withdrawn at will (People by and through the Department of Public Works v. DiTomaso, 57 C.A. 2D 741). Encroachment permits may also be conditioned to require compliance with stormwater regulations and the requirements of the County's WQP.

Sections 23112, 23113, 23114 and 23115 of the Vehicle Code provide legal authority to prevent spills, dumping, or disposal of materials on the highways and freeways under the County's jurisdiction. Section 23112 states, "No person shall throw or deposit, nor shall the registered owner or the driver, if such owner is not then present in the vehicle, aid or abet in the throwing or depositing upon any highway any bottle, can, garbage, glass, nail, offal, paper, wire, any substance likely to injure or damage traffic using the highway, or any noisome, nauseous, or offensive matter of any kind, rocks, refuse, garbage, or dirt in or upon any highway, including any portion of the right-of-way thereof, without the consent of the state or local agency having jurisdiction over the highway."

Section 23113 states, "Any person who drops, dumps, deposits, places or throws, or causes or permits to be dropped, dumped, deposited, placed or thrown, upon any highway or street any material described in Section 23112 or in subdivision (d) of Section 23114 shall immediately remove the material or cause the material to be removed."

If the person fails to comply with subdivision (a), the governmental agency responsible for the maintenance of the street or highway on which the material has been deposited may remove the material and collect, by civil action, if necessary, the actual cost of the removal operation in addition to any other damages authorized by law from the person made responsible under subdivision (a).

Section 23114 states (in pertinent part), "No vehicle shall be driven or moved on any highway unless the vehicle is so constructed, covered, or loaded as to prevent any of its contents or load other than clear water or feathers from live birds from dropping, sifting, leaking, blowing, spilling, or otherwise escaping from the vehicle."

1.4.2 County Codes

The County, by ordinance (County Code Chapter 13.24) authorizes the County Health Department, Division of Environmental Health to manage the handling, storage, transport, and use of hazardous material. Additionally, the Division of Environmental Health is authorized to inspect for hazardous materials on private property and oversee clean-up activities.

The County, by ordinance (County Code Chapter 12.20), authorizes the County Department of Public Works to regulate all grading activities, and requires that such activities be undertaken in such a manner that quantities of sediment or other materials substantially in excess of natural levels are prevented from leaving the site.

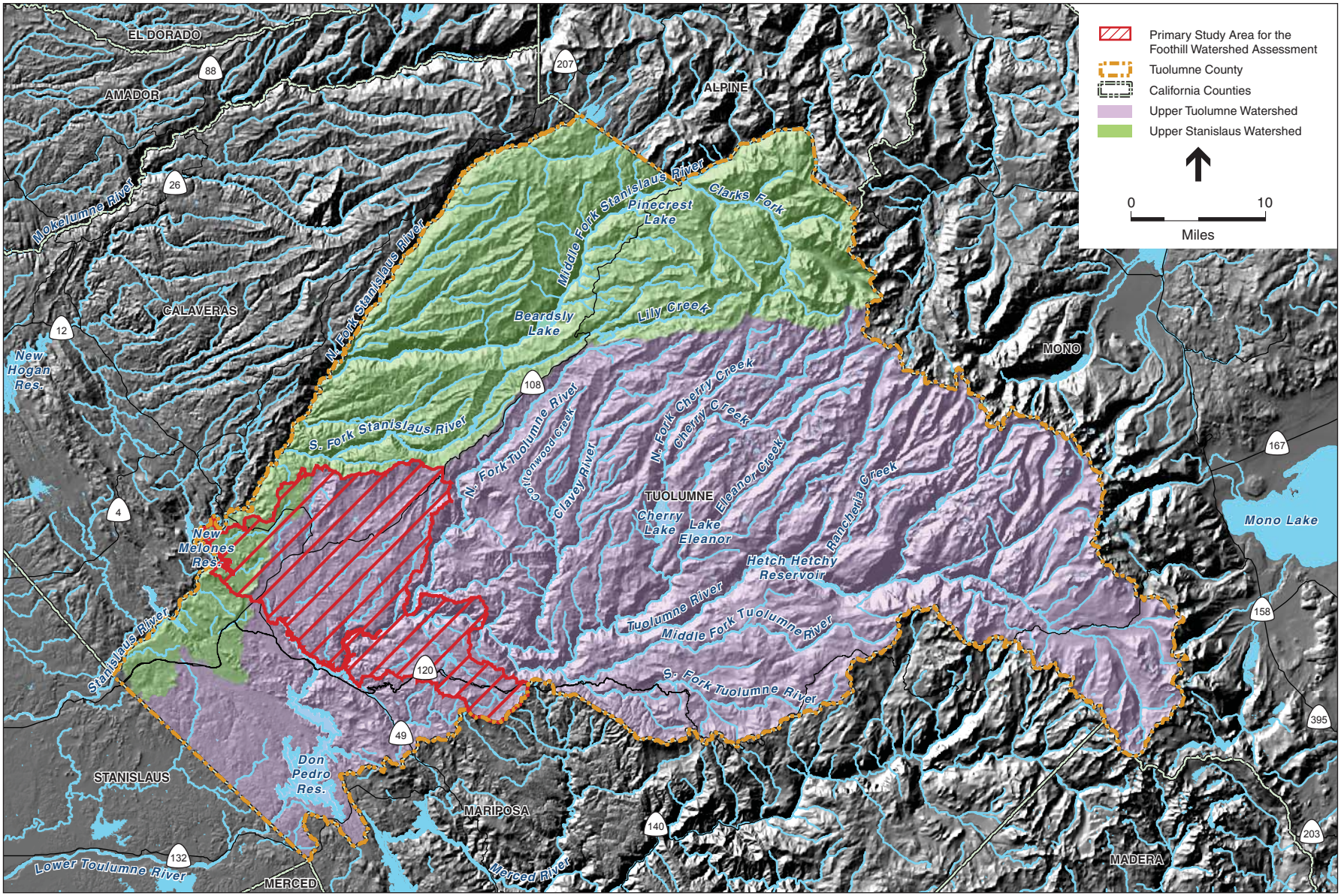
CHAPTER 2
Approach to Water Quality Planning

This chapter describes how the WQP study area was defined, the condition of watersheds within the study area, and the parameters to be addressed within the WQP. This chapter also identifies the County's approach to prioritizing the watersheds within the study area, minimizing adverse water quality effects to local waterways and downstream water supply reservoirs, and monitoring the results of water quality management efforts and improving those results, where feasible. The resulting approach offers both a watershed level and a more project or parcel-specific level approach to managing water quality to best address short-term, long-term, and cumulative effects on the County's water resources. Following this approach, Chapter 3, County-Based Programs, describes specific actions and programs to be undertaken to address activities affecting water quality within the County's jurisdiction. Chapter 4, Community and Voluntary Stewardship Programs, identifies actions and programs addressing activities outside the County's regulatory jurisdiction.

2.1 Primary Study Area

The County contracted with Environmental Science Associates (ESA) to conduct baseline water quality studies in support of the Assessment for prioritized watershed and sub-watershed units within the Upper Stanislaus River (USGS Cataloging Unit [CU] 1804010) and Upper Tuolumne River (CU 1804009) watersheds (Figure 2-1). The highest priority watershed units within the County's jurisdiction include those under development pressure that supply drinking water reservoirs and include all or portions of the Big Oak Flat, Clavey River, and Copperopolis Hydrologic Areas as identified in the 1999 California Interagency Watershed Map (CalWater Version 2.2.1).

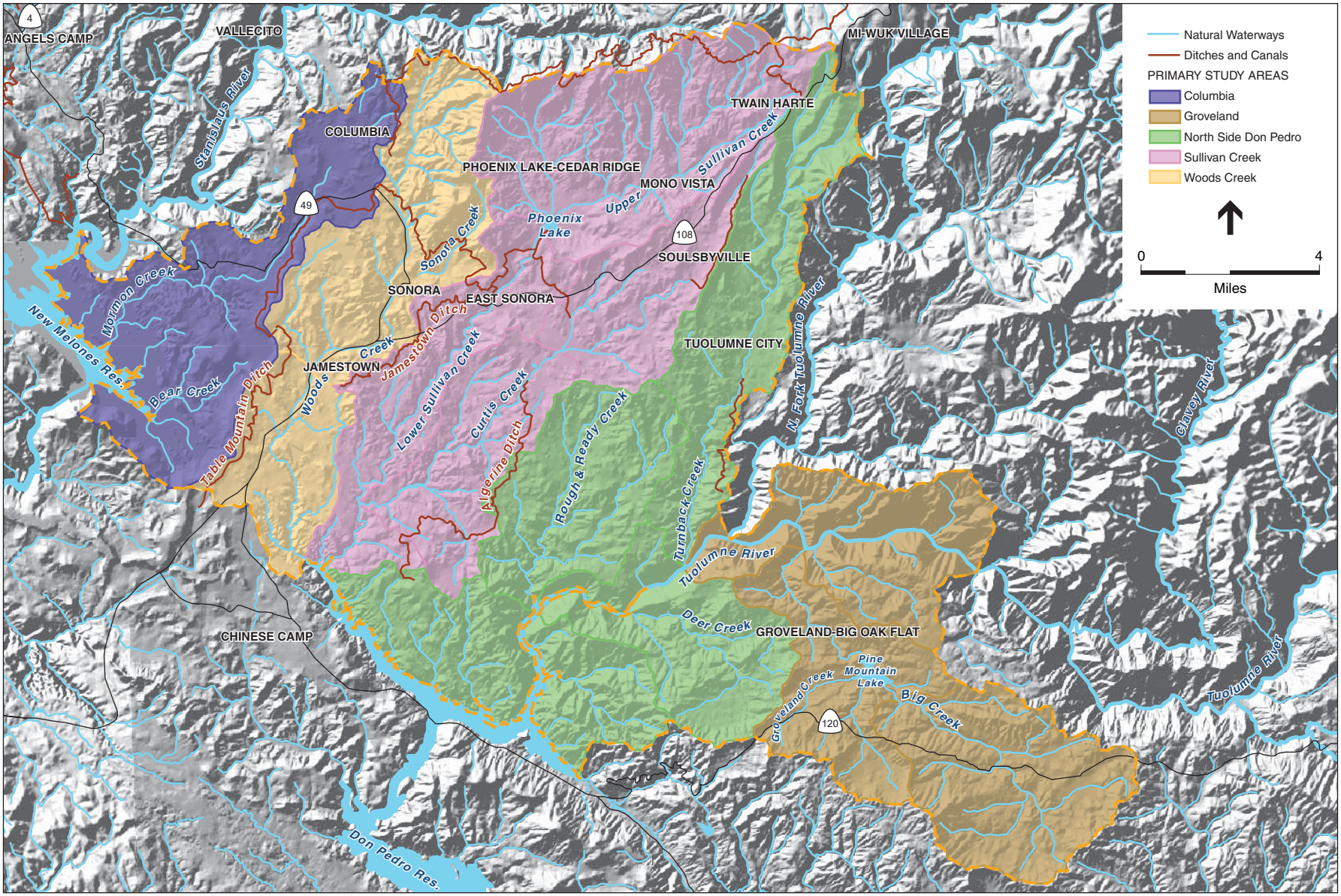
Due to the expansive area contained within the County's jurisdiction and the range of possible contaminants that could be present in foothill waterways, the County's MRP consists of a two-phased approach to monitoring. Phase 1 involved the establishment of a water quality baseline data for five watersheds that comprise the County's Primary Study Area (PSA). The five watershed units include all or portions of the Sullivan Creek, Woods Creek, North Don Pedro, Big Creek, and Rawhide Flat watersheds and sub-watersheds of the Upper Stanislaus River and Upper Tuolumne River watersheds (Figure 2-2). The PSA, located near the base of the two watersheds, represents a small fraction of the total watershed area, but contains a majority of the existing and planned urban development within the County. Within the Upper Stanislaus River watershed, the PSA accounts for a very small fraction (approximately 3 percent) of the total watershed area; whereas within the Upper Tuolumne River watershed, the PSA accounts for a larger, but still relatively small portion (approximately 11.5 percent) of the total watershed area.



SOURCE: USGS, 1993; ESRI, 2005; and ESA, 2006

Tuolumne County Foothill Watershed Assessment . 204254

Figure 2-1
County Watersheds



SOURCE: USGS, 1993; CalWater 2.2.1, 1999; and ESA, 2006

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Figure 2-2
Primary Study Area for the
County Foothill Watershed Assessment

The monitoring locations sampled were selected to assess cumulative or mass loadings within each of the five watersheds and provide an indication of total pollutant loading into downstream water supply reservoirs (i.e., New Melones and Don Pedro Reservoirs). These monitoring locations are illustrated in Figure 2-3. The constituents sampled included flow, pH, total suspended solids (TSS), specific conductance, oil and grease, temperature, priority pollutant metals, dissolved oxygen (DO), turbidity, and nitrate plus nitrite. Other constituents included chlorinated-herbicides, volatile organics compounds (VOCs), and total and fecal coliform bacteria. Concurrent with collection of grab samples, visual observations for the presence of floating and suspended materials, films or sheens, discoloration, turbidity, potential nuisance conditions (e.g., odor), and aquatic life were also recorded and photo-documented. The results of these sampling events are provided in the Assessment and are summarized below in Section 2.2.

Phase 2 of the MRP was initiated in November 2006 and is being implemented monthly by the citizen monitoring group. Future monitoring objectives are more fully described in Chapter 3, County-Based Programs, and Chapter 4, Community and Voluntary Stewardship Programs.

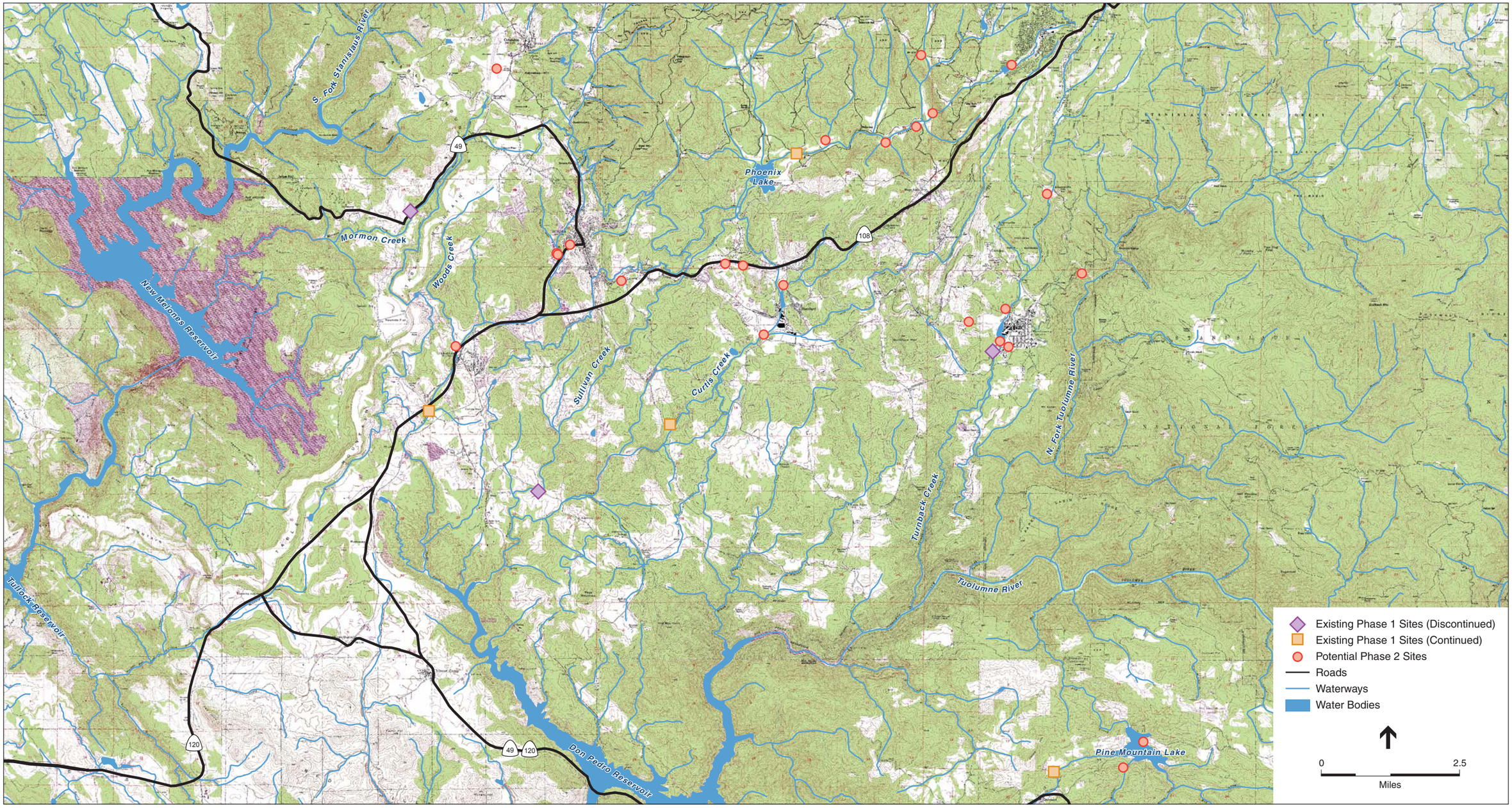
2.2 Existing Conditions

Prior to the preparation of the County's Assessment, much of the preexisting water quality information for the foothill region of the Upper Tuolumne and Upper Stanislaus River watersheds was limited to watershed sanitary surveys for local water supply infrastructure and compliance monitoring for point-source discharges. In contrast, there exists a more-established dataset for the upper reaches of the larger watersheds (e.g., Upper Tuolumne River) due to regional water supply, forestry, and hydroelectric interests. For these reasons, water quality monitoring data collected in support of the Assessment represent the best available information for characterizing current water quality conditions within the PSA and developing a planning framework to address those water quality conditions identified as a concern.

The findings of the County's Assessment specifically note that current water quality conditions within the foothill region of the County are a result of historic land management activities. These conditions are primarily associated with the significant landscape alteration that has occurred within the last 150 years as a result of road construction, the development of local water supply infrastructure, mining and agricultural practices, and population growth. Contaminant sources identified in the Assessment and in prior studies include residential and commercial onsite sewage disposal systems, leaking underground storage tanks (USTs), and unobstructed grazing practices. Chronic sources of soil erosion and enhanced sediment delivery to local waterways are also identified as a concern. Based on the range of potential NPS, the Assessment recommends that the County's WQP prioritize the following concerns:

RECOMMENDED NON-POINT SOURCE WATER QUALITY PARAMETERS TO BE PRIORITIZED

- ***Soil Erosion and Sediment Delivery to Waterways.***
- ***Total and Fecal Coliform Bacteria, Associated Pathogens, and Nutrients.***
- ***Urban Contaminants.*** (e.g. trace metals, herbicides, hydrocarbons, solvents, etc.)



SOURCE: Tuolumne County, 2004; and ESA, 2006

Figure 2-3

Existing and Potential Phase 2 Surface Water Monitoring Locations

2.3 Watershed Prioritization – Catchments

To enable prioritization of the County's limited resources to address these pollution issues, the Assessment report included a vulnerability analysis for smaller watershed catchments that comprise the PSA. This approach allowed for the prioritization of smaller drainage catchments that are potentially vulnerable to the above identified sources of NPS pollutants. For this reason, this planning methodology is incorporated into the WQP and will enable the County to focus outreach efforts, identify potential grant funding opportunities, and evaluate the success of BMPs.

Watershed catchments were delineated for the five major watersheds comprising the PSA through surface interpolation of 10-meter Digital Elevation Models (DEM) for the U.S. Geological Survey (USGS) 7.5-minute quadrangles for New Melones Dam, Sonora, Standard, Tuolumne, Columbia, Columbia SE, Twain Harte, Keystone, Chinese Camp, Duckwall Mountain, Moccasin, Groveland, and Jawbone Ridge. These watershed or drainage catchments were then given unique identifiers (e.g., US01 = Upper Sullivan Creek, Catchment Unit No. 1) to allow for risk analysis using GIS overlay techniques. The watershed vulnerability analysis then used spatial analysis to categorize smaller watershed catchments based on the three major risks identified: (1) urban contaminants, (2) enhanced soil loss and deliverability to the stream network, and (3) problematic septic systems.

In the short-term, this analysis is limited to the watershed units comprising the PSA. However, the County intends to expand the delineation of the drainage catchments to areas outside of the PSA as funding becomes available. As indicated in the preceding section, prioritization of the smaller watershed catchments will allow County staff to better focus outreach efforts, identify and direct potential grant funding opportunities, and evaluate the effectiveness of BMPs to those areas with the highest potential for contamination.

For the purpose of implementing the WQP, prioritization of smaller watershed catchments focused on the three previously identified potential causes of water quality pollution: urban runoff, fecal coliform bacteria and nutrients, and soil erosion and stream sedimentation. Prioritization will be the primary method for implementing watershed rehabilitation projects consistent with General Plan Policy 4.L.n, which provides for such watershed improvements as:

1. A reduction in the presence of contaminants in drinking water by addressing the origins of the contaminants, including, to the maximum extent practicable, the specific activities that affect the drinking water supply of a community or communities.
2. An increase in the quantity of water available from the watershed.
3. The improvement, restoration, or enhancement of fisheries habitat, including riparian habitat, in and along streams and watercourses in the watershed. These projects may address factors which increase sedimentation in streams and watercourses in the watershed.
4. The improvement of overall forest health, including the reduction of factors which may contribute to the severity of wildfires in the watershed.

To prioritize watershed catchments based on potential risks from the wide of range of potential sources of NPS pollution, impervious surface coverage estimates where calculated for each catchment within the PSA. Impervious surface is one of the more commonly used indicators of watershed stress and was considered the most appropriate variable in capturing those catchments at the highest risk to threats from the NPS priorities. Impervious surface cover was estimated by categorizing County zones based on allowable development intensities as defined in Title 17 of the County's Zoning Ordinance. Four development intensity categories were developed to cover the range of development intensities present within the County; these are more thoroughly described in the Assessment report. Although the use of the zoning coverage potentially could over-estimate impervious cover, at least in the interim, it provides the best practical information for watershed planning in terms of NPS pollution for the large land area (224.8 square miles) that comprises the PSA.

Figure 2-4 provides NPS pollutant prioritization ratings for individual drainage catchments based on the maximum allowable building intensities. The highest prioritized watershed catchments are those with the highest concentrations of impervious surfaces at zoning build-out, and therefore, are the primary focus of the stormwater controls and water quality monitoring activities outlined in Chapters 3 and 4 of this document. Watershed units with the greatest vulnerability to urban runoff include specific catchments contained within the Upper Curtis Creek, Lower and Upper Sullivan Creek, Upper Mormon Creek, Upper Turnback Creek, and Big-Oak Flat-Groveland (Pine Mountain Lake) subwatersheds. Urban centers within each of these drainage units include Columbia, Jamestown, East Sonora, Pine Mountain Lake, Standard, Tuolumne City, and Twain Harte. It should be noted that zoning information for the City of Sonora (the city limits are excluded from the PSA) is not reflected in Figure 2-4, and therefore, watershed catchments within the Sonora city limits should be incorporated in cooperation with the City as funding allows.

In addition to planning for increased runoff, the County's objective of controlling urban nonpoint sources of pollution includes isolating specific drainage catchments containing contaminated sites. As part of the County's 1999 Groundwater Protection Report, a database of sites was created. Currently, the database documents 58 sites with Class V injection wells,[1] 45 sites with waste discharge requirements (WDRs) issued by the CVRWQCB, 67 sites with underground fuel storage tanks, and 74 active commercial sites with onsite sewage disposal. Although designed to be GIS compatible, much of these data have not been integrated into the GIS. The ability to overlay these data with specific drainage catchments would further enhance the prioritization ratings depicted in Figure 2-4.

[1] Typically, Class V injection wells are shallow "wells," such as septic systems and drywells, used to place nonhazardous fluids directly below the land surface. Some examples of Class V wells are agricultural drainage wells, stormwater drainage wells, large capacity septic systems, sewage treatment effluent wells, mine backfill wells, special drainage wells, heat pump/air conditioning return flow wells, and industrial wells. For facilities that generate nonhazardous wastes, Class V wells provide for disposal when there is no access to a sewer system.

PRIORITIZATION RATING
- Very Low (0 - 5%)
- Low (6 - 15%)
- Medium (16 - 25%)
- High (26 - 50%)
- Very High (51 - 80%)

NOTE:
Impervious surface at zoning buildout.

0 4
Miles

SOURCE: USGS, 1993; Tuolumne County, 2004; and ESA, 2006

Figure 2-4
Watershed Catchment Prioritization for Urban Non-Point Source Pollutants

2.4 Response to County-Wide Water Quality Issues

The preparation of the WQP represents an initial attempt to address sources of cumulative watershed effects (CWEs) identified in the County's Assessment report and to proactively respond to the assessed conditions through adaptive management. Based on the County's Assessment (Section 2.2) and the prioritization of catchments (Section 2.3), the County can manage watershed units in its jurisdiction in a way that minimizes adverse water quality effects to local waterways and downstream water supply reservoirs. The WQP emphasizes watershed planning to enable the cost-effective allocation of the County's limited resources to respond to local water quality concerns and maximize opportunities identified in the Assessment report. Further, watershed planning at the catchment level allows for the prioritization of smaller drainage units based on identified vulnerabilities (Section 2.2). Although the County's Assessment concluded that water quality degradation has occurred within each of the five watersheds that comprise the PSA (see Section 2.1), the main forms of degradation, elevated levels of turbidity and fecal coliform bacteria, can be attributed to historical land management practices. Based on these findings, the County can manage sources of urban NPS pollutants both by planning both at a small-scale (individual project) level and at the watershed level. This planning approach will enable the County to cost-effectively focus the implementation of new regulatory requirements on individual projects and public infrastructure while at the same time setting forth a broader, long-range, watershed-level approach to address legacy pollutants while minimizing cumulative water quality effects.

Programs contained in Chapters 3 and 4 of this document are intended to provide the initial framework for complying with the requirements of the Phase II NPDES Program. Although not identified as a Phase II regulated entity, there is a high likelihood that future County regulation may occur; especially as population growth continues. For this reason, the County has developed objectives that can easily be expanded, enhanced, or integrated with other existing programs to satisfy Phase II NPDES Permit requirements for small MS4s. These objectives were developed to address each of the six program elements required for Phase II regulated entities.

SIX PROGRAM ELEMENTS OF PHASE II NPDES PROGRAM

- Illicit Discharge Detection and Elimination
- Construction and Post-Construction Activities
- New Development and Planning
- County Operations
- Public Outreach and Education
- Community Involvement and County Stewardship Priorities

Those program elements largely within the County's regulatory purview (e.g., Illicit Discharge Detection and Elimination; Construction and Post-Construction Activities; New Development and Planning; and County operations) are described in Chapter 3, County-Based Programs. Those program elements more within the public element are likely to be applicable on a watershed level are described in Chapter 4. All programs are intended to demonstrate and sustain improvements to surface water quality over the WQP's 20-year planning horizon and beyond.

Chapters 3 and 4 of this document address both short-term and long-term planning efforts to manage water quality. Generally, remediation of water quality issues resulting from historical practices ("legacy pollutants") requires long-range or broad-scale programs. While a few such programs may be incorporated into County regulations (Chapter 3), the majority of these programs will require a broader effort and the involvement of multiple agencies, the public, and other stakeholders County-wide (Chapter 4).

Programs identified in Chapters 3 and 4 of this document respond to locally assessed conditions to demonstrate a need for grant funding, especially as funding becomes more competitive. Further, these programs emphasize the necessity of demonstrating potentially foreseeable improvements and linking those improvements to water quality objectives for the Delta.

2.5 Adaptive Management

As previously indicated, the overall strategy of the County for reducing pollutants to the maximum extent practicable involves the use of effective management practices and programs through a process of continuous improvement and refinement (adaptive management) focused on source control and pollution prevention activities. Using the WQP as a guide, the County will regularly review its activities, inspect its facilities, and conduct studies to obtain information that supports responsible management and allocation of the resources for improving water quality.

Initial monitoring efforts will focus on the qualitative, and in certain instances, quantitative evaluation of stormwater practices since these practices have the greatest potential to affect the quality of the water being discharged into local receiving waters. As the WQP is implemented, the County expects that monitoring efforts will expand to involve collecting information to:

- Better characterize the composition of stormwater discharges from the County's storm drainage system(s).
- Identify other sources of pollutants.
- Continue to characterize the quality of receiving waters.
- Inventory the storm drainage system(s).
- Develop greater focus on priority pollutants of concern.
- Evaluate the performance of BMPs.

Results from these efforts will be used to assess the effectiveness of the WQP and to develop new or refined programs, including new or improved practices.

The County will continue to work cooperatively with the CVRWQCB and other interested stakeholders during future watershed planning efforts. It is anticipated that the CVRWQCB will provide input on monitoring site selection and sampling and analysis plans in conjunction with these efforts. Results and recommendations of these studies will help refine existing or establish new County-recommended BMPs based on local site conditions and cost-effective implementation. Efforts will continue to emphasize innovative practices that address the specific stormwater constituents expected to cause or contribute to exceedances of applicable water quality objectives.

In addition to evaluating effectiveness of various alternative BMPs, the County or other appropriate entity (e.g., RCD) will investigate the feasibility of developing a Watershed Coordinator position to monitor, research, pursue, propose, refine, and oversee water quality County-wide (see Chapter 4).

2.6 Long-term Monitoring and Response

The WQP includes multiple activities that will require measurement of several surface water quality parameters necessary to evaluate the WQP's performance over the long term and determine whether or not the County's goals and objectives are ultimately achieved.

As more data become available both within the County and elsewhere, the County will be in a better position to assess the actual or threatened effects that runoff from storm drainage systems owned and/or operated by the County may have on local receiving water quality. These data will be used in a variety of ways, including:

- Determining exceedances of water quality objectives
- Developing total maximum daily loadings (TMDLs)
- Refining the WQP
- Watershed planning.

Water quality data collected as part of the WQP will be collected consistent with the County's adopted QAPP. The QAPP documents the requirements and criteria for field and laboratory procedures used during the planning and implementation phases of the County's MRP. The QAPP also discusses water quality objectives and criteria identified for beneficial uses applied to local water resources as prescribed in the Basin Plan. The MRP is a dynamic document that will be amended over time based on changes to sampling parameters and monitoring locations. All amendments to the MRP will be integrated into the most current version and distributed to appropriate County and CVRWQCB staff.

The sampling network for Phase 2 of the MRP will be comprised of some of the cumulative loading sites sampled during Phase 1 and sites that characterize more discrete drainage catchments. Section 2.3 identifies priority watershed catchments determined to be at the highest

risk for water quality degradation. Therefore, the WQP will direct more discrete sampling efforts to these locations as funding becomes available. Potential monitoring sites that may be sampled in the future as part of the WQP are depicted in Figure 2-3. Monitoring parameters at new locations will be contingent on the prioritized risk being assessed. Likewise, monitoring at the Phase 1 monitoring sites will focus on tracking those parameters identified as "constituents of concern," namely turbidity and fecal coliform bacteria, and other standard water quality field parameters (e.g., pH). A citizen-monitoring group under the possible oversight of the County RCD will conduct a majority of the monitoring under Phase 2. Data will be recorded and entered into a master database developed during Phase 1 to track improvements and establish water quality data trends.

In addition to long-term data collection, the WQP encourages acquiring data using protocols outlined in the County's QAPP and MRP to evaluate the effectiveness of BMPs as they are implemented. This approach emphasizes obtaining pre-BMP implementation data for construction and grading projects, and pollution prevention programs to enable actual quantification of their effectiveness. Initially, BMP evaluation will emphasize sediment production and associated transport mechanisms. However, as additional funding becomes available, the evaluation will be expanded to evaluate BMPs aimed at managing other constituents.

Recognizing that the focus area for the County covers a wide range of land uses, the pollutants of concern or target pollutants that will be monitored during the WQP's planning horizon will include a combination of those identified below. These various pollutants are collectively referred to as non-point source (NPS) pollutants in the WQP.

Sediment is soil material transported or deposited by the action of wind, water, ice, or gravity, as a product of erosion. For example, sediment can erode from land when disturbed by a construction activity or heavy rainfall. Sediment can increase turbidity, clog the gills of fish, reduce spawning, smother bottom dwelling organisms, suppress the growth of aquatic vegetation, and transport other pollutants, such as heavy metals.

Oil and grease are characterized as high-molecular weight organic compounds. Primary sources of oil and grease are petroleum hydrocarbon products, motor products, esters, oils, fats, waxes, and high molecular-weight fatty acids. The main sources of oil and grease are leakage from engines, spills at fueling stations, overfilled tanks, leaking under ground storage tanks (USTs), and restaurant waste oil disposal.

Metals (including lead, zinc, cadmium, copper, chromium and nickel) are commonly found in stormwater. Many of the artificial surfaces of the urban environment (e.g., galvanized metal, paint, automobiles, or preserved wood) contain metals, which enter stormwater as the surfaces corrode, flake, dissolve, decay, or leach. Metals are of concern because they are toxic to aquatic organisms, can accumulate to toxic levels in aquatic animals such as fish, and have the potential to contaminate drinking water supplies.

Nutrients are inorganic substances, such as nitrogen and phosphorous. They commonly exist in the form of mineral salts that are either dissolved or suspended in water. The primary source of nutrients in urban runoff has been identified as fertilizer products, but also is associated with organic waste. Excessive use of fertilizer can result in the discharge of nutrients to water bodies and streams, resulting in excessive aquatic algae and plant growth.

Pathogens are agents, usually living microorganisms, or components of these organisms hat cause or may cause disease (e.g., viruses, protozoa, fungi, parasites, proteins, various species of bacteria). Water may be contaminated by pathogens such as the bacteria, *E. coli* thereby creating a potentially harmful environment for humans and aquatic life. Sources of these contaminants include animal excrement, sanitary sewer overflow, improperly functioning septic systems, and soil. High levels of indicator bacteria in stormwater have led to the closure of beaches, lakes and rivers to contact recreation such as swimming.

Organic compounds (including toxic synthetic compounds such as adhesives, cleaners, sealants, and solvents) are widely applied and may be improperly stored and disposed. In addition, deliberate dumping of these chemicals into storm drains and inlets causes environmental harm to waterways and adversely affects drinking water supplies. For example, when rinsing off objects, toxic levels of solvents and cleaning compounds can be discharged to the storm drain.

Pesticides (including herbicides, fungicides, rodenticides, and insecticides) are commonly detected in stormwater. As use of pesticides has increased, so have concerns about the potential adverse effects of pesticides on the environment and human health. Accumulation of these compounds in simple aquatic organisms, such as plankton, provides an avenue for biomagnification through the food web, potentially resulting in toxic levels in those organisms that feed on them, such as fish and birds.

Oxygen-Demanding Substances are those substances that require oxygen as part of their natural, biological, or chemical processes. The oxygen demand of a substance can lead to depletion of natural oxygen resources in a waterbody and possibly the development of anoxic conditions. Proteins, carbohydrates, and fats are examples of oxygen-demanding substances. They can also be referred to as "biodegradable organics." The presence of oxygen-demanding substances in water is measured as the biochemical oxygen demand and the chemical oxygen demand.

Floatable Materials include trash (e.g., paper, plastic, polystyrene packing foam, aluminum materials, etc.) and biodegradable organic matter (e.g., leaves, grass cuttings, food waste, etc.). The presence of floatable materials has a significant impact on the recreational value of a water body and can potentially impact aquatic species habitat. Excess organic matter can create a high biochemical oxygen demand in a stream and thereby, lower the water quality of the stream. Also, in areas where stagnant water exists, the presence of excess organic matter can promote anoxic conditions resulting in the growth of undesirable organisms and the release of odorous and hazardous compounds such as hydrogen sulfide.

Ecological Indicators include the measurement of certain habitat parameters (e.g., canopy cover, bank vegetation, etc.) and identification of periphyton, benthic macroinvertebrates, and fish assemblages. The measurement of these ecological indicators requires the use of standardized biological monitoring protocols as a way to measure present biological conditions and to provide a means to compare them with the conditions expected in the absence of man-made sources of change. As biological communities reflect overall ecological integrity (i.e., chemical, physical, and biological integrity) and integrate the effects of different stressors, these forms of indicators provide a broad measure of their aggregate impact.

CHAPTER 3
County-Based Programs

3.1 Program Overview

The principal findings of the County's Assessment suggest that a range of NPS pollutants, currently or have the potential to impact surface water quality within the foothill region. Further, the Assessment also indicates that foothill watersheds are at risk for further degradation by continuing urbanization and associated drainage modifications. These findings combined with a projected annual growth rate of 0.5 percent and a current population of more than 50,000 suggests that the County meets the criteria for possible regulation under the USEPA's Phase II NPDES Program.

The Phase II NPDES Program is administered by the SWRCB and the California Environmental Protection Agency (Cal EPA) through the California NPS Pollution Control Program. Actually implementation occurs at the RWQCB level. To satisfy USEPA requirements, the SWRCB adopted a General Permit for the Discharge of Stormwater from small municipal separate storm sewer systems or MS4s (WQ Order No. 2003-0005-DWQ) to provide permit coverage for smaller municipalities, including non-traditional small MS4s (e.g., public campuses). The MS4 permit requires a discharger to develop and implement a Stormwater Management Plan/Program with the goal of reducing the discharge of pollutants to the maximum extent practicable (MEP). MEP is the performance standard specified in Section 402(p) of the Clean Water Act and is generally achieved by implementing BMPs that cover the USEPA's six required elements to addresses NPS pollution in conjunction with assessing their effectiveness during implementation. These six elements include:

- Illicit Discharge Detection and Elimination (Section 3.2)
- Construction and Post-Construction Activities (Sections 3.3)
- New Development and Planning (Section 3.4)
- County Operations (Section 3.5)
- Target User Outreach (Section 3.6) and Public Outreach and Education (Chapter 4)
- Community Involvement and Watershed Stewardship Programs (Chapter 4)

The County is not currently identified as a Phase II entity, but has developed this WQP to address all forms of NPS pollution that are thought to originate from lands within the County's jurisdiction. The program is a comprehensive approach that outlines a range of BMPs with the intent of reducing the concentration of pollutants in stormwater to the MEP. In presenting a range of BMPs and in recognition of localized conditions (e.g., climate), it is necessary to understand the range of preventative and/or treatment BMPs available. Extensive literature is available on various BMPs. BMPs presented in the WQP were chosen based on recognized hydrologic conditions in conjunction with their range of effectiveness and applicability to the various land uses present within the County (Table 3-1).

TABLE 3-1
EXPECTED TARGET POLLUTANTS GENERATED BY LAND-USE CATEGORY

	Target Pollutants								
				Toxic Substances					
Land-Use Category	Pathogens	Heavy Metals	Nutrients	Pesticides	Organic Compounds	Sediment	Floatables	Oxygen-Demanding Substances	Oil and Grease
Detached Residential	X		X	X		X	X	X	X
Attached Residential	P		X	X		X	X	P(1)	P(2)
Commercial/ Industrial	P(3)		P(2)	P(5)	P(2)	P(1)	X	P(5)	X
Automotive		X			X(4)(5)		X		X
Restaurants	X						X	X	X
Hillside Development			X	X		X	X	X	X
Parking Lots		X	P(1)	P(2)		P(1)	X	P	X
Roadways		X	P(1)		X(4)	X	X	P(5)	X

X – Anticipated
P – Potential
(1) Potential pollutant if landscaping exists onsite
(2) Potential pollutant if project includes uncovered parking
(3) Potential pollutant if land use involves food or animal wastes
(4) Including petroleum hydrocarbons
(5) Including solvents

Source: CASQA, 2003

Much of the available literature suggests that multiple BMPs used conjunctively (e.g., source and treatment controls) provide the most effective means to achieving MEP. The WQP distinguishes between the three main BMP categories: preventative, source control, and treatment control. The implementation of these three BMP categories will be approached in a hierarchical manner whereby pollution prevention will be emphasized as the highest priority. The three BMP categories are as follows:

1. **Prevention.** Implementation of practices that use or promote pollution free alternatives (e.g., implementation of practices such as integrated pest management, hazardous materials management plans, educational venues, etc.).

2. **Source control.** Implementation of control measures that focus on minimizing urban runoff from contacting pollutant sources (e.g., controls through land use planning practices or material exposure control practices). Source control measures cover a wide-range of NPS pollutant sources that include a combination of education and outreach, watershed-level planning, identification of illicit (or unauthorized) discharges, soil stabilization and/or modifications to current ministerial procedures.

3. **Treatment controls.** Implementation of practices that require treatment of polluted runoff either onsite or offsite (e.g., extended detention basins). For treatment BMPs it is necessary to distinguish between those BMPs designed for temporary construction applications and those BMPs designed for hydrologic conditions as a result of existing infrastructure and/or new development.

Several County departments are responsible for implementing various BMPs. Many of the prescribed BMPs for each of the program elements are intended to complement existing County programs and are subject to modification throughout the implementation of the WQP. The County Department of Public Works in cooperation with other departments will oversee the implementation of most BMPs and related activities, evaluate their effectiveness based on methods outlined in Section 2.6 of this document, and strive to improve the program over time.

The following describes BMPs addressing five of the USEPA's six required elements to reduce NPS pollution:

- Illicit Discharge Detection and Elimination (Section 3.2)
- Construction and Post-Construction Activities (Section 3.3)
- New Development and Planning (Section 3.4)
- County Operations (Section 3.5)

Chapter 4 of this document addresses the remaining USEPA required element to reduce NPS pollution (Public Education and Outreach, and Stewardship Programs).

3.2 Illicit Discharge Detection and Elimination

Achieving successful source control requires a coordinated approach to detecting unauthorized (illicit) discharges to local waterways and illegal dumping. The goal of this program element is to reduce the discharge of pollutants to storm drainage systems by eliminating connections of wastewater lines, interior drains, and other non-permitted direct connections.

In the absence of specific regulations, the County currently relies on more generic state law (Health & Safety Code) to deter illicit disposal. Options available to the County for discouraging illicit discharges include: (1) development of a structured drainage enforcement policy and guidance procedures, with appropriate monetary penalties and/or cost recovery for violations of related ordinances; (2) mapping of the stormwater conveyance system and identification of high priority drainage areas for targeted investigation/enforcement/correction efforts; and (3) County staff education of illicit discharge identification and reporting procedures and alternatives for proper disposal methods within the County. The County's Illicit Discharge Detection and Elimination program incorporates objectives that address each of these three options as follows:

- Structured Enforcement Policy
- Storm Drain Outfall Mapping and Identification/Evaluation Program
- Illicit Discharge Education Program

The programs are described in detail as follows.

3.2.1 Structured Enforcement Policy – Amend County Ordinance Code

The County currently does not have an adopted drainage ordinance that specifically prohibits non-stormwater discharges into the County's drainage conveyance systems (e.g., roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains under County ownership). Currently, drainage is covered under the following chapters of the County Code: Roads (Title 11- Section 11.04.050 (E)), Grading (Title 12 – Sections 12.20.280 and 290), and Subdivisions (Title 16 – Section 16.26.180). Initial amendments should be focused to Titles 11 and 12. Eventually, the County intends to develop and adopt a structured Enforcement Policy as part of an Ordinance Code update and revision process.

Responsible Agency: County Health Department, Division of Environmental Health

Anticipated Timeline: Through December 2012 with updates approximately every five years thereafter

3.2.2 Storm Drain Outfall Mapping and Identification Program

The County in cooperation with other entities operating storm drain facilities and/or conveyance systems within the PSA (e.g., Tuolumne Utilities District [TUD], Groveland Community Services District [GCSD], Twain Harte Community Services District [THCSD]), should develop a Comprehensive Storm Sewer System Map showing the location of all outfalls and the names and locations of receiving waters. To the maximum extent feasible, the County may obtain such information from existing sources (e.g., TUD). Alternatively, the County may pursue a cooperative mapping venture with other agencies. The final map should be compatible with the County's GIS. For those facilities within its jurisdiction, the County should conduct a field inventory of storm drain outfalls for existing development including an inventory of land uses associated with outfalls (e.g., commercial, residential, roadway, industrial and specifying particular type of industry such as automotive, painting etc.). Field inventories should include a general evaluation of water quality at the outfalls.

Responsible Agencies: County Department of Public Works in cooperation with other discharging entities (e.g., TUD, GCSD, THCSD). Mapping assistance and field inventories may be provided by qualified citizen volunteer monitors.

Anticipated Timeline: Commencing in June 2008 through December 2012 with mapping prioritized for watershed catchments identified as high and very high priority in Figure 2-4 of the WQP; updates approximately every five years

3.2.3 Illicit Discharge Education Program

For controlling non-permitted discharges into the County drainage/drainage conveyance system(s), the County should implement an Illicit Discharge Education Program that focuses on educating County staff on the types of illicit discharges. Initially focus will be placed on educating individuals about illicit connections and discharges and illegal dumping. Discharges authorized under a NPDES permit will be exempt from this program. In addition, the following discharges are also exempt because they are not expected to contain pollutants and can therefore be discharged without direct application of control practices. These discharges include:

- water line flushing
- landscape irrigation
- diverted stream flows
- rising ground waters
- uncontaminated ground water infiltration (as defined at 40 CRF §35.2005(20)) to separate storm sewers
- uncontaminated pumped ground water
- discharges from potable water sources
- foundation drains
- air conditioning condensation
- irrigation water
- springs
- water from crawl space pumps
- footing drains
- individual residential car washing
- flows from riparian habitats and wetlands
- dechlorinated swimming pool discharges

The CVRWQCB has issued a general permit for dewatering, Order No. CAG995001. Qualifying dewatering operations are able to obtain permit coverage under this order by submitting a Notice of Intent (NOI) to the CVRWQCB. Allowable discharges must not contain significant quantities of pollutants and be either four months or less in duration, or not exceed 0.25 million gallons per day (mgd) during dry weather. Under the terms of the permit, monitoring and reporting are required. Copies of this permit are available from the CVRWQCB.

Non-potable irrigation water, landscape irrigation, and lawn or garden watering runoff, though minimized, will occur on a regular basis as a result of excess irrigation water running off vegetated and nearby impervious areas and into storm drains. These discharges are not expected to result in the discharge of appreciable pollutants. If these activities subsequently result in an unacceptable level of pollutant discharges, the County will undertake to develop, or require the responsible discharging party to develop, a pollution management plan.

Illicit Connections and Discharges

During routine maintenance of conveyance systems and drainage structures, County staff should look for evidence of illegal discharges or illicit connections. The following steps should be followed:

- Identify spills such as paints, discoloring, etc.
- Identify odors associated with the drainage system.
- Record locations of apparent illegal discharges/illicit connections.
- Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- Once the origin of flow is established, require illicit discharger to eliminate the discharge.

Illegal Dumping

County staff should regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occur. They should establish a system for tracking incidents; preferably in a format that is compatible with the County's GIS. The system should be designed to identify the following:

- Illegal dumping hot spots
- Types and quantities (in some cases) of wastes
- Patterns in time of occurrence (time of day, month, or year)
- Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
- Responsible parties

The County will post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.

The State Department of Fish and Game operates a hotline for reporting violations called Cal TIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).

The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations. Notification of hazardous waste spills and/or dumping should also be directed to the County Environmental Health Department.

Responsible Agency: Oversight and County staff training by the County Environmental Health Department, Environmental Health Division

Anticipated Timeline: Ongoing, commencing by December, 2010

3.2.4 Storm Drain Stenciling Program

The County should support a stenciling program to apply messages at storm drain inlets located at key locations and in key facilities (e.g., parks and other areas with notable dumping problems) with the intent of assisting in educating the public about stormwater runoff pollution.

Responsible Agency: County Department of Public Works

Anticipated Timeline: New development projects will require that all new storm drain inlets be stenciled by 2008

3.3 Pre-Construction, Construction, and Post-Construction Activities

This program element describes the controls to reduce the discharge of pollutants associated with construction activities by providing a standardized implementation process and a range of BMPs acceptable to the County. The goal is to control pollutants associated with construction activities by requiring a construction site to implement adequate water quality control measures and by enforcing the implementation of the requirements through adequate construction site inspections. A key factor for the success of this program is contractor education; namely identifying acceptable BMPs and explaining techniques for preparing a stormwater pollution prevention plan (SWPPP). The County is currently providing outreach to private developers, designers, and engineers to raise awareness and inform them of their responsibilities to minimize water quality impacts from construction (Chapter 4.0).

3.3.1 Standardized Practices for Establishing Stormwater Management Measures - Process Checklist

Stormwater pollution control requirements are intended to be implemented on a year-round basis at an appropriate level and in the context of local site conditions. The contractor is expected to deploy measures sufficient to achieve compliance with the County's Grading Ordinance and, as applicable, the NPDES General Permit for Stormwater Discharges Associated with Construction Activity. The following process has been developed to standardize the County's requirements for construction activities and outline a protocol that minimizes on- and/or offsite water quality impacts during construction.

The County should work toward adopting standardized practices addressing and a process checklist for applying stormwater management practices based on the following. The process checklist will be used during field inspections by County staff pursuant to the County's Grading Ordinance and will be made available to contractors and engineers to guide them in preparing County grading plans. Aspects of the following that also address air quality issues may require amendments for consistency with adopted air quality management guidelines.

Scheduling

Construction scheduling shall consider the amount and duration of soil exposed to erosion by wind, rainfall, runoff, and vehicle tracking and shall be scheduled to minimize construction activities in watercourses and the amount of active disturbed soil areas, during the rainy season. A schedule shall be prepared that shows the sequencing of construction activities with the installation of erosion and sediment control practices.

Construction shall be scheduled to minimize construction activities in "high-risk areas" and the amount of actively disturbed soil areas during the rainy season (October 15 to May 15). "High-risk areas" include those areas within 50 feet of watercourses designated on USGS topographic maps, 100-year floodplains, regulated wetlands, and where slopes exceed 15 percent.

Unless specifically authorized by the County's onsite representative, during the rainy season the contractor shall not schedule construction activities in "high risk areas" or schedule to have more than 5 acres of active disturbed soil area. As an alternative to these restrictions, the contractor may elect to assure that these areas are fully protected by "sediment basins" or "treatment," in addition to the normally required "effective combination" of soil stabilization, sediment barriers and basins/traps. Where permanent stormwater treatment devices are to be constructed, these devices should, whenever feasible, be constructed as an early work item.

Site Conditions

Existing site characteristics such as vegetation, environmental features, topography, and areas of historic contamination (natural and/or industrial or agricultural) should also be recorded on the project layout. Soil laboratory analyses may be required if prior contamination is suspected. The selection and implementation of construction BMPs will be affected by what existing features need to be protected or mitigated during construction.

Preservation of Existing Vegetation

Preserving existing vegetation to the maximum extent possible and for as long as possible on a construction site reduces or eliminates erosion in those areas. To facilitate this practice, on a year-round basis, temporary fencing shall be provided prior to commencement of clearing and grubbing operations or other soil disturbing activities to protect those areas where no construction activity is planned or where construction will occur at a later date. Prior to the commencement of soil disturbing activities, areas of existing vegetation that are to remain and environmentally sensitive areas (i.e., wetlands, protected habitats, etc) shall be fenced for protection. In general, site designs shall preserve existing vegetation to the MEP; and during construction, existing vegetation shall be preserved (and protected by fencing) for as long as possible to minimize erosion.

Stormwater Run-Off and Concentrated Flows

The diversion of stormwater run-off and conveyance of concentrated flows must be considered in determining the appropriateness of the practices chosen. Practices to divert or manage concentrated flows in a non-erosive fashion may be required on a project-by-project basis to divert offsite drainage through or around the construction site or to properly manage construction site stormwater runoff. Existing watercourses shall be protected; and if diverted, handled in a non eroding fashion. To the extent feasible, all concentrated water flows shall be channeled away from disturbed soil areas / stockpiles. Concentrated water flows shall be conveyed in a non-eroding fashion; and they shall, to the MEP, be channeled away from all disturbed soil areas.

Stockpile Management

Stockpile management is required year round. In addition, the County should require the following:

Soil stockpiles:

- Rainy season (October 15 to May 15): Covered or protected with soil stabilization measures and perimeter sediment barriers.
- Non-rainy season: Covered or protected with perimeter sediment barriers.
- Concrete/asphalt rubble, rock and aggregate base/subbase: Covered or protected with perimeter sediment barriers.
- "Cold mix" asphalt: Covered.

Sediment Tracking Control

Appropriate measures should be deployed to minimize the tracking of sediment offsite by vehicles and/or equipment. These measures include stabilized construction entrances/exits and roadways, and tire washing. Where tracking occurs, streets shall be swept or vacuumed. Sediment tracking control practices are required year round. These measures include:

- Street sweeping
- Stabilization of construction roadways
- Entrance/outlet tire washing

These measures may also include stabilized construction entrance/exit controls; however, frequently this control is not effective and does not suffice as a substitute for tire washing.

Wind Erosion Control

Wind erosion control measures are required year round to minimize dust generated by construction activities. These measures include applying water or other dust palliatives to minimize dust.

Non-Stormwater Management

Non-stormwater discharges shall be minimized to the extent feasible. Sediment laden non-stormwater must be filtered (or equivalent treatment) prior to discharging. Measures to control non-stormwater discharges are required year round. These measures include, but are not limited to:

- Water conservation practices
- Vehicle and equipment operational practices
- Dewatering operational practices
- Waste (including hazardous and septic / sanitary) management practices
- Spill prevention and control practices
- Material handling practices
- Practices for paving, pavement grinding, pile driving, demolition, temporary batch plant and irrigation operations

On construction sites, the Construction Manager and the Contractor shall be alert to and report the potential presence of illicit connections to the County's storm drainage system or illicit discharges. The NPDES permit prohibits the discharge of non-permitted non-stormwater discharges. The County Department of Public Works will coordinate the reporting of prohibited non-storm discharges to the CVRWQCB.

If the non-permitted non-stormwater discharge occurs as a result of the construction activity, the Construction Manager and the Contractor shall immediately halt the discharge and take measures to minimize any potential reoccurrence.

If the non-permitted non-stormwater discharge is not as a result of the construction activity, then the County Department of Public Works will address remediation of the situation with the responsible authorities. The County Department of Public Works will log and track each reported non-permitted non-stormwater discharge to conclusion. The ongoing log will be included within the Annual Report.

Disturbed Soil Area Management

Minimum disturbed soil area management requirements shown in Tables A-1 and A-2 in Appendix A, are based on typical rainfall patterns (i.e., time frames, intensities, and amounts), general soil types, the seasons, slope inclinations, and slope lengths. These same factors must be considered for each site when developing the appropriate levels of soil stabilization and sediment control for a specific site. Disturbed soil areas shall be protected with an effective combination of measures including soil stabilization, sediment barriers, and sediment basins/traps.

BMP Monitoring

The type of BMP monitoring depends on which BMP is implemented. In the case of contractor activity BMPs, the monitoring consists of visual inspection to ensure that the BMP was implemented and maintained according to the SWPPP. Such inspection would include, but is not limited to:

- Identifying spills and resulting clean-up procedures (e.g., supplies of spill cleanup materials)
- Verifying adequacy of trash receptacles
- Verifying waste disposal practices (e.g., recycle vs. hazardous waste bins)
- Examining integrity and use of containment structures
- Verifying use of employee education programs for the various activities
- Noting the location of activity (e.g., outdoor vs. indoor, concrete vs. grass)
- Developing BMPs for any chemicals or fuels not addressed in the SWPPP

In the case of erosion and sediment control BMPs, the monitoring program should consist of regular inspection to determine the following:

- Proper installation of erosion and sediment control BMPs
- Effectiveness of BMPs based on the presence of sediment behind or within control devices, the presence of sediment downstream of the site, and signs of erosion in stabilized areas after a storm event.
- Change in drainage patterns
- Stabilization of areas as quickly as possible after completion of construction activities in an area

Responsible Agency: County Department of Public Works

Anticipated Timeline: Use of checklist to commence by January 1, 2008

3.3.2 Require Implementation of BMPs

The County should prepare a recommended list of BMP's similar to that found in Appendix A, for use by property owners and contractors. Such BMP's will be implemented as required by the revised grading code and other ordinances.

Responsible Agency: County Department of Public Works

Anticipated Timeline: Commencing no later than January 1, 2008

3.3.3 Establish a BMP Effectiveness Evaluation Process

The County should consider developing a Best Management Practices Evaluation and Guidelines Program (BMP Program) to track the effectiveness of local source and treatment control practices in efforts to refine the BMPs identified in Appendix A. Selection of the appropriate BMP for a given situation is a difficult decision that must consider factors such as cost, engineering parameters, and effectiveness in attaining the desired result. This program will facilitate adaptive management objectives by assessing and documenting the development of monitoring procedures to evaluate the implementation and effectiveness of BMPs for a variety of activities in four different program areas: construction, urban NPS pollution, roadway engineering, and vegetation management. This program will require a collaborative process of monitoring and reporting between County and State agencies, landowners, and private developers and contractors that implement BMPs within the County.

3.3.4 BMP Guidelines/Stormwater Control Plan Handbook

The County should explore developing and/or adopting an existing BMP Guidebook to help local businesses, landowners, and contractors comply with the water quality standards enforced by the CVRWQCB. As funding becomes available, the County envisions developing a Guidebook in concert with other foothill counties that includes a step-by-step guide on how to prepare a Stormwater Control Plan that supports the analysis of stormwater impacts under CEQA and includes relevant mitigation requirements. The Guidebook should be supported by schematic designs and a simplified design procedure for stormwater treatment and hydrograph modification management BMPs. In addition, the Guidebook should describe the necessary maintenance agreements (e.g., dedication of fee or easement) or other long-term commitment to provide for operation and maintenance of stormwater treatment facilities in perpetuity.

Responsible Agency: County Department of Public Works

Anticipated Timeline: Within four years of WQP adoption

3.3.5 Amend Title 12 (Grading Ordinance)

Please refer to Section 3.4.1, amend County Ordinance Code and General Plan.

Responsible Agency: County Department of Public Works

Anticipated Timeline: Within four years of WQP adoption

3.4 New Development and Planning

This plan element describes the existing, pending, and proposed new controls to reduce the discharge of pollutants associated with runoff from new development projects after construction is complete. This element also describes existing, pending and proposed new methods to

strengthen zoning requirements and enhance the environmental review process to better address water quality impacts before construction begins. These goals will be achieved through a combination of the following:

- **Amend the County Ordinance Code**, as needed, to provide consistent guidelines for drainage management and/or infrastructure improvements for new developments or major redevelopments in the County through amendments to the County Ordinance Code including identifying BMPs
- **Refining environmental impact analysis** related to water quality pursuant to CEQA including provisions to address both project specific and cumulative stormwater regulatory and permitting issues (Section 3.4.2)
- **Educating County staff** to effectively evaluate water quality and potential threats to water quality (Section 3.4.3)

3.4.1 Amend County Ordinance Code

The Tuolumne County Ordinance Code (TCOC) contains requirements for limiting impacts to water quality from development, such as grading, septic systems, wells, land divisions, residential, agricultural, commercial and industrial land uses designated near surface waters. In the context of the findings of the County's Assessment report, it is uncertain whether existing codes and practices are adequate to mitigate impacts to water quality in the County. Potential modifications to the existing TCOC may include, but are not limited to, new requirements for the preparation of a Stormwater Control Plan; identification of prohibited discharges; establishing an authority to inspect and monitor BMPs; and establishing penalties for violations. The following programs are proposed to standardize, streamline, and improve the County's existing mechanisms for maintaining and improving water quality within County regulations. Beyond these proposals, the County should consider additional modifications to existing ordinances or the establishment of a specific stormwater ordinance.

Title 12 (Grading)

Title 12 of the TCOC governs grading activities within the County (Chapter 12.02). Currently, language contained in Title 12 regulating erosion or sedimentation from stormwater runoff is limited to the following:

> "All drainage facilities shall be designed to carry waters to the nearest practicable drainageway approved by the department as a safe place to deposit such waters. Erosion of ground in the area of discharge shall be prevented by installation of nonerosive downdrains or other devices." (TCOC Section 12.20.290)
>
> "The faces of cut and fill slopes shall be prepared and maintained to control against erosion. This control may consist of effective planting. If, in the opinion of the department, the protection for the slopes is not subject to erosion due to the erosion-resistant character of the materials, such protection may be omitted." (TCOC Section 12.20.310)
>
> "When necessary, check dams, cribbing, riprap or other devices or methods shall be employed to control erosion and provide safety." (TCOC Section 12.20.320)

The Public Works Department is currently in the process of amending Chapter 12.20 to better address erosion from grading and construction operations in efforts to reflect the current base of knowledge. In addition to those changes, the following changes to Title 12 are proposed:

Amend the Grading Ordinance

The County will amend Title 12 to incorporate applicable provisions of Program 3.3.1 (e.g., stockpile management, wind erosion controls, disturbed soil area management, BMPs).

Responsible Agency: County Department of Public Works

Anticipated Timeline: Commencing no later than January 1, 2009

Title 13 (Water and Sewers)

Title 13 of the TCOC governs the installation of individual sewage treatment and disposal systems and water supply wells. This ordinance was the subject of extensive review and revision as part of the 1999 Groundwater Investigation. The current requirements contained in Title 13 are consistent with current State and Federal requirements. The requirements for these systems may be reviewed at the following locations in the County Code:

- TCOC Chapter 13.04: Private Sewage Disposal Systems (site and soil requirements for division of land in un-sewered areas).
- TCOC Chapter 13.08: Onsite Sewage Treatment and Disposal (site, soil and construction standards for construction of septic tank-leachfield systems).
- TCOC Chapter 13.12: Abatement of Contamination or Nuisance.
- TCOC Chapter 13.16: Well Ordinance (specifies water well construction and testing standards).

In addition to the above, the County intends to develop a stormwater management ordinance.

Prepare a Stormwater Management Ordinance

The County will develop a Stormwater Management Ordinance through a collaborative process that involves local stakeholders and County leaders. Elements of the Stormwater Management Ordinance should, at minimum, contain the following:

- Requirements for the preparation of a Stormwater Control Plan,
- Identifying prohibited discharges,
- Requiring inclusion of Best Management Practices and Standards as identified in the California Stormwater Best Management Practice Handbook,
- Authority to Inspect and Monitor; and
- Penalties for violations.

Responsible Agencies: County Health Department, Division of Environmental Health and County Department of Public Works

Anticipated Timeline: Complete draft ordinance by December 31, 2012

Tuolumne County General Plan – Watershed Planning

The State defines watershed-based water quality protection as the prevention/control of pollution and management of human activities in a geographically or other defined drainage area to protect, restore, and/or enhance the natural resources and beneficial uses within the watershed. The County intends to achieve this directive through a process of watershed prioritization as discussed in Section 2.3 in conjunction with the implementation of voluntary watershed stewardship programs described in Chapter 4 of this document.

Continue to Implement General Plan Policy Directives to Minimize Water Quality Impacts to Local and Regional Water Supply Reservoirs

The County's General Plan outlines several goals and policies, which through their implementation programs seek to achieve basic watershed protection goals by limiting the encroachment of urbanized land uses near regional drinking water supply reservoirs and encouraging the efficient extension of public infrastructure. For example, Implementation Programs 7.J.a through 7.J.e, 7.K.a through 7.K.d, 1.E.k, 1.F.k, and 1.G.3 direct the County to minimize the use of private onsite sewage disposal systems in favor of extension of public sewer service.

Likewise as revealed in the County's Assessment report, a majority of Community areas are situated in the upper reaches of the Assessment's Primary Study Area and at a substantial distance from regional and Federal water supply reservoirs; thus, providing an urban setback from the reservoirs. The County's General Plan land use diagram reflects this land use pattern and supports the continued concentration of urban and suburban centers in the upper reaches of the foothill margin and rangeland, agricultural, and rural residential areas in the lower reaches. Policy directives contained within the County's General Plan specifically instruct the County to orient urban forms of development to defined community areas as supported by Implementation Programs 1.A.b, 1.A.c, 1.A.d, 1.A.j, 13.A.d, and 13.B.d of the General Plan.

Responsible Agency: County Community Development Department: Planning Division and GIS Division

Anticipated Timeline: In conjunction with consideration of urban development boundary programs

Future Revisions

Additional revisions to the TCOC will be developed during the first five years of the WQP's implementation. These additions, revisions, and/or modifications will specifically address stream zone protection corridors, post-construction drainage, and NPS runoff controls and will be tailored after California Stormwater Best Management Practice Handbooks (Handbooks). The Handbooks have provided guidance for municipalities since 1993 and reflect the current practices, standards, and significant amount of knowledge gained since the early 1990s about the effectiveness of BMPs.

3.4.2 Environmental Impact Analysis

CEQA applies to all proposed public and private actions or projects requiring discretionary approval by a State governmental or other public agency (unless an exemption applies; see Articles 18 and 19 of the CEQA Guidelines). A "project" is generally defined as the whole of an action or activity with the potential for resulting in direct or indirect physical effects on the environment. The Community Development Department is the agency within the County responsible for implementing CEQA.

The County has not formally adopted significance standards for hydrology and water quality impacts, but consistent with Appendix G of the CEQA Guidelines, the County considers that implementation of a project would have a significant effect on hydrology (other than flooding) and water quality if it were to:

- Violate any water quality standards or waste discharge requirements,
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge,
- Substantially alter the existing drainage pattern of a site or area in a manner that would result in substantial erosion or siltation on- or off-site,
- Create or contribute to runoff water that would exceed the capacity of existing or planned stormwater drainage systems,
- Provide substantial additional sources of polluted runoff, or
- Otherwise degrade water quality.

Within unincorporated portions of the County, a development generally includes commercial, industrial, transportation, residential, or mixed use projects involving the creation of new or expanded impervious surfaces, such as roof areas, streets, roadways, parking lots or sidewalks in sufficient quantity to potentially affect water quality. To assist in the County's environmental analysis of a project's potential impacts to water quality, the following programs are proposed:

Update Standardized Mitigation Measures

Amend the County's standardized mitigation measures for CEQA documents to include BMPs for maintaining surface water quality (see Sections 3.3.2 and 3.3.3).

Responsible Agency: County Community Development Department, Planning Division

Anticipated Timeline: Commence by December 31, 2008 and complete no later than June, 2009

Adopt Significance Criteria

In addition to criteria established pursuant to CEQA, adopt significance criteria:

- Establish that a project would have a significant adverse impact on water quality if it fails to maintain nonpoint source pollutants at preconstruction levels, and
- Impair existing beneficial uses and/or conflict with water quality objectives established by the CVRWQCB in the Basin Plan.

Responsible Agency: County Community Development Department, Planning Division

Anticipated Timeline: Commence by December 31, 2008 and complete no later than June, 2009

Evaluate Cumulative Drainage and Water Quality Impacts

The County should establish a minimum threshold (e.g., project size, nature of land use, requirement for an Environmental Impact Report) to determine when these evaluations will be required.

Responsible Agency: County Community Development Department: Planning Division and GIS Division; County Department of Public Works

Anticipated Timeline: Adopt guidelines and procedures by December 31, 2009

Update Field Review Checklists

Update existing field review checklists to incorporate water-quality evaluation criteria (e.g., noting the condition of outflows, existing or potential new sources of NPS pollutants, overall watershed health). The County is encouraged to use existing published checklists to the extent feasible.

Responsible Agency: County Community Development Department, Planning Division

Anticipated Timeline: Amend checklists by December 31, 2009

3.4.3 Educate County Staff

Staff Education and Training

When funding becomes available, the County should organize a field training event for County staff to include, but not limited to:

- Attending a stream walk training session identifying water quality indicators (similar to stream walks provided for the Tuolumne County Stream Team citizen water quality monitors)

- Participating in a cooperative field inspection with planners, public works officials, environmental health staff, and others to increase interdepartmental communications and understanding of field applications of various grading practices, erosion control techniques, soil testing procedures, effectiveness of BMPs and monitoring provisions, and similar field operations affecting water quality.

Responsible Agency: County Community Development Department, Planning Division; County Department of Public Works; County Health Department, Division of Environmental Health; and other agencies involved in applying water quality management measures and evaluations in the field.

Anticipated Timeline: Adopt criteria and/or incentive programs by December 31, 2012

Agency and Local Official Outreach

County Officials. Provide opportunities for County officials to participate in environmental education and the distribution of proclamations for groups, industries, businesses, and individuals who have provided an outstanding contribution to water pollution prevention.

County Department Partnerships. Nurture and maintain opportunities to work with County departments to promote the stormwater message. Incorporate public awareness into County staff training on the Stormwater Program.

Annual Agency and County Supervisors Update. Provide copies of the County's Annual Reports submitted to the CVRWQCB and provide periodic program updates to the County supervisors and other agencies, as appropriate.

Responsible Agency: County Community Development Department, Planning Division; County Department of Public Works; County Health Department, Division of Environmental Health; and other affected agencies

Anticipated Timeline: Ongoing

3.5 County Operations

This program element describes the control measures to reduce pollutants from County activities conducted in public right-of-ways and at publicly operated facilities. The goals of these control measures are to:

1. Reduce the amount and type of pollutants that collect on streets, parking lots, park and recreation areas, and material storage and vehicle maintenance areas

2. Reduce the amount and type of pollutants that result from maintenance of storm drainage systems

3. Set an example for what the County expects on privately-owned lands and facilities

It is critical that the County identify and isolate controllable NPS pollutant sources originating from its own operations. Primary pollutant sources of concern include: high activity parking lots; material (including wastes) storage and handling areas; vehicle and equipment fueling, washing maintenance, repair areas; erodible soils; streets and highways; and handling and application of landscape maintenance products. Reduction or elimination of stormwater pollutants at these sources can be achieved by implementing source control BMPs, which include good housekeeping, employee training, spill prevention and cleanup, preventative maintenance, regular inspections, and record-keeping. These BMPs enhance the effectiveness of engineering, structural, and physical controls (such as impervious containments and covers).

3.5.1 Develop and Implement New Source Reduction Strategies

Training will be essential to ensure that employees are aware of and able to implement pertinent provisions of the stormwater program. Areas of focus should include: (1) equipment maintenance and washing; (2) pesticide application practices; and (3) waste storage and disposal. Fact sheets, performance standards, and procedural worksheets and/or manuals for common activities will help simplify the process and encourage compliance. If operational and source control BMPs are not feasible or adequate, then stormwater treatment BMPs may be necessary (see Appendix A).

A range of source reduction strategies includes:

Vehicle and Equipment Fueling/Cleaning/Maintenance

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation to prevent or reduce the discharge of pollutants to stormwater during vehicle and equipment fueling, maintenance, and cleaning.

Waste Handling and Disposal

The discharge of pollutants to stormwater from waste handling and disposal can be prevented and reduced by tracking waste generation, storage, and disposal; reducing waste generation and disposal through source reduction, reuse, and recycling; and preventing drainage run-on and runoff.

Spill Prevention, Control and Cleanup

Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, disposal activities, documentation, and follow-up procedures.

Landscape Maintenance

1. The major objectives of this BMP is to minimize the discharge of pesticides, herbicides, and fertilizers to the storm drainage system and receiving waters; prevent the disposal of landscape waste into the storm drain system by collecting and properly disposing of clippings and cuttings, and educating employees and the public.

Drainage System Maintenance

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff that may contain certain pollutants. This BMP focuses on maintaining catch basin/stormwater inlet structures, treatment devices, open channels, pump stations, and other stormwater conveyance structures on a regular basis to remove pollutants, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

3.5.2 Roadway Drainage and Erosion Survey Program

Observations documented as part of the County's Assessment report suggest that erosion sites within or connected to the roadway system contribute a large fraction of controllable sediment to local creeks. These sites include road cut slopes, road embankments, road-side cast material, roadside ditches with long slope lengths, and culvert outfalls without sufficient downslope protection. These factors contribute to the road systems ability to efficiently intercept surface runoff and subsurface flow from offsite locations (e.g., adjacent properties), concentrate it within roadside ditches, and redirect it toward natural drainages and creeks through culverts and/or overside drains. Increasing slope steepness and length further intensifies this effect.

This Roadway Drainage and Erosion Survey Program was developed to address these issues by inventorying the roadway system for high priority drainage catchments (Figure 2-4) and prescribing corrective treatments. The purposes of the Roadway Drainage and Erosion Survey Program are to:

- inventory road drainage and erosion features
- identify whether the features do or do not have identifiable problems
- provide treatment recommendation based on the field observations and office evaluations
- develop a treatment priority system
- implement treatments based on the priority system
- establish a tracking and monitoring program for the inventory and instituted treatments

Field Inventory

The field inventory should progressively seek to cover all County road systems. The field inventory should begin in the highest priority watersheds as identified in the Assessment (Figure 2-5) as well as any updated information derived from the on-going inventory or other sources. To the extent possible a mid- and long-term inventory schedule should be developed to determine the range of needs for personnel, equipment, and time to complete the inventory. This schedule will also facilitate budgeting and contribute to grant submittals to assist in funding the inventory and treatment.

Site Prioritization

After the completion of the field inventory, evaluation of the identified sites will be necessary to develop a prioritization scheme for treatment. The site prioritization system should consider the following factors: analysis of inventory results, biological factors, regulatory factors, and management factors. Criteria for each of these categories should be developed. Prioritization discussions in the Five Counties Salmonid Conservation Program (http://www.5counties.org/) should be useful in developing criteria for the County.

Identify Treatments and Treatment Priority

A series of treatment options for erosion control and engineering improvements of the road drainage system should be developed. This list of treatment options should be based on the experience of other entities (refer to Identification of Revegetation Techniques Suitable for Tuolumne County below), the specific drainage structure and erosion conditions identified in the field inventory, the location of these inventory sites within priority watersheds, the specific cost/benefit ratio of treating a given site, and the budgetary and staffing opportunities and constraints that exist as the program is implemented.

As the program is implemented, new ideas will likely emerge based on experience and new information as well as information developed from monitoring the implemented treatments. These should be integrated into the program as appropriate.

Identification of Revegetation Techniques Suitable for Tuolumne County

Establishing a vegetative cover is often an effective erosion control technique. However, the soils that are exposed in road cuts, road embankments, and other disturbed sites are often difficult sites upon which to establish plant cover. The decomposed granitic soils and shallow soils in the County are particularly difficult to establish vegetation on because they have a low nutrient status; have a low organic matter content; have low water holding capacities that makes them too dry for plants; are shallow making it difficult for plants to establish effective root systems; or are steep and highly erosive which may physically remove any soil nutrients, seeds, or young plants that are placed on them. Investigation of effective means of treating such sites is an on-going process. The following discusses useful information identified during the course of this study; however, a detailed literature review and evaluation of revegetation methods is beyond the scope of this outline. Consequently, a more detailed literature review as well as interviews with knowledgeable professionals and the identification of area-specific revegetation and erosion control techniques would be a useful addition to the treatment options available in the County. Interested professionals would include personnel from Caltrans, Sierra Nevada region Resource Conservation Districts, and the Sierra Nevada National Forests. Identification of sources for vegetative materials will also be useful.

Caltrans has an on-going program of stormwater quality evaluation including soil stabilization, vegetation establishment and maintenance, roadside vegetated treatment, and new erosion technology (www.dot.ca.gov/hq/env/stormwater/ongoing/soil/index.htm) with recent reports available at (www.dot.ca.gov/hq/env/stormwater/special/newsetup/index.htm).

Caltrans also has an online training site on Soil Resource Evaluation – a stepwise process for regeneration and revegetation of drastically disturbed soils (www.dot.ca.gov/hq/LandArch/research/es_site_0522/index.html). This site contains four case studies one of which addresses revegetating a Mehrten Formation deposit along Highway 80 in Placer County and another on decomposed granite in Shasta County. Additional information on the Shasta County site (Buckhorn Summit) is also contained in Claassen and Zasoski (1997a, b).

Additional information and experience with physical and revegetation treatment of erodible decomposed granite soil is contained in Trinity County Resource Conservation District and Natural Resources Conservation Service (1999). The report includes background on the Grass Valley Creek watershed including a history of issues and monitoring information.

Hogan (2005) provides a good overview of sediment source control appropriate to the higher elevation Sierra Nevada. It includes three sections: Part I Guiding Principles, Part II Technical Notes, and Part III Literature Review. Part II contains a review of assessing site conditions, gathering baseline information, soil preparation, fertilizers, soil amendments, plant materials and monitoring. Part III contains a good overview of erosion and variables that influence erosion rates including soil structure and treatments.

The California Department of Fish and Game Salmonid Habitat Restoration Manual (www.dfg.ca.gov/nafwb/manual.html) contains a variety of information on revegetation methods and upslope erosion inventory and sediment control guidance.

The California Geological Survey publication Rehabilitation of Disturbed Lands in California: A Manual for Decision Making (www.conservation.ca.gov/OMR/reclamation/index.htm) addresses restoration of moderately and severely disturbed mining lands some of which is applicable to Difficult To Re-Vegetate Sites Associated With Road Cuts (Newton and Claassen 2003).

Responsible Agencies: County Department of Public Works; County Administrator's Office, Facilities Management

Anticipated Timeline: Ongoing. Identify potential funding sources prior to December 31, 2012. If successful, prepare and implement plan for watershed catchments identified as high or very high priority by 2015.

3.5.3 Drainage Planning Program

Based on the findings of the County's Assessment report, alterations to natural drainage patterns as a consequence of continuing urbanization within the County have resulted in degradation of receiving waters (e.g., stream morphology) due to higher stormwater runoff volumes, changes in

peak runoff timing, and the introduction of urban contaminants. The purpose of the County's Drainage Planning Program is to develop supplemental technical information and data necessary to develop master drainage plans for urbanized portions of the County. The ultimate objective of this program is to provide County decision makers with better information regarding cumulative drainage effects from existing and planned development as related to the drainage catchments identified in Figure 2-4.

New requirements contained in Section 3.4.1 of the WQP will require that new development projects maintain pre-project runoff volumes up to a specified design event. As a result, this program will focus on cumulative changes to runoff for existing development in terms of timing and velocity in order to identify attenuation requirements for local drainage areas. This process will help the County in retrofitting older stormwater control devices or installing them where none currently exist. For the purposes of this discussion, retrofitting refers to a process that involves the modification of existing surface water runoff control structures or surface water runoff conveyance systems that were designed to control flooding and will also serve a water quality improvement function. Further, retrofitting should also be considered as an opportunity to improve existing water quality BMPs and/or test new ones.

This Program will follow right after the Storm Drain Outfall Mapping and Identification Program (refer to Section 3.2) and require the delineation of watershed catchments outside of the PSA as identified in the Assessment report. The Program will require the generation of a hydrograph for specific drainage-catchments within larger, yet prioritized drainage basins (e.g., Phoenix Lake Basin). This program will require the use of a hydrologic model to provide insight about the effect of land-management practices on the quantity and quality of runoff, infiltration, lateral flow, both saturated and unsaturated subsurface flow, and deep percolation. The steps in developing local master drainage plans will generally include:

1. Determine issues and prioritize areas of concern (what you want to find out)
2. Determine available data
3. Determine available analytical tools and methods
4. Determine project constraints
5. Determine additional data needs
6. Determine acceptable levels of assurance within project constraints

In selecting a model, the County will consider the following: (1) ease of running the model and interpreting the results, (2) availability of data, (3) availability of models, (4) applicability to land-use activities, (5) applicability to broad geographic areas, and (6) accuracy of prediction. Federal agencies, such as the U.S. Army Corps of Engineers (Corps), Natural Resources Conservation Service (NRCS; formerly Soil Conservation Service), the U.S. Environmental Protection Agency (USEPA), and the U.S. Geological Service (USGS) have developed a plethora of documentation related to models, methods used, and assumptions involved. Documentation, technical publications and models are electronically available from agency internet sites: http://www.wrc-hec.usace.army.mil/ for the Corps Hydrologic Engineering Center (HEC) and

http://www.wcc.nrcs.usda.gov/ for the NRCS National Water and Climate Center (WCC). Based on preliminary review, the County will use one of the below methods in developing master drainage plans for prioritized basins:

> ***HEC-1.*** All ordinary hydrograph computations associated with a single recorded or hypothetical storm can be accomplished with the Corps' HEC-1, Flood Hydrograph Package.
>
> ***Technical Release 55*** **(Urban Hydrology for Small Watersheds. Graphical or Tabular Method).** The graphical method in Technical Release 55 (TR55) is used to determine the peak discharge for a single storm event on a watershed. The method applies to an urban or a rural watershed or one in transition. The method uses NRCS hydrology as described in National Engineering Handbook Section 4, Hydrology (NEH-4), and was developed from hydrograph analysis using Technical Release 20: Computer Program for Project Formulation–Hydrology. The procedure calculates the runoff curve number and time of concentration based on measured watershed parameters

Responsible Agency: County Department of Public Works

Anticipated Timeline: Ongoing. Identify potential funding sources prior to December 31, 2009. If successful, prepare and implement plan for the PSA by 2012.

3.5.4 Wastewater Regionalization and Connection Study

Water quality monitoring conducted as part of Phase 1 of the County's MRP discovered that fecal coliform levels in all the monitored waterways were above Basin Plan objectives at one or more times. One of the primary non-point sources thought to contribute to these elevated levels includes concentrated areas of failing individual septic systems. The County's 1999 Groundwater Investigation identified three primary factors that limit the performance of onsite wastewater systems, including shallow depths to bedrock, coarse-textured soils, and restrictive lot sizes and/or configurations.

Corrective measures for failing septic systems are problematic and controversial in that each system in need of repair or replacement more than likely requires expensive onsite improvements and/or specially engineered systems. In some instances onsite restrictions may only be corrected through an extension of sewer service, which would only be cost-effective for clusters of development. The County recognizes the need to initiate a comprehensive planning process to address these concerns in coordination with major wastewater service providers within the County, which include the Tuolumne Utilities District (TUD), Groveland Community Services District, Tuolumne Sanitary District, and the Jamestown Sanitary District.

In consultation with these entities, the County should encourage further study of connecting existing development within prioritized watershed catchments to an expanded collection system. In addition, the County will continue to coordinate with the CVRWQCB regarding any applications that include variances to the requirements contained in Chapter 13.04 of the TCOC.

To help fund collection system feasibility studies, the County should take a lead in obtaining project funds in the form of loans from the NRCS and the State Revolving Loan Fund, as well as USEPA Hardship Grants and Community Development Block Grants and the Sierra Nevada Conservancy. Over the long-term, the objectives of the County's Wastewater Regionalization and Connection Study are to:

- Provide sufficient wastewater disposal capacity to meet its short- and long-term growth demands as projected under the County's adopted General Plan
- To site and operate new wastewater collection facilities that minimize adverse environmental effects and eliminate dense clusters of failing onsite wastewater disposal systems
- To achieve the above objectives in a cost-effective manner that limits system capital costs, operations and maintenance costs, and user rates to the extent feasible

Responsible Agency: County Administrators Office; Environmental Health Division; Tuolumne Utilities District

Anticipated Timeline: Ongoing.

CHAPTER 4
Community and Voluntary Stewardship Programs

This chapter describes the current and planned public education and outreach activities that are intended to increase the public's awareness of the County's water resources and the effects of NPS pollution on those resources. In addition, the chapter includes voluntary stewardship programs intended to encourage participation in water quality improvement programs through non-regulatory means throughout the community.

These programs will be implemented contingent on available funding over the course of the planning period. It is anticipated that the majority of these programs will be initiated outside of County regulatory agencies, but with cooperation from those agencies. Specifically, it is anticipated that the Tuolumne County Resource Conservation District and/or similar organization(s) will spearhead efforts to promote community and stewardship-based programs to maintain and improve surface water quality County-Wide.

This chapter describes the current and planned public involvement and participation activities focused on maintaining and improving runoff water quality from urbanized and rural land uses. The primary goal is to identify water quality control measures that the public can implement "in their own backyards."

These activities and programs can be broadly grouped into the following categories:

- Establishing Oversight – Watershed Coordinator (Section 4.1)
- Citizen Monitoring (Section 4.2)
- Landowner Technical Assistance Programs: Erosion Control and Community Source Reduction Programs (Section 4.3)
- Existing County Programs (Section 4.4)
- Public Outreach (Section 4.5)
- Workshops (Section 4.6)
- Community Water Body Cleanup Activities (Section 4.7)
- Recognition Programs (Section 4.8)

4.1 Establishing Oversight - Watershed Coordinator

It is anticipated that the majority of community-based programs will be initiated outside of County regulatory agencies, but with cooperation from those agencies. The County should work with the newly-formed Tuolumne County Resource Conservation District (RCD) to fund a permanent County Watershed Coordinator position. The Watershed Coordinator would establish and promote water quality efforts countywide. Recommended watershed coordinator activities include, but are not limited to:

1. Overseeing citizen and private water quality monitoring efforts, maintaining a master database, and providing direction for making program improvements (Section 4.2)
2. Identifying and distributing educational materials
3. Overseeing implementation of a landowner technical assistance program (Section 4.3)
4. Applying for and administering grants and identifying other funding sources (Chapter 5)
5. Overseeing formation of a watershed stewardship program including educational programs for target stakeholder groups (e.g., ranchers, farmers, and landowners within target watersheds or priority catchments)
6. Overseeing formation of local watershed groups focused on specific catchment areas (refer to Chapter 2, Priorities), identifying and pursuing funding, and implementing stewardship programs to improve water quality within those catchment areas
7. Promoting and overseeing preparation of a Watershed Owner Manual(s) for landowners and/or stakeholder groups, providing common and innovative BMPs, and activities aimed at voluntary landowner implementation countywide
8. Organizing and promoting public outreach programs (Section 4.4)
9. Organizing and promoting educational workshops (Section 4.5)
10. Organizing and promoting community water cleanup activities (Section 4.6)
11. Organizing and promoting source reduction programs (Section 4.7)

4.2 Citizen Water Quality Monitoring

The County Citizen Water Quality Monitoring Group (or Stream Team) was developed to implement a comprehensive monitoring strategy by helping to create integrated, long-term, volunteer-based water quality and watershed monitoring programs within the County's watersheds. The goals of the team are:

- To provide guidance, training, equipment, and support to monitoring groups
- To increase the amount and quality of citizen water quality monitoring data
- To increase public and agency use of, and access to, citizen monitoring data
- To establish communications between citizen monitors and government agencies to ensure that useful information is collected

Water quality monitoring is initially focused at implementing Phase 2 of the County's MRP, but may be expanded, subject to community interest. Expanded activities may include visual assessments of little studied watersheds, measurements of water quality parameters at new monitoring locations, surveys of fish and other aquatic organisms that are indicators of water quality, and measurements of flow and sediment load in the streams. The Stream Team will follow an established sampling protocol, provide equipment, and access to a centralized database.

It is anticipated that the Stream Team will operate under the auspices of the County Resource Conservation District with oversight by the Watershed Coordinator.

4.3 Landowner Technical Assistance: Erosion Control and Community Source Reduction Programs

The connection of individual properties to the County-maintained road system plays an important role in terms of the actual delivery of sediment to natural surface waters. Similarly, watershed planning necessarily involves participation by individual landowners in undertaking practices to prevent NPS pollutants on their properties from entering County surface waters.

The County's Assessment report identified runoff from unvegetated portions of properties, driveways, corrals, and sites under development as contributors of sediment to the stream systems. In addition, animal waste, gardening practices, general maintenance practices, pest control, disposing of household hazardous wastes and related substances, and uses on and from individual properties can contribute to the accumulation of NPS pollutants in streams.

The County should investigate potential grant opportunities to fund the development of a Landowner Technical Assistance Program that would be implemented in conjunction with public education and public outreach programs described in Section 4.6. This program would seek to find and disseminate applicable information for landowners on how they could reduce erosion and sediment and other non-point source pollutant delivery from their individual property. Initially, the Program should consist of the following elements:

- Property Self–Assessment: Watershed Owner's Manual
- Erosion Control Techniques
- Techniques for Managing NPS Pollutants
- Defensible Space/Fuel Modification Areas

4.3.1 Property Self-Assessment: Watershed Owners Manual

This program involves developing a simple to use property self-assessment method to assist landowners in conducting a voluntary runoff, erosion, and NPS pollutant assessment of their property. The property self-assessment should be used for existing properties to identify potential retrofits and for newly developing properties so that effective runoff and erosion control measures can be incorporated. Methods for managing, measuring, and/or reducing NPS pollutants on

individual properties also should be included. Runoff from both impermeable and permeable surfaces should be addressed. Impermeable surfaces would include roofs, paved driveways, and paved patios. Permeable sites will include lawns, gardens, corrals, and park areas.

The property self-assessment will guide landowners through their property and produce an inventory of where runoff occurs and is concentrated, where runoff and sediment and other pollutants may be carried off their property, and where the sediment and other pollutants might be delivered to a local creek. The assessment will produce a simple drawing of the property and the location of runoff and sediment from it. The property self-assessment methodology could be simplified from the more formal procedure used in the Lake Tahoe Basin (Coburn et al., 2003). Examples of other homeowner assessment tools include, but are not limited to:

- Mokelumne River Watershed Owner's Manual (2002) adapted by permission from Home*A*Syst (see below) by the San Joaquin County Resource Conservation District Watershed Coordinator, John Brodie. Available from the San Joaquin County RCD, (209) 9472-7127, online at http://www.sjcrcd.org, or e-mail them at info@ sjcrcd.org.

- Home*A*Syst: An Environmental Risk-Assessment Guide for the Home (1997) by the Regents of the University of Wisconsin System with the cooperation of the Northeast Regional Agricultural Engineering Service (NRAES). Available from NRAES Cooperative Extension, P.O. Box 4557, Ithaca, NY 14852-4557, (607) 255-7564, or online at http://www.nraes.org/publications/nraes87.html

- Lodi Winegrower's Workbook. Guides assessment of farming techniques (specifically winegrape growing), preparation and implementation of action plans to improve soils, water, pest management techniques, and other resources. Published by the Lodi-Woodbridge Winegrape Commission (Ohmart and Matthiasson, 2000). Available from the Lodi-Woodbridge Winegrape Commission, (209) 367-4727 or online at http://www.lodiwine.com

- Healthy Horses for Clean Water – A Guide to Environmentally Friendly Horsekeeping for Equine Businesses. Published by Horses for Clean Water in partnership with Rainier Audubon Society and the King County Department of Natural Resources (Alayne Rneee Blickle, 2000). Available from the Snohomish Conservation District, (425) 335-5634, Ext. 4, or available at http://www.psat.wa.gov/Publications/Pub_Master.htm.

- Tips on Land and Water Management for Small Farm and Livestock Owners in Western Washington also by Horses for Clean Water. The manual addresses mud, manure, pasture, weed, wildlife, woodlot management; compost bins, and more. Copies are available from the King Conservation District, 935 Powell Ave., SW Renton, WA 98055; (206) 764-3410, or may be ordered online at http://www.kingcd.org/pub.htm

Additional resources are listed in Appendix B.

4.3.2 Erosion Control Techniques

The Watershed Owners Manual should address erosion control techniques and treatments and designs that can be implemented at modest cost by the landowners themselves, general laborers, landscapers, or more specialized contractors. These treatment techniques could include items

such mulching bare soils in open space or around shrubs, installing lawns in larger open spaces, infiltration enhancement using rock-filled trenches or basins (dry wells), downspots and cisterns, flow-through planters, infiltration planters, slotted drains in new driveways, vegetated or grassy swales, or outlet protection where runoff is concentrated. These features are described for the Lake Tahoe Basin in Cobourn et al., 2003; examples are also shown at http://www.tahoebmp.org/examples.aspx) and for the Contra Costa County Clean Water Program (http://www.cccleanwater.org/construction/nd.php#SourceControl). Other descriptions are in The Mountain Driveway Best Management Practices Manual (Wright Water Engineers and Denver Regional Council of Governments, 1999).

NRCS - Backyard Conservation shows how conservation practices used on agricultural lands across the United States to conserve and improve natural resources can be adapted for use on the land around your home. These practices help the environment and can make your yard more attractive and enjoyable (http://www.nrcs.usda.gov/feature/backyard/).

Techniques that may be more suitable for small commercial developments include vegetated and grassy swales, dry wells, infiltration trenches, and infiltration basins (http://www.cccleanwater.org/construction/nd.php#SourceControl).

The Watershed Coordinator will be available to discuss the results of a property self-assessment and help identify suitable treatments that meet the site conditions and the owner's financial and physical capabilities. A list of local supply dealers, who carry the appropriate materials, or local contractors, who have experience installing these treatments will also be assembled and updated as appropriate.

4.3.3 Non-Point Source Pollutant Reduction

The Watershed Owner's Manual also will address techniques for managing NPS pollutants on individual properties. Topics may include, but are not limited to: Landscaping and site management to control runoff; household wastewater, yard and garden care; septic system maintenance; managing household hazardous wastes; safe management of gasoline, heating oil, diesel and other fuels; and recycling, reusing, composting and on-site waste disposal (refer to Section 4.4)

4.3.4 Defensible Space/Fuel Modification Areas

Chapter 15.20 of the TCOC outlines the County's fire safety standards for residential, commercial, and industrial structures. Section 15.20.005 of the TCOC defines "Defensible Space" as the area within the perimeter of a parcel where basic wildland fire prevention practices and measures are to be implemented and maintained, including but not limited to removing brush, flammable vegetation, or combustible growth that is located 30 feet or more from a building or structure measured from the eaves, porches, decks and balconies to the property line, to provide the key point of defense from an approaching wildfire or an escaping structure fire. Additional requirements for defensible space setback distances are provided in Section 15.20.060, Defensible Space and Fuel Modification of the TCOC.

A common misconception is that these fire safety priorities must be weighed against the objectives of erosion control. Rather, the concepts of defensible space and fuel reduction essentially mean arranging trees, shrubs, and other fuel sources in a way that makes it difficult for fire to transfer from one fuel source to another. It does not mean cutting down all trees and shrubs, or creating a bare ring of earth across a specific property (BOF, 2006). An erosion-resistant defensible space involves the maintenance of the existing duff layer, as opposed to its removal, and the use of landscaping with favorable fire performance ratings. The County Watershed Owners Manual should include basic guidelines for common forms vegetation that are identified as having a favorable fire performance rating.

4.4 Existing County Programs

The County's existing source reduction programs will encourage community members to recycle, reclaim, or reuse materials whenever possible to keep the following items out of streams. Approaches to source reduction may include, but are not limited to:

Recycling. The County's Blue Bag Roadside Recycling Program allows the recycling of specific items by placing them in blue bags, provided by the County, and placing them at the curb on regular trash collection days for free pick-up in their area, whether individuals have collection service or not. Additional information on the program is available at the County's web-site under Living/Environment.

Oil Recycling. Used motor oil can be recycled at certified used oil recycling collection centers throughout the State. Certified used oil collection centers are able to take used motor oil from the public and reimburse individuals at a rate of 16 cents a gallon. The County's Solid Waste Division website provides more information on where the community can recycle used motor oil.

E-Waste. Electronics are a fast-growing portion of America's trash. The "Universal Waste Rule" eliminates these wastes from being commingled in curbside collection services. The County's Solid Waste Division website provides more information regarding the types of E-Wastes that will be accepted at the following locations:

Cal Sierra Transfer Station
19309 Industrial Dr., Sonora, CA
(209) 536-1719
8:00 a.m. - 4:45 p.m.
7 days (except Christmas and New Years)

Groveland Transfer Station
10912 Merrell Rd., Groveland, CA
(209) 962-4376
Wednesday and the County's Solid Waste Division website provides more information regarding the types of E-Wastes that will be accepted.
Saturday
7 days (except Christmas and New Years)

Household Hazardous Waste Collection. The absence of routine or affordable pickup service for trash and recyclables in some communities encourages illegal dumping. A lack of understanding regarding applicable laws or the inadequacy of existing laws may also contribute to the problem. Providing a central location for the disposal of household hazardous wastes (e.g., paint, fertilizers, antifreeze, batteries, fluorescent light tubes, products containing batteries, products containing mercury [e.g. thermometers], etc.) will help to protect surface water quality by offering citizens an alternative to disposing of these materials in the storm drain. Disposal costs vary considerably depending on the size of the program, and what types of wastes are collected.

Cal Sierra Transfer Station
19309 Industrial Drive
(Hwy 108 & Industrial Drive)
Sonora, CA 95370-9232
(209) 536-1719

Groveland Transfer Station
10912 Merrell Road
(End of Merrell Road)
Groveland, CA 95321
(209) 962-4376
8:00 a.m. – 4:00 p.m.
Wednesday and Saturday only (except Christmas and New Years)

Businesses that qualify as Conditionally Exempt Small Quantity Generators (CESQG) may participate in the County's CESQG program and take certain hazardous wastes to their disposal/household hazardous waste facilities. A CESQG is defined by law as a business that generates certain hazardous wastes in the course of its regular business in quantities of no more than 27 gallons or 220 pounds in any given monthly period. Businesses that qualify as a CESQG are encouraged to contact the County Solid Waste Division for a CESQG program overview and application at (209) 533-5588.

4.5 Public Outreach

Public education and outreach is generally the cornerstone of an effective water quality program. The goal is to educate the general population about surface water quality and basic steps that they can take to protect it. Public education outreach will be accomplish through several outlets including, but not limited to, civic organizations and clubs, volunteer groups, schools, businesses, the Tuolumne County Resource Conservation District, UC Cooperative Extension, community services districts, utility districts, community members, and other stakeholder individuals and groups . It is anticipated that public outreach and education will use local newspapers, radio stations, the internet, organizational newsletters, local events (e.g., Home and Garden Show) public access television and other communication resources.

The primary goal of education and outreach is to generate awareness of surface water pollution prevention by educating people about the storm drainage system, pollutants of concern, and their connections to the health of local waterways and water supply facilities (e.g., reservoirs). Secondly, it is critical to generate public interest and enthusiasm through education and

encouragement of active participation in water pollution prevention resulting in changed behavioral patterns benefiting water quality efforts. Outreach activities can be broadly grouped into four categories:

- Outreach to general public and target industries
- Outreach to children and school staff
- Outreach to agency managers and local officials
- Regional partnerships

4.5.1 General Public and Target Industry Outreach Programs:

Clean Water Business Partners. Develop a priority list of businesses that may impact water quality as a result of the services they provide. Enhance efforts to publicly recognize businesses that actively promote activities that reduce or eliminate surface water pollution. Make the program concepts available to businesses that are incorporating water quality protection measures into their operations. Incorporate these businesses in the promotion of clean water awareness and implementing post-construction BMPs (refer to Chapter 3).

Community Events. Partner with environmental and watershed groups to provide material for surface-water pollution prevention information booths at various public events, such as farmer's markets, the County Fair, Home and Garden Shows, and other community events.

Media Campaigns. Develop multimedia materials, campaigns, and partnerships. Look for ways to partner with agencies, businesses, and industries. Increase the use of local and regional media to promote citizens' awareness of the causes of NPS pollution problems and of solutions that they can help implement.

Water Wise Pest Control Program. Coordinate with the County Agricultural Commissioner to form partnerships with nurseries, retailers, landscapers, and pest control operators to encourage less toxic methods of pest control to reduce pesticide toxicity in streams and drainage systems.

4.5.2 School Outreach

Stormwater Classroom Presentations. Support School Board approved stormwater pollution and water quality related presentations suitable for third through sixth grade. Present more technical presentations to seventh through twelfth grade with the idea of integrating such topics into the existing science curriculum. Develop and implement educational materials to tie into science standards by introducing the water cycle, streamside communities and aquatic food chain concepts, and the effects of stormwater pollution.

Water Education for Teachers. Support efforts to develop a Water Education for Teachers Workshop to promote awareness, appreciation, knowledge, and stewardship of water resources through the development of classroom-ready teaching aids (e.g., through workshop sponsorships, informing local school districts regarding the availability of such programs, assisting in funding to acquire classroom teaching aids).

4.5.3 Statewide and Regional Outreach Activities

California Stormwater Quality Association (CASQA). Join CASQA to enable informational sharing, provide technical support, and identify successful approaches to public education and outreach.

4.6 Workshops

The Watershed Coordinator will organize and hold public workshops that focus on specific stormwater topics. These workshops will be for the purpose of sharing information and facilitating a collective focus on potential solutions for improving surface water quality. The County, the community, and other watershed stakeholders will participate. These workshops will be held on an as-needed basis.

4.7 Community Water Body Cleanup Activities

In conjunction with other watershed planning efforts, it is anticipated that the Watershed Coordinator will organize and promote community water cleanup activities in association with other community organizations including, but not limited, to:

Urban Waterways Beautification Projects. Encourage citizens, school districts, County agencies, and watershed groups to participate in the clean up of different watershed drainage areas. This partnering of governmental and citizen groups will help foster good working relationships throughout the community. "Adopt a Storm Drain" programs encourage individuals or groups to keep storm drains free of debris and to monitor what is entering local waterways through storm drains.

Stenciling Program. The County is proposing to undertake a stenciling program to apply messages at storm drain inlets located at key locations and in key facilities, such as parks and other areas with notable dumping problems, to educate the public about stormwater runoff pollution. The County will develop and distribute information on the storm drain stenciling program and solicit volunteers through schools, community neighborhood associations and clubs, environmental groups, and the Water Quality Planning website. New development projects will require that all new storm drain inlets be stenciled by 2008.

4.8 Recognition Programs

Citizen volunteers performing water quality monitoring or undertaking projects on individual properties to improve the County's watershed should be recognized. Promoting successful efforts and awarding a "pat on the back" is an effective means for encouraging ongoing efforts and for increasing community involvement, participation and enthusiasm. Successful recognition programs that can serve as a model program include, but are not limited to:

The Lower Mokelumne River Watershed Stewardship Award Program
http://www.sjcrcd.org/involve/2005_Mokelumne_River_Stakeholder_Recognition_Award_FINAL_Jan_2006.pdf

Arcade Creek Project
http://www.arcadecreekproject.org/main.php?content=generalcontent/home

Pit River Watershed Alliance
http://www.pitriveralliance.net/

Dry Creek Conservancy
http://drycreekconservancy.org/

South Yuba River Citizens League
http://syrcl.org/

CHAPTER 5
Grant Funding Opportunities

Funding the County's watershed stewardship priorities over the planning period is one of the more difficult tasks faced by County staff and community groups alike. Because of staffing limitations and financial constraints, the County will continually need to seek both financial and technical assistance to enable implementation of the County's watershed stewardship priorities. This section outlines many of the grant funding mechanisms that may be used to partly or fully fund implementation projects outlined in this chapter. As previously indicated, grant monies are becoming more and more competitive, and therefore, emphasis will be placed on implementation projects. Programs will include a focused water quality monitoring effort to track and evaluate effectiveness. Additionally, in efforts to promote regional partnerships, the County intends to partner with other local public agencies (e.g. utilities), the County Resource Conservation District, tribes, citizen groups, regional agencies (e.g., Turlock Irrigation District), and Federal agencies (e.g., U.S. Bureau of Reclamation) in future grant efforts. A range of potential funding sources include, but not limited to, the following:

Environmental Quality Incentives Program (EQIP). As part of the reauthorization of the Farm Security and Rural Investment Act of 2002, USEPA and the USDA currently provide funding through the EQIP (current funding is $200 million annually) to enable more rapid support for agricultural producers' actions that will protect water quality. EQIP offers contracts with a minimum term that ends one year after the implementation of the last scheduled practices and a maximum term of ten years. These contracts provide incentive payments and cost-shares to implement conservation practices. Persons who are engaged in livestock or agricultural production on eligible land may participate in the EQIP program. The EQIP may cost-share up to 75 percent of the costs of certain conservation practices. Incentive payments may be provided for up to three years to encourage producers to carry out management practices they may not otherwise use without the incentive. However, limited resource producers and beginning farmers and ranchers may be eligible for cost-shares up to 90 percent. Farmers and ranchers may elect to use a certified third-party provider for technical assistance. An individual or entity may not receive, directly or indirectly, cost-share or incentive payments that, in the aggregate, exceed $450,000 for all EQIP contracts entered during the term of the Farm Bill. Additional information is available at http://www.nrcs.usda.gov/programs/eqip/

Conservation of Private Grazing Land Program. The Conservation of Private Grazing Land (CPGL) Program was authorized by the conservation provisions of the Federal Agricultural Improvement and Reform Act (1996 Farm Bill). The intent of this provision is to provide accelerated technical assistance to owners and managers of grazing land. The CPGL Program

is a voluntary program that helps owners and managers of private grazing land address natural resource concerns while enhancing the economic and social stability of grazing land enterprises and the rural communities that depend on them. Additional information is available at http://www.nrcs.usda.gov/PROGRAMS/cpgl/

Conservation Security Program. The Conservation Security Program is a voluntary program that provides financial and technical assistance for the conservation, protection, and improvement of soil, water, and related resources on Tribal and private lands. The program provides payments for producers who historically have practiced good stewardship on their agricultural lands and incentives for those who want to do more. Additional in formation is available at http://www.nrcs.usda.gov/Programs/csp/

State Revolving Loan Funds. State revolving loan funds (SRFs) are loan programs that are capitalized by federal grants, state appropriations and dedicated revenues. States use the funds to provide a range of financial assistance to local governments, including loans, grants and credit enhancement. The drinking water and wastewater SRF programs provide low-interest loans to local governments and operators of sewer and water facilities. The program has become a major source of water infrastructure financing and is often leveraged with bonds. Additional information is available at http://www.swrcb.ca.gov/funding/srf.html

Proposition 50, Integrated Regional Water Management (IRWM) Grant. The IRWM Grant Program is a joint program between the Department of Water Resources (DWR) and the SWRCB, which provides funding for projects to protect communities from drought, protect and improve water quality, and reduce dependence on imported water. The IRWM Grant Program includes two separate grant types: Planning Grants and Implementation Grants. Additional information is available at http://www.grantsloans.water.ca.gov/grants/integregio.cfm

Small Community Wastewater Grant (SCWG). The SCWG Program provides grant assistance to small communities with financial hardship, needing to install or upgrade failing wastewater treatment facilities. SCWG program funds are some of the most sought after; so funds go quickly. In the last eight years, the program provided assistance totaling $60 million for projects such as installing sewers, upgrading failing treatment plants, and repairing leaking sewer pipes. The SCWG Program offers three types of grants: Planning, Design, and Construction. More information on this program is available at http://www.waterboards.ca.gov/cwphome/scwg/index.html

Safe Drinking Water Act (SDWA) Grant. In California, the responsibility for regulating public water systems and overseeing the allocation of SQWA grant funding resides with the Department of Health Services (DHS). Through an interagency agreement (contract), DWR provides assistance in administering the local financial assistance portion of the Drinking Water State Revolving Fund (DWSRF) program. The federal law provides that a portion of the federal funds may be used for specified activities in addition to providing financial assistance to public water systems for infrastructure improvements. These activities include: (1) administration of the DWSRF financial assistance program, (2) technical assistance to small water systems, (3) source water assessment and protection, and (4) water system capacity development. Federal and State statutes mandate source water assessment and protection, and capacity development. Collectively, funding for these

"set-aside" programs may utilize up to 31 percent of the federal Capitalization Grant. Tribes can also receive grants for public water system infrastructure improvements through a national set-aside. Additional information is available at http://www.grantsloans.water.ca.gov/index.cfm

Clean Water Act (CWA) Section 319(h) Grants. Congress amended the CWA in 1987 to establish the section 319 NPS Management Program, because it recognized the need for greater federal leadership to help focus State and local NPS efforts. Under Section 319, State, Territories, and Indian Tribes are eligible to receive grant money to support a wide variety of activities including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring to assess the success of specific NPS implementation projects. Additional information on this grant program is available at http://www.epa.gov/OWOW/NPS/cwact.html

Watershed Coordinator Grants. Information is available at http://www.consrv.ca.gov/DLRP/rcd/grant_program/watershed_grants.htm

Targeted Watershed Grants. The Targeted Watersheds Grant Program is a competitive grant program to encourage the protection and restoration of the country's water resources. The program supports environmental stewardship and action by providing needed funding to watershed organizations for on-the-ground restoration and protection efforts designed to achieve quick, measurable, environmental results. The goal of the Targeted Watersheds program is to build on the successes of existing partnerships and coalitions that have evaluated and assessed their watersheds, devised a technically sound watershed plan, and are ready to embark on steps to implement their plan. More information is available at http://www.epa.gov/owow/watershed/initiative/

CHAPTER 6
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Appendix A
Menu of Best Management Practices

APPENDIX A
Menu of Best Management Practices

In following the County's Process Checklist (Section 3.3.a), the selection and implementation of BMPs will be driven by the pollution risks associated with the construction activity. The pollution prevention objectives of BMPs are defined based on a review of information gathered during the assessment of the site and planned activities (Process Checklist). Once defined, BMP objectives should be developed in order to encourage the proper selection of BMPs.

The WQP emphasis a distinction between two major categories of treatment measures for construction—erosion control and runoff/sediment control—each of which includes treatment methodologies designed for specific site conditions (e.g., climate, slope gradient, etc.). Erosion control is any practice that protects the soil surfaces and prevents the soil particles from being detached by rainfall or wind. Therefore, erosion control is almost a form of source control that treats the soil surface and protects it from erosive forces. Runoff control involves the use of engineered structures and/or bioengineering to reduce runoff velocities and/or pre-treat runoff prior to discharge offsite. Runoff control often includes some form of sediment control to keep sediment, the product of erosion, onsite and away from waterways. Most importantly, both erosion and runoff control measures have applications both during and flowing construction (e.g., post-construction).

The following terms are used extensively throughout this Appendix and are defined below:

Disturbed Soil Area - Disturbed soil areas (DSAs) are areas of exposed, erosive soil that are within the construction limits and that result from construction activities. The following are not considered DSAs:

- Areas where soil stabilization, erosion control, highway planting, or slope protection are applied and associated drainage facilities are in place and functional.
- Roadways, construction roads, access roads or contractor's yards that have been stabilized by the placement of compacted sub-base or base material or paved surfacing.
- Areas where construction has been completed in conformance with the contract plans and permanent erosion control is in place and functional.
- Erosion control is considered functional when a uniform vegetative cover equivalent to 70 percent of the native background vegetation coverage has been established or equivalent stabilization measures have been employed.

Active and Non-Active Areas - Active areas are construction areas where soil-disturbing activities have already occurred and continue to occur or will occur during the ensuing 21 calendar days. Non-active areas are construction areas (formerly active areas) that will be idle for at least 21 calendar days. The contractor will conduct a review of the existing active areas on a regular basis to determine if a non-active status should be applied to some DSAs.

Slope Length and Terraces - Slope length is measured or calculated along a continuous inclined surface. Each discrete slope is between one of the following: top to toe, top to terrace, terrace to terrace, and terrace to toe. Terraces are drainage facilities that intercept surface flow and convey the resulting concentrated flow away from a slope.

Rainy Season - The rainy season for the County is defined as October 15 through May 15.

Sediment Basin - A sediment basin is a controlled stormwater release structure formed by excavation or by construction of an embankment of compacted soil across a drainage way, or other suitable location. It is intended to trap sediment before it leaves the construction site. The basin is a temporary measure in most cases and is to be maintained until the site area is permanently protected against erosion or a permanent detention basin is constructed. The length of the basin is determined by measuring the distance between the inlet and the outlet and as a rule of thumb is typically more than twice the basin's width to provide sufficient settling time.

Treatment - A combination of basin and treatment engineered to capture and treat (to remove 0.01 mm sized particles and larger) the **10-year, 6-hour rain** event using Q=CxIxA where C=0.5 and I ranges from 1.9 inches (Jamestown) to 2.6 inches (Twain Harte).

This Appendix presents a menu of BMPS for the following two categories, which follow on the accompanying pages:

I. Erosion Control BMPs
II. Runoff Treatment BMPs (II.1 - Flow-Reduction and II.2 - Sediment/NPS Pollutant Reduction Controls)

I. Erosion Control BMPs

When erosion control BMPs are implemented and maintained, the amount of sediment associated with runoff waters can be dramatically reduced. Whenever possible, it is recommended that erosion control measures be emphasized in project planning due to their cost-effectiveness and long term sustainability, especially with the integration of biostabilization[1] measures. Erosion control primarily focuses on the maintenance and reestablishment of a vegetative (or other) cover to protect the soil surface during and following construction or land disturbance. Temporary erosion control is usually achieved by seeding or mulching barren areas with fast growing annual grasses and protecting the soil with mulch or matting. Permanent erosion control usually involves the planting of perennial grasses, shrubs, and trees in a way that resembles native vegetation.

To establish a permanent vegetative cover that will prevent soil detachment, reduce sheet and rill erosion, and stabilize slopes and channels, permanent seeding should be used in conjunction with other erosion control measures. Erosion control blankets and mats, fiber roles, riprap, hydraulic plantings, mulching, biofilters, and cellular confinement systems provide enhanced erosion control by facilitating the establishment of a permanent vegetative cover. Each of these erosion control measures is considered acceptable to the County and is described more thoroughly below. Information regarding the proper installation and design of erosion control measures outlined in the WQP may be reviewed at: http://www.cabmphandbooks.com/

Erosion Control Blankets and Mats

Erosion control blankets (ECBs) and soil stabilization mats (turf reinforcement mats or [TRMs]) can be applied to problem areas to supplement revegetation during its initial establishment. Blankets and matting surfaces temporarily stabilize and protect disturbed soil and enhance water infiltration, decrease compaction and soil crusting, and conserve soil moisture. These temporary surfaces also protect seeds from predators, and reduce desiccation and evaporation by insulating the soil and seed environment. ECBs and TRMs may be used on road-side ditches, construction sites, and drainages channels where water velocities between 3 and 6 feet per second (ft/sec) are likely to wash out new vegetation.

Some types of ECBs and TRMs are specifically designed to stabilize channelized flow areas. These blankets and mats can aid in the establishment of vegetation in waterways and increase the maximum permissible velocity of the given channel by reinforcing the soil and vegetation to resist the forces of erosion during runoff events. Stems, roots, and rhizomes of the associated vegetation become intertwined with the mat, thereby reinforcing the vegetation and anchoring the mat. Conditions where ECBs and TRMs are appropriate may include:

- Slopes and disturbed soils where mulch must be anchored.
- Steep slopes, generally steeper than 3:1(generally not applicable to the County limits).

[1] Biostabilization, also commonly referred to a bioengineering, is a practice that brings together biological, ecological, and engineering concepts to produce living, functioning systems to prevent erosion, to stabilize slopes and to enhance wildlife habitat.

- Critical slopes adjacent to sensitive areas such as streams and wetlands.
- Disturbed soil areas where planting is likely to be slow in providing adequate protective cover.
- Channels with flow exceeding 2 to 4 ft/sec.
- In channels intended to be vegetated and where the design flow exceeds the permissible velocity. Allowable velocity, with turf reinforcement mats after vegetative establishment, is up to 10 ft/sec (3 m/sec).

Hydraulic Plantings

Hydraulic planting is a method of applying erosion control materials to bare soil and establishing erosion-resistant vegetation on disturbed areas and critical slopes. By using hydraulic equipment (hydroseeders and hydromulchers) seed, soil amendments, wood fiber mulch and tackifying agents, bonded fiber matrix and liquid co-polymers can be uniformly broadcast, as a hydraulic slurry, onto the soil. These erosion and dust control materials can often be applied in one operation.

Hydraulic planting techniques are expensive, but provide the most dependable results on steep critical slopes, with limited accessibility and on which mulch must be anchored and on shallow soils which restrict the use of erosion control blankets. Hydraulic machines today are used to spray seed, tack down straw, bind the soil, seal the soil, or apply blanket-like coats of bonded fiber matrix (BFM).

Grass-Lined Channels

Grass-lined channels consist of vegetation lining along a natural or constructed waterway, swale, or dike to protect it from erosion. Grass protection of drainages reduces erosion by lowering water velocity over the soil surface and by binding soil particles with roots. A drainage is any ground surface over which concentrated runoff travels. It is typically a manmade waterway, swale or ditch. Grass-lined channels should be used where:

- A vegetative lining can provide sufficient stability for the channel grade by increasing maximum permissible velocity;
- Slopes are generally less than 5 percent; or
- Site conditions required to establish vegetation, i.e., climate, soils and topography are present.

<u>V-shaped Channels:</u>

Generally used where the quantity of water is relatively small, such as roadside ditches. The V-shaped cross section is desirable because of difficulty stabilizing the bottom, where velocities may be high. A grass or sod lining will suffice where velocities are low or rock or riprap lining may be necessary.

Parabolic Grass Channels:

Often used where larger flows are expected and sufficient space is available. The shape is pleasing and may best fit site conditions. Riprap should be used where higher velocities are expected and where some dissipation of energy (velocity) is desired. Combinations of grass with riprap centers or turf reinforcement mat centers are useful where there is a continuous low flow in the channel.

Trapezoidal Grass Channels:

Used where runoff volumes are large and slope is low so that velocities are non-erosive to vegetated linings. Trapezoidal channels generally have concrete or riprap lined center for low flow.

Mulching

Mulching is an inexpensive method to stabilize the soil surface in locations where the protective vegetation has been removed. The most common use of mulch or plant debris is to provide temporary stabilization of soil, usually until permanent-stabilizing vegetation is established. Where mulches are used to complement vegetation establishment, they should be designed and installed to maximize contact with the ground and last as long as it takes to establish vegetation. On steep slopes, greater than 2.5:1, or where the mulch is susceptible to movement by wind or water, the material should be appropriately anchored. On small sites, where plant material is distributed by hand, it can be anchored by hand punching it into the soil every 1 to 2 feet (0.3 to 0.6 meters) with a dull, round nosed shovel. Mulching effectively complements surface roughening applications.

Cellular Confinement Systems

A cellular confinement system (CCS) is a more expensive three-dimensional, earth-retaining structure used to mechanically stabilize the surface of cut and fill slopes. A CCS is a permanent erosion control practice intended to stabilize infill materials for slope and channel protection, load support, and earth retention applications. The expandable panels create a cellular system that confines topsoil infill, protects and reinforces the plant's root zone, and permits natural subsurface drainage. Slopes as steep as 1:1 can be treated with cellular confinement systems.

A CCS provides durable protection to channels exposed to severe hydraulic or mechanical stresses. The cell structure is a flexible form for distributing a uniform thickness of concrete over a wide range of channel geometry. The erosion-resistant concrete lining system conforms to minor subgrade movement and prevents uncontrolled concrete cracking. The system is used in conjunction with a geotextile underlayer to relieve hydrostatic pressures. The geocell system provides protection to geomembranes in stormwater detention ponds and basins, lagoons, dikes, dam faces, and landfill cover applications. Cell depth of geocell sections is based on the potential tractive and uplift forces.

Fiber Rolls

Fiber rolls consist of straw that is wrapped in tubular black plastic netting. These rolls are used extensively in the construction industry due to their cost-effectiveness. They are approximately 8 inches (200 mm) in diameter and 25 to 30 feet (8 to 9 meters) long. If

installed correctly, straw rolls will capture and keep sediment and minimize sheet and rill erosion until permanent vegetation can get established. Installed, straw rolls shorten the slope length, thereby interrupting the ravelling and rilling processes, and reduce the slope steepness. They catch soil material that moves down the slope by the freeze/thaw processes. Organic matter and native seeds are trapped behind the rolls, which provide a stable medium for germination. Rolls trap fertile topsoil and retain moisture from rainfall, which aids the growth of tree seedlings planted along the upslope side of the rolls.

It is imperative, especially on steeper slopes, that a sufficient trench is constructed to place the roll in. Without it, the roll will not function properly, runoff will scour underneath it, and trees or shrubs planted behind the roll will not have a stable environment in which to become established. Straw rolls will last an average of one to two years and are a relatively low-cost solution to sheet and rill erosion problems. This is an important factor when planning the optimum length of time the slope or construction site will need mechanical stabilization. Fiber rolls can be staked with willow stakes if site conditions warrant, and the moisture retained by the fiber roll will encourage willow establishment. Plastic netting will eventually photo-degrade, eliminating the need for retrieval of materials after the straw has broken down.

Compost Blankets and Berms

Compost blankets are usually used on slopes of 2:1 or gentler, but can be used on slopes as steep as 1:1, with consideration given to the length of slope and depth of application. Compost blankets should not be applied in areas of concentrated flow, and can be used in conjunction with compost berms. Adding components such as a tackifier, or using compost blankets in conjunction with other techniques can increase the allowable steepness of the slope to be treated. Compost blankets should be extended 3 to 6 feet over the top shoulder of the slope to prevent water from getting underneath. Compost blankets can be more effective than ECBs, because they come in better contact with the underlying soil, reducing the chance of rill formation.

RipRap

Riprap is a layer of stone designed to protect and stabilize cut-and-fill slopes subject to seepage or weathering, particularly where conditions prohibit establishment of vegetation. Riprap is a versatile, highly erosion-resistant material that can be used effectively in many locations and in a variety of ways to control erosion on construction sites. Riprap is used extensively along several local creeks (e.g., Woods Creek below Jamestown). Riprap is classed as either graded or uniform. Graded riprap is preferred to uniform riprap in most applications because it forms a dense sub-straight. Uniform riprap is more open and cannot adjust as effectively to movement of the stones.

When considering riprap for surface stabilization, it is important to anticipate visual impacts (including weed control) hazards from snakes and other animals, danger of slides and hazards to areas below steep riprap slopes, damage and possible slides from people moving stones, and general safety. Proper slope selection and surface preparation are essential for successful long term functioning of riprap. Adequate compaction of fill areas and proper use of filter blankets or aggregate foundation is necessary.

Riprap should be a well-graded mixture with 50 percent by weight larger than the specified design size. The diameter of the largest stone size in such a mixture should be 1.5 times the d50 size with smaller sizes grading down to 1 inch (25 millimeters). The designer should

determine the riprap size that will be stable for site conditions. The minimum thickness should be 1.5 times the maximum stone diameter, but in no case less than 6 inches (150 millimeters). The stone should be hard, angular, and of such quality that it will not break down on exposure to water or weathering, and suitable in all other respects for the purpose intended.

Riprap stone for slope stabilization not subject to flowing water or wave action should be sized for stability for the proposed grade. The gradient of the slope to be stabilized should be less than the natural angle of repose of the stone selected. Riprap used for surface stabilization of slopes does not add significant resistance to sliding or slope failure and should not be considered a retaining wall. The inherent stability of the soil must be satisfactory before riprap is used for surface stabilization. Design criteria for sizing stone and determining the dimensions of riprap pads at channel or conduit outlets are presented in NRCS (1992), ABAG (1995), and other engineering design manuals.

Bioengineering

Groundcover serves an instrumental role in controlling surface erosion by shielding soil materials from the impact energy of precipitation, slowing the velocity of runoff, and promoting the aggregation of soil materials. In the County the establishment of permanent vegetative cover should be focused to specific areas where open space uses are planned, within designated setbacks, and in open areas where current revegetation efforts have been unsuccessful or yet to be completed. In this sense, permanent planting will be more associated with rehabilitation of riparian buffer strips for NPS pollution control. In most instances, revegetation will be used to complement and reinforce the primary control measure or structure (e.g., grass-line swales and native-tree re-introduction within road-side ditches).

Bioengineering uses plants and structures together in mutually reinforcing or complimentary roles. The structural components initially protect and stabilize the site and create a stable zone for the plants to grow. Bioengineering techniques are used to prevent erosion on upland slopes, to protect streambanks and channels against erosion, and to provide slope stability. Soil bioengineering generally requires minimal access for equipment and workers and causes relatively minor site disturbance during installation. Therefore, these practices are considered appropriate for environmentally sensitive areas. Bioengineering systems are often more cost effective than the use of vegetation or structural solutions alone. Using indigenous materials accounts for some of the cost effectiveness, since costs are limited to labor for plant harvesting, handling, and transportation to the site.

In bioengineering, the plant material itself may provide both the structural and vegetative components of the design. For example, in willow wattles, live staking and brushlayering the woody material is used to provide initial structural protection and later, vegetative cover. Soil bioengineering is useful on small, highly sensitive or steep sites where the use of machinery is not feasible. However, constraints on planting times or availability of the required quantities of suitable plants during allowable planting times may limit the usefulness of bioengineering methods. Vegetated rock gabions, willow check dams, live stake planting, branchpacking, brushlayering, willow wattles, and coir rolls are all examples of successful bioengineering methods.

The probability of successful plant establishment can be maximized through (1) initial site planning; (2) an understanding of the soil base (i.e., will sediment entrapped promote or hinder stability); (3) selection of appropriate seed blends; (4) careful seedbed preparation; and (5) timely planting. In spite of this, the potential for accelerated erosion will remain during the establishment stage. For this reason and prior to seeding, it will be necessary to install other control structures to minimize runoff velocities, which if left unabated could remove seedlings from their target area and concentrate them at the outlet location. In order to prevent costly maintenance operations on other erosion and sediment control practices, permanent vegetative cover should be established in phases; as work is completed on upslope areas, permanent seedlings should be applied to stabilize these areas.

Slopes or barren areas not amiable to site preparation or erosion control blankets should be treated with mulch and soil binder products such as bonded fiber matrix, acrylic copolymers, or cementitious binders. Nutrient availability will be a primary limitation for vegetation reestablishment within the County since the soil resource is generally deficient in nitrogen and phosphorous. As a consequence, biofertilizers[2] and mycorrhizae[3] are very important to any revegetation effort, as they help to rebuild the living component of the soil that is typically damaged by earthwork. **Table A-1** provides a costs and benefits matrix for several revegetation techniques that may be used for various bioengineering applications.

TABLE A-1
COSTS AND BENEFITS OF REVEGETATION TECHNIQUES

Technique	Benefits	Drawbacks
Soil stabilization materials		
Rice straw	Provides favorable conditions for plant establishment.	May have some weed seeds; generally few drawbacks.
Native grass straw[1]	Combines seeding and mulching in one step.	Availability can be limited.
Straw wattles[2]	Creates stable areas where vegetation can establish.	Only effective if properly installed and maintained.
Willow wattles[3]	Combines erosion control and revegetation in one step, uses local materials.	Cannot be ordered ready-made. Most useful in wet areas.
Erosion control fabric and netting[4]	Retains soil on steep slopes, promotes plant establishment.	Cost, requires proper installation and maintenance.
Revegetation materials		
Native grass seed, price per pound and per acre[5]	Deep root systems provide excellent erosion control. After they are established, native perennials provide erosion control even during the first fall rains.	Establishment success varies with site conditions, yearly rainfall patterns, and species.
Native grass plugs, price per plug and per acre[6]	Survival of plugs is higher than seeds; plants are larger after one growing season.	Cost of material and labor is higher than seeding. Best for smaller areas.
Cost of collecting seeds onsite and growing local genotypes[7]	Higher survivorship; plants are adapted to local conditions; preserves integrity of local populations.	Cost

2 Biofertilizers are fertilizers containing living microorganisms, which increase microbial activity in the soil. Often, organic food is included to help the microbes get established.

3 The association, usually symbiotic, of fungi with the roots of seeds plants. There are two major types of mycorrhizae: Ectomycorrhizal Fungi (EM) and Endomycorrhizal Fungi (AM).

TABLE A-1
COSTS AND BENEFITS OF REVEGETATION TECHNIQUES

Technique	Benefits	Drawbacks
Seedlings and saplings of native forbs, shrubs, and trees[8]	Provide long-term erosion control and return the site to original conditions.	Cost, should be planted in areas with stabilized soil. Some species may be limited in availability.
Physical soil stabilization procedures		
Installing water bars along a steep trail	Temporary way to reduce velocity of water along slopes.	Needs constant monitoring maintenance. If improperly placed, may worsen erosion.
Installing a culvert through a dirt road	Reduces erosion associated with access roads.	Cost
Re-contouring slopes	May be the only way to stop erosion on very steep, degraded sites.	Cost, difficult to do on hard-to-access sites.

[1] Available from Hedgerow Farms, Winters, CA. Recommended application rate varies with amount of seed in hay- varies from 10 to 20 bales per acre. Contact Hedgerow Farms for availability of native grass hay.
[2] Costs of installation will vary depending on spacing of straw wattles required on a given slope. Consult manufacturer's guidelines (www.strawwattles.com) for general recommendations of spacing along a variety of slopes and soil conditions.
[2] Instructions for constructing willow wattles can be found through extension programs or online searches
[4] Quality of netting/erosion control fabric needs to increase as site stability decreases. Estimates from one professional restoration firm are as follows: cost per acre for an all-day crew to seed and blanket a slope with coconut matting is approximately $12,000 to $15,000 acre, not including cost of plant materials. Cost of using heavy duty matting on a 1:1 slope with hydrology less than 18 cubic feet/second is approximately $28,000/acre.
[5] Available from Hedgerow Farms, Winters, CA. Contact for recommendations on specific genotypes appropriate for Modoc County. Prices may change due to availability of seeds. Recommended seeding rates for broadcast seeding is between 20 to 25 lbs/acre.
[6] Plant on 6- to 12-inch centers, depending on species and conditions. Contact grower for site-specific recommendations.
[7] Service available from Cornflower Farms, Elk Grove, CA. Contact for estimates of time needed to collect specific species.
[8] Plants should be available from a variety of local native plant nurseries, including Cornflower Farms.

Source: ESA, 2005

II. Runoff TReatment BMPs

Runoff treatment control measures become necessary in instances where erosion control measures would otherwise prove ineffective in the presence of higher runoff velocities. Additionally, these forms of BMPs are typically integrated into new development to address peak discharges associated post-construction runoff. In contrast, sediment/NPS control BMPs include those measures that intercept and slow or detain the flow of stormwater to allow sediment to settle and be trapped. Both forms of BMPs must factor existing and/or planned drainage system design in conjunction with considering variables such as local climate, the infiltration rate and erosivity of the soil base and slope.

Due to large capital expenditures associated with the construction and maintenance of treatment-oriented BMPs, the first step in planning the location and type of treatment BMP is to understand that large reductions in treatment BMP size and investment can be made by (1) reducing the runoff volumes that need to be captured, infiltrated, or treated, and (2) controlling sources of pollutants. These two strategies are the most cost-effective in managing post-construction stormwater. The principles and methodologies for incorporating these flow reduction strategies into site facility planning and design are discussed in the following section.

There are four basic strategies for treating runoff prior to it entering a waterway and include (1) infiltrating runoff into the soil, (2) retaining runoff for later release with the detention providing treatment, (3) conveying runoff slowly through vegetation (e.g., bioretention[4]), or (4) treating runoff on a flow-through basis using various treatment technologies. Based on the strategy selected and applicable BMPs, the capacity and primary design sizing criteria must be established using a combination of local hydrology, project drainage characteristics (e.g., percent imperviousness or runoff coefficient), and numerical sizing requirements. BMPs will be either volume-based or flow-based and must be able to effectively treat the design quantity. Peak storm event flows must also be taken into account so the BMP can safely pass the design peak event while maintaining its water quality functions up to the design volume. Information regarding the proper installation and design of runoff and sediment control measures may be reviewed at: http://www.cabmphandbooks.com/

Treatment BMP maintenance arrangements will be developed during the planning phase of development and redevelopment projects. To ensure that BMP maintenance will take place, the County will require evidence that project proponents have executed an approved method of treatment BMP maintenance, repair, and replacement before construction approvals are issued. Mechanisms used by the County to assign responsibility for maintenance to public and private sector project proponents may include, but are not limited, to the following:

- Maintenance agreements
- Conditional use permits
- Other legal agreements

[4] Bioretention basins direct sheet flow across a grass buffer strip to a ponding area for infiltration. They utilize soils and both woody and herbaceous plants to remove pollutants from stormwater runoff (EPA, 1999).

II.1 Flow Reduction BMPs

Estimating Surface Runoff and Pollutant Removal Requirements

There are many factors that may affect runoff discharge from a particular site; some of these include: precipitation, soil permeability, watershed area, ground cover, antecedent moisture, storage in the watershed, and time parameters. Given varying contributions to runoff at any one site, it is often difficult to predict the amount of runoff to ensure the integrity of a particular treatment. However, to account for this problem, control measures should be designed based on anticipated runoff velocities from smaller, more discrete catchments within the drainage network.

As part of the County's Assessment, drainage-catchments were delineated for the drainage network within Primary Study Area (PSA) using a 10-meter digital elevation model (DEM). The modeled drainage catchments delineated in the County's Foothill Watershed Assessment provide insight as to drainage influences for future engineering applications. It is recommended that entire catchment(s) above the prescribed BMP location be modeled to calculate the maximum expected runoff volumes in order to reduce the chances of failure. The modeling effort should also include an accurate characterization of land use to determine an appropriate Runoff Curve Number (RCN). This approach will allow County staff to identify and actively manage specific up-slope locations that contribute concentrated flow to new and existing drainage systems. For projects outside the PSA, project sponsors and contractors should refer to County Public Works staff for further direction.

The design objectives presented in this program for any new separate stormwater systems are adopted from the Santa Clara Valley MS4 Program. They are paraphrased as follows:

> Numeric Sizing Criteria For Pollutant Removal Treatment Systems: All Dischargers shall require that treatment BMPs be constructed for applicable projects (those projects that create 5,000 square feet or more impervious surface), that incorporate, at a minimum, the following hydraulic sizing design criteria to treat stormwater runoff. As appropriate for each criterion, the Dischargers shall use or appropriately analyze local rainfall data to be used for that criterion.
>
> i. **Volume Hydraulic Design Basis:** Treatment BMPs whose primary mode of action depends on volume capacity, such as detention/retention units or infiltration structures, shall be designed to treat stormwater runoff equal to:
>
> 1. the maximized stormwater quality capture volume for the area, based on historical rainfall records, determined using the formula and volume capture coefficients set forth in Urban Runoff Quality Management, WEF Manual of Practice No. 23/ASCE Manual of Practice No. 87, (1998), pages 175-178 (e.g., approximately the 85th percentile 24-hour storm runoff event); or the volume of annual runoff required to achieve 80 percent or more capture, determined in accordance with the methodology set forth in Appendix D of the California Stormwater Best Management Practices Handbook (CASQA, 2003) using local rainfall data.

ii. **Flow Hydraulic Design Basis:** Treatment BMPs whose primary mode of action depends on flow capacity, such as swales, sand filters, or wetlands, shall be sized to treat:

1. 10 percent of the 50-year peak flow rate; or

2. the flow of runoff produced by a rain event equal to at least two times the 85th percentile hourly rainfall intensity for the applicable area, based on historical records of hourly rainfall depths; or

3. the flow of runoff resulting from a rain event equal to at least 0.2 inches per hour intensity.

Rock-Lined Channels

Rock-lined channels are channels or conveyances (e.g., roadside ditches) lined with rock or riprap and designed to convey concentrated surface runoff without erosion. This is applied in areas where design flow exceeds 2 ft/sec such that channel lining is required, but conditions are not suitable for vegetative protection. This practice is required in locations where a channel will continue to down-cut without protection because of increased flow or a new base line (outlet elevation). Depending on the application, the use of pre-constructed concrete units such as grid pavers, articulated concrete mats, and interlocking concrete blocks may be required to armor stream channels while maintaining porosity and allowing the establishment of vegetation. These structures may be obtained in pre-cast blocks or mats, or may be formed and poured into place. As in any application, these structures should be inspected at regular intervals and after major storms.

Diversion Dike/Continuous Berm

A diversion dike or continuous berm, consists of a ridge of compacted soil constructed immediately above a new cut or soil fill slope or around the perimeter of a disturbed area. These structures typically divert sediment-laden runoff from a disturbed area to a sediment-trapping facility such as a sediment basin. The downslope dike assures that sediment-laden runoff will not leave the area of concern without treatment.

It is very important that a temporary diversion dike be stabilized immediately following installation with temporary or permanent vegetation to prevent erosion of the dike itself. This practice will extend the life of the structure by stabilizing it with a root system. The gradient must have a positive grade to assure drainage, but if the gradient is too great, precautions must be taken to prevent erosion due to high velocity channel flow.

This practice can use material available onsite and can usually be constructed with equipment needed for site grading. Diversion dikes are aesthetically preferable to silt fence and are more durable, less expensive, and require much less maintenance when constructed properly. As a rule of thumb, the channel behind the dike should have a positive grade to a stabilized outlet (e.g., sediment basin). If the channel slope is 2 percent or less, no stabilization is required.

Waterbars And Rolling Dips

Waterbars and rolling dips are defined as ridges or ridge-and-channels constructed diagonally across a sloping road or trail that is subject to erosion. Water bars are used to limit the accumulation of erosive volumes of water on unpaved roads by diverting surface

runoff at pre-designed intervals. Waterbars generally become less effective if driven over by motor vehicles during wet weather. Special consideration must be taken in assessing the cumulative effect of added diversions. The peaks of the water bars and rolling dips should be reinforced for active routes. The Bureau of Land Management and U.S. Forest Service "dog bones" may be the preferred reinforcement. Gravel or concrete may be needed in some locations to stabilize the diversion where significant vehicular traffic is anticipated (e.g., extend downslope from roadway culverts).

Infiltration Techniques

As a stormwater management method, infiltration techniques include a variety of BMPs capable of retaining or detaining water within soils to reduce runoff. Stormwater infiltration methods may be categorized as follows:

A. *Site design practices,* which while having a significant effect on runoff and infiltration, are very much integrated into the overall process of land development. These practices include laying out the site to reduce impervious area, routing drainage from building roofs, and selecting of surface treatments when designing site grading and paving. Site design practices must be integrated with the site's urban design, architecture, landscape architecture, and engineering as part of a multifaceted design solution.

B. *Indirect infiltration* methods, including swales and bioretention areas. These features are expressly designed to hold runoff and allow it to percolate into surface soils. Runoff may reach groundwater indirectly, or may be underdrained into subsurface pipes.

C. *Direct infiltration* methods, which are designed to bypass unsaturated surface soils and transmit runoff directly to groundwater. Devices must be located and designed to limit the potential for stormwater pollutants to reach groundwater. Direct infiltration methods include dry wells and infiltration trenches.

Table A-2 identifies several examples of for each infiltration method.

TABLE A-2
DESCRIPTION OF SPECIFIC INFILTRATION METHODS AND FACILITIES

Method / Facility	Description
A. Site Design	
Site Layout Practices	Concentrate development on least sensitive portions of the site; preserve pervious soils and natural drainage features; minimize the amount of impervious area by using shared parking, efficient site circulation and by designing taller buildings with smaller footprints or tuck-under parking,
Green Roofs	May be "extensive" with a 3 to 7 inch lightweight substrate and a few types of low-profile, low-maintenance plants, or may be "intensive" with a thicker substrate, more varied plantings, and a more garden-like appearance.
Disconnected Downspouts	Rather than connecting directly to storm drains, extended leaders direct roof runoff away from the building to nearby landscape detention, pop-up emitters, or infiltration devices.
Amending Soils	Soil amendments and tilling enhance or restore permeability and storage in the top layer of soils, reducing runoff.

TABLE A-2
DESCRIPTION OF SPECIFIC INFILTRATION METHODS AND FACILITIES

Method / Facility	Description
Structural Soils	An engineered mix of angular aggregate and clayey loam provides structural support for sidewalks and paving while creating void spaces to support urban tree roots.
Site Grading	Using gentler slopes and concave areas to reduce runoff and encourage infiltration.
Pervious Pavement	Special mixes of concrete and asphalt. Require a base course of crushed aggregate and installation by experienced crews.
Unit Pavers	Traditional bricks, stone, or other pavers on sand or fine crushed aggregate
B. Indirect Infiltration	
Flow-through Planter Box	Contained planter, usually above-ground, holds runoff in a surface reservoir and lets it infiltrate through a layer of soil. Infiltrated runoff collects in a gravel layer below, seeps into a perforated pipe underdrain, and is drained to a storm drain or discharge point.
Infiltration Planter	In-ground planter collects runoff from roofs and paved surfaces and allows it to percolate through permeable soil. May require an underdrain if the underlying native soils are poorly drained.
Bioretention	Discussed under Sediment/NPS Pollutant Reduction Controls subheading
Grassy Swale	Works like bioretention, but also transmits high flows along its length.
C. Direct Infiltration	
Infiltration Basin	An excavation exposes relatively permeable soils and impounds water for rapid infiltration.
Dry Well	Small, deep hole filled with open graded aggregate. Sides may be lined with filter fabric or may be structural (i.e., an open bottom box sunk below grade). Typically receives roof runoff.
Infiltration Trench	Trench, with no outlet, filled with rock or open graded aggregate.

Source: Contra Costa County, 2003

Energy Dissipater

An energy dissipater is a structure designed in a public roadway which reduces the velocity of flow thus dissipating the energy thus controlling erosion at the outlet of a channel or conduit (e.g., trail). This applies when the discharge velocity of an open channel exceeds the permissible velocity of the receiving channel or disposal area. A riprap-lined apron is the most commonly used practice for this purpose because of its relatively low cost and ease of installation. The riprap apron should be extended downstream until stable conditions are reached.

Gabions

Gabions are rectangular wire baskets filled with stones used as pervious, semi-flexible, rock-filled baskets to protect streambanks from the erosive forces of moving water. Rock-filled gabions can be used to armor the bed or banks of channels, or used to divert flow away from eroding channel sections. This practice is applicable where flow velocities exceed 6 ft/sec and where vegetative streambank protection alone is insufficient. Gabions can be used to construct deflectors intended to divert flow away from eroding trail or streambank sections. Gabions are also used to construct retaining walls and grade control structures.

Gabions can provide an important component to a bioengineering solution for streambank or slope erosion because they allow the growth and establishment of natural vegetation. Gabion walls are appropriate where the vertical integrity of a soil bank needs a higher tensile strength to reduce sloughing, excessive sub-surface water is present, or a retaining or toe wall is needed. Additionally, these structures are preferred when riprap is an appropriate practice but the available rock size is insufficient to resist the expected shear stress.

II.2 Sediment/NPS Pollutant Reduction BMPs

Bioretention

Bioretention basins direct sheet flow across a grass buffer strip to a ponding area for infiltration. They utilize soils and both woody and herbaceous plants to remove pollutants from stormwater runoff (USEPA, 1999). The ponding area generally consists of a surface layer containing organics such as mulch, trees, grasses and shrubs, a subsurface layer of planting soil, and a sand bed.

Bioretention areas are used to treat stormwater runoff from impervious surfaces in commercial, residential and industrial developments, but can be just as effective in treating runoff from intensively managed open spaces, such as parks, golf courses, or gardens. Bioretention ponds can be used to filter stormwater prior to discharge to a storm drain or sewer system or as an infiltration device with no outflow. By virtue of the intended purpose (e.g., pollutant removal), the vegetative growth should be routinely maintained via mechanical treatments (e.g., mowed) to remove the various pollutants that have been assimilated by the plant mass. The plant debris should be properly disposed of at a local landfill.

Temporary and Permanent Sediment Basin

A temporary sediment basin is a pond created by excavation in construction of an embankment and designed to retain or detain runoff sufficiently to allow excess sediment to settle. The temporary sediment basin is intended to collect and store sediment from sites that are cleared and/or graded during construction or for extended periods of time before permanent vegetation is re-established or before permanent drainage structures are completed. It is intended to trap sediment before it leaves the construction site. The basin is temporary, with a design life of 12 to 18 months, and is to be maintained until the site area is permanently stabilized.

Basins should be located at the stormwater outlet from the site, not in any natural or undisturbed stream. Use of temporary dikes, pipes and/or channels may be necessary to divert runoff from disturbed areas into the basin and to divert runoff originating from undisturbed areas around the basin. Sediment basins can trap 70 to 80 percent of the sediment which flows into them if designed and constructed appropriately. This design requires a runoff detention time of 24 to 40 hours and is only practically effective in removing sediment down to the medium silt size fraction. Sediment-laden runoff with smaller size fractions, fine silts and clay, will likely pass untreated through the basin. For this reason, basins modified with a "skimmer" device can increase efficiency and reduce turbidity by skimming relatively clear water from the top.

There are inherent problems associated with constructing basins large enough to pond all the sediment-laden runoff long enough to allow all of the fine soil particles to settle out. Therefore, sediment basins must be used in conjunction with other erosion control practices in order to increase effectiveness and trap efficiently. These other concurrent practices include:

- Temporary seeding and/or mulching;
- Minimizing disturbance;

- Scheduling construction operations;
- Diversions to reduce runoff into the basin;
- Frequent use of other, smaller erosion control structures that will capture sediment upslope;
- Frequent inspection and maintenance of all practices.

Straw Bale Dike

- A straw bale dike is a temporary barrier consisting of straw bales installed across a slope, at the toe of a slope, and/or around the perimeter of the construction site. A straw bale dike intercepts and detains small amounts of sediment transported by sheet type runoff. The dikes detain sediment by ponding water and allowing sediment to settle out. Straw bale dikes also slow runoff velocities, thus reducing sheet and rill erosion. They are also useful for erosion and sediment control around the perimeter of a construction site. Straw bale dikes may be used where the following conditions apply: The placement area is not a slope nor likely to receive concentrated runoff;
- The maximum slope gradient above the barrier is 2:1;
- The maximum slope length above the barrier is 100 feet (30.5 m);
- The placement area is suitable for ponding of sheet runoff and sedimentation can occur.

Oil/Grease Separators

Coalescing Oil/Grease Separators are passive, physical separation systems designed for removal of oils, fuels, hydraulic fluids, creosote, pentachlorophenol, turbine oils, mineral oils, and BTEX products from water. The process, in simplified terms, begins when the water/oil mixture enters the separator and is spread out horizontally, distributed through an energy and turbulence diffusing device. As oils accumulate they coalesce into larger droplets, rising upward through pack corrugations until they reach the top of the pack, where they detach and rise to the water's surface. At the same time solids encounter the media and slide down the corrugations, falling into a treatment media. In theory, the oil droplet rise rate and other parameters dictate the surface area required for gravity & coalescent separation. The design will need to satisfy site-specific design criteria as indicated below:

- The hydraulic distribution of the influent flow must assure full usage of the cross-sectional area of the media to fully utilize the available surface area.
- Flow control and direction must be determined to prevent hydraulic short circuiting around, under or over the media pack.
- A laminar flow condition must be maintained (Reynolds "Re" number less than 500) in order to assist droplets to rise. Per the American Petroleum Institute's (API) Publication 421 of February 1990.

- Horizontal flow through velocities in the separator must not exceed 3 feet per minute or 15 times the rate of rise of the droplets which ever is smaller.

- The media containment chamber design must contain spacing sufficient to facilitate removal of accumulating solids.

Compost Berms

A compost filter berm is a trapezoidal berm that intercepts sheet flow and ponds runoff, allowing sediment to fall out of suspension, and often filtering sediment as well. Compost binds heavy metals and can break hydrocarbons down into carbon, salts and other benign compounds (USEPA, 1997). Compost is organic, biodegradable, renewable, and can be left onsite. This is particularly important near streams. Compost does not generally leach nutrients (Glanville, 2003). Standard specifications for both compost berms have been developed for the American Association of State Highway and Transportation Officials (AASHTO).

Compost berms are more cost-effective than many other erosion/sediment control methods. The invention of the blower truck makes compost an easy to install and reliable method of sediment and erosion control. Most municipal programs are now generating compost as municipal greenwaste programs, thus making it readily available in most areas.

Drop-Inlet and Curb-Inlet Sediment Barriers

Drop-inlet and curb-inlet sediment barriers are temporary barriers constructed from concrete block and gravel or gravel filled sandbags. These forms of sediment barriers are intended to reduce the sediment discharged into storm drains by ponding the runoff and allowing the sediment to settle out. The structures allow for overflow from high runoff events and the gravel allows the ponds to dewater rapidly.

The sandbag curb inlet and block and gravel sediment barrier can be used at curb inlets on gently sloping, paved streets where:

- Water can pond and allow sediment to separate out of suspension;

- Runoff is relatively low, less than 0.5 ft^3/sec (0.01 cubic meters/sec).

- Once the small catchment areas behind the sandbags or block and gravel fill with sediment, future sediment-laden runoff will enter the storm drain without being desilted. Therefore, sediment must be removed from these structures during or after each storm. Additional storage can be obtained by constructing a series of sandbag barriers along the gutter so that each barrier traps small amounts of sediment.

Appendix B
Links to Other Organizations and Information

APPENDIX B
Links to Other Organizations and Information

Management Practices Promoting Resource Conservation

Home*A*Syst/Farm*A*Syst Program. These are model stewardship-based programs for homeowners and farmers assisting in the conservation of agricultural and natural resources. The program is a cooperative effort between the Northeast Regional Agricultural Engineering Service (NRAES) and the University of Wisconsin. For more information: NRAES, Cooperative Extension, 152 Riley-Orb Hall, Ithaca, NY 14853-5701; (607) 255-7654.

The San Joaquin County Resource Conservation District in cooperation with the NRAES has adapted the Home*A*Syst model into a watershed owner's manual for the Lower Mokelumne River. For more information: http://www.nraes@cornell.edu or Homeasys@uwis.edu

Horses for Clean Water. Publishes Healthy Horses, Clean Water - Horses for Clean Water - a program developed by horse owners for horse owners to promote horse health and environmental health. http://www.horsesforcleanwater.com

Lodi-Woodbridge Winegrape Commission. Winegrower's Workbook. View on-line and/or order a copy of the groundbreaking Lodi Winegrowers Workbook promoting farm stewardship for vineyard owners and managers. http://www.lodiwine.com

National Stormwater Best Management Practices Database. Database of BMP performance data for over 150 BMP studies. Developed by the Urban Water Resources Research Council. http://www.bmpdatabase.org

San Joaquin County Resource Conservation District Lower Mokelumne River Watershed Stewardship Plan. http://www.sjcrcd.org

University of California, Davis B Rangeland Watershed Program Provides extensive links and information for managing rangelands to conserve resources. http://agronomy.ucdavis.edu/calrng/RWP.html

U.S. Environmental Protection Agency. Stream Monitoring: On-line Guide for Developing a Citizen Water-Quality Monitoring Program, Volunteer Stream Monitoring. http://www.epa.gov/volunteer/stream/index.html

Yolo County Resource Conservation District. Order your copies of these excellent publications: Bring Farm Edges Back to Life!, How to Enhance Your Agriculture and Farm Landscape with Proven Conservation Practices for Increasing the Wildlife Cover on Your Farm; Know Your Natives: A Pictorial Guide to California Native Grasses. http://www.yolorcd.ca.gov

Lower Mokelumne River and Other Watershed Stewardship Information. California Environmental Resources Evaluation System (CERES). Information on San Joaquin County's flood conditions, demographics, land uses, historical and cultural resources, recreation, special status species, water resources, vegetation and habitats with maps, photos and other documents. http://www.ceres.ca.gov/geo_area/counties/San_Joaquin/

California Rivers Assessment. Provides extensive information and links describing the status of California Rivers and their resources. http://www.endeavor.des.ucdavis.edu/newcara/

Central Sierra Watershed Coalition. Grass roots organization for the protection and eco-restoration of the five rivers of the central Sierra Nevada: Mokelumne, Calaveras, Stanislaus, Tuolumne and Merced Rivers. http://www.cswc.org

City of Lodi's Storm Drain Detectives. A citizen volunteer and education program monitoring water quality along the lower Mokelumne River, including Lodi Lake. http://www.lodi.gov/Storm%20Drain%20Detectives/index.htm

Mokelumne-Cosumnes Watershed Alliance. Provides oversight for and links to multiple watershed planning efforts ongoing for the Mokelumne and Cosumnes River watersheds. http://www.mcwatershed.org

National Association of Conservation Districts. Environmental education links. http://www.nacdnet.org/resources/links.htm#EviEd:

City of Sacramento Stormwater Management Program. Good information on stormwater management including information for teachers and programs for volunteers to protect water quality. http://www.sacstormwater.org

Sacramento-San Joaquin Delta Atlas. On-line copies of the Sacramento-San Joaquin Delta Atlas. Extensive photos, history, and resource information for the Delta. http://rubicon.water.ca.gov/delta_atlas.fdr/daindex.html

San Francisco Estuary Project B State of the Estuary Reports. Link is to the Bay/Delta Estuary=s biological resources report. http://www.abag.ca.gov/bayarea/sfep/reports/soe/soe4a.htm

San Joaquin County Resource Conservation District Lower Mokelumne River Watershed Stewardship Plan. http://www.sjcrcd.org

Shodor Education Foundation, Inc.: Surface Water Runoff Modeling. Examining the effect of soil type, ground cover type, and rainfall amount on the quantity of water runoff. http://www.shodor.org/master/environmental/water/runoff/index.html:

UC Davis Information Center for the Environment. A collaboration of UC Davis scientists and private, state, Federal and international resource agencies and efforts. Provides extensive links related to resource conservation and programs. http://www.ice.ucdavis.edu

UC Davis Land, Air, and Water Resources Department. Link to Dr. G. Pasternack's research on the Mokelumne River Salmon Spawning Gravel Restoration project. Includes areal-time and link to stream conditions at Camanche Reservoir.
http://lawr.ucdavis.edu/faculty/gpast/mokelumne.html

U.S. Environmental Protection Agency, Office of Ground Water and Drinking Water Quality. Provides extensive information on water quality and NPS pollutants.
http://www.epa.gov/OGWDW/

U.S. Environmental Protection Agency, Office of Water. Extensive links to all aspects of water quality including laws and regulations, funding opportunities, publications and more.
http://www.epa.gov/ow/

U.S. Environmental Protection Agency, Office of Water Watershed Protection Division. Includes funding, databases, publications, outreach, and other information links for watershed planners.
http://www.epa.gov/owow/watershed/

U.S. Environmental Protection Agency. Surf Your Watershed website site. Excellent source to find out all about your watershed (e.g., size, boundaries, water quality, threats, land uses).
http://www.epa.gov/surf/

U.S. Environmental Protection Agency. Watershed Information Network (WIN). Roadmap to information and services for protecting and restoring water resources. http://www.epa.gov/win/

United States Geological Survey website providing information on water resources of the United States. http://water.usgs.gov

Watershed Management Council. Non-profit educational organization dedicated to the advancement of the art and science of watershed management. Lots of watershed links.
http://www.watershed.org

Flooding and Water Supply – Mokelumne River. California Department of Water Resources, California Data Exchange Center with link to the Division of Flood Management. Provides detailed flow and flood stage information for the Lower Mokelumne River and Cosumnes River.
http://cdec.ca.gov/

California Department of Water Resources, Division of Flood Management, California Data Exchange Center. Provides flow and flood stage information. Listed website is for the Cosumnes River. http://www.cdec.water.ca.gov/river/cosumnesStages.html

East Bay Municipal Utility District. Provides East Bay Municipal Utility District's water supply reports for the Lower Mokelumne River Watershed.
http://www.ebmud.com/info/water_supply_reports/default.htm

East Bay Municipal Utility District, Emergency Preparedness Office (EPO) website. In case of earthquake or flood, the EPO action plan is designed to protect the community. For more information: (510) 287-1259. http://www.ebmud.com/emergency/emergency.html:

Humboldt State University Foundation. The San Joaquin County Resource Conservation District (SJRCD) in cooperation with the East Bay Municipal Utility District and the non-profit Humboldt State University Foundation is funding a geographic information system mapping and research program for one of Humboldt State University's graduate students. The study will provide the SJCRCD with valuable information related to the historic flooding and vegetation patters along the Lower Mokelumne River. http://www.humboldt.edu/~hsuf/

California Department of Conservation, Division of Land Resource Protection Resource Conservation District Assistance Program. This state agency has successfully secured funding for the State's Resource Conservation Districts to assist in watershed planning and implementation. This organization funded a watershed coordinator position for the San Joaquin County RCD. http://www.consrv.ca.gov/dlrp/RCD/index.htm

California Farm Bureau Federation. http://www.cfbf.com

Delta Protection Commission (DPC). State agency with oversight of land use and planning for the Primary Zone of the Sacramento-San Joaquin Delta. The San Joaquin County RCD is working with the DPC to determine the feasibility of establishing a Resource Conservation and Development District (RC&D) http://www.delta.ca.gov

East Bay Municipal Utility District. EBMUD operates Camanche Reservoir and Dam that form the eastern boundary of the Lower Mokelumne River Watershed. EBMUD, in cooperation with the U.S. Fish and Wildlife Service and California Department of Fish and Game, implements the Lower Mokelumne River Partnership Fund which makes small grants available for organizations interested in undertaking projects which promote the health of the Lower Mokelumne River. http://www.ebmud.com

East Bay Municipal Utility District. A Historical Perspective of the Mokelumne River Watershed. http://www.ebmud.com/services/environmental/fwhistory.html:

City of Lodi website promoting tourism and the economy of the City of Lodi. Good links to the wine-tasting region of northern San Joaquin County. http://www.visitlodi.com

City of Lodi website. Provides links to the City of Lodi's Storm Drain Detectives site and to other departments involved in water quality management, solid waste management, and similar resource-related activities. http://www.lodi.gov/

Lodi-Woodbridge Winegrape Commission. View on-line and/or order your copy of the groundbreaking Lodi Winegrowers Workbook promoting farm stewardship for vineyard owners. http://www.lodiwine.com

University of California Cooperative Extension B San Joaquin County office. Provides extensive assistance with farm and ranching operations in San Joaquin County. http://cesanjoaquin.ucdavis.edu

United States Department of Agriculture, Natural Resources Conservation Service, California. http://www.ca.nrcs.usda.gov: