

**CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY**

**Total Maximum Daily Loads for  
Chlorpyrifos  
*for the*  
San Lorenzo River Watershed (including San  
Lorenzo River, Zayante Creek, and  
Branciforte Creek) and Arana Gulch  
Watershed  
Santa Cruz County, California**

**Final Project Report  
May 2014**

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
CENTRAL COAST REGION**

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**LIST OF ACRONYMS**

AI	Active Ingredient
CCAMP	Central Coast Ambient Monitoring Program
CCC	Criterion Continuous Concentration
CDFG or CDFW	California Department of Fish and Game, now referred to as California Department of Fish and Wildlife.
CDPR	California Department of Pesticide Regulation
CDPR	California Department of Pesticide Regulation
CMC	Criterion Maximum Concentration
FMP	Farmland Mapping and Monitoring Program
GIS	Geographic Information System
MS4s	Municipal Separate Storm Sewer Systems
OP	Organophosphate
PUR	Pesticide Use Report
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
Water Board	Regional Water Quality Control Board, Central Coast Region

## EXECUTIVE SUMMARY

<b>Summary at a Glance TMDLs for Chlorpyrifos in the San Lorenzo River Watershed and Arana Gulch Watershed</b>	
<b>Waterbody identification</b>	San Lorenzo River watershed including: <ul style="list-style-type: none"> <li>• San Lorenzo River (WBID: CAR3041202219980827084709),</li> <li>• Branciforte Creek (WBID: CAR3041205119990223104548),</li> <li>• Zayante Creek (WBID CAR3041202220020124155410), and tributaries.</li> </ul> Arana Gulch watershed including: <ul style="list-style-type: none"> <li>• Arana Gulch (WBID: CAR3041205119990222133711), and tributaries.</li> </ul>
<b>Location</b>	Santa Cruz County. Hydrologic Unit Code #18060001
<b>TMDL Pollutants of Concern</b>	Chlorpyrifos
<b>Pollutant Sources</b>	No current sources. Historic sources of chlorpyrifos leading to impairment are uncertain.
<b>Beneficial Uses Impaired</b>	Aquatic Habitat Beneficial Uses, which include wildlife habitat (WILD), cold freshwater habitat (COLD), estuarine habitat (EST), preservation of biological habitats of special significance (BIOL), migration of aquatic organisms (MIGR), spawning, reproduction, and/or early development (SPWN), rare, threatened, or endangered species (RARE), commercial and sport fishing (COMM).
<b>Numeric Targets, Allocations, and TMDL</b>	See Table 1 below.
<b>Implementation Strategy</b>	Implement existing USEPA cancellations and labeling restrictions, and County, City, and University policies that prohibit application of chlorpyrifos. <b>No additional regulation or implementation is being proposed.</b>
<b>Problem Statement</b>	Waterbodies showed exceedances of numeric targets for chlorpyrifos in 2006. Impaired waters currently have non-detectable levels of chlorpyrifos based on 2010/2011 data.

### Introduction

The following Project Report, Total Maximum Daily Loads for Chlorpyrifos for the San Lorenzo River and Arana Gulch Watersheds (TMDL Report), evaluates sources of chlorpyrifos and assigns a TMDL for chlorpyrifos to the San Lorenzo River watershed and Arana Gulch watershed in Santa Cruz County.

Recent sampling (2010/2011) indicates that these waterbodies are currently meeting the proposed numeric targets for chlorpyrifos. Additionally, no current sources of chlorpyrifos were found.

Staff finds that current USEPA, City, County, and University policies have been instrumental in reducing/eliminating chlorpyrifos use so that these waterbodies are achieving proposed numeric targets, allocations, and TMDLs for chlorpyrifos. **No additional regulation or implementation is being proposed.**

### **Total Maximum Daily Load**

A TMDL is a term used to describe the maximum amount of pollutants, in this case, chlorpyrifos, that a waterbody can receive and still meet water quality standards. A TMDL study identifies the probable sources of pollution, establishes the maximum amount of pollution a waterbody can receive and still meet water quality standards, and allocates that amount to all probable contributing sources. By allocating an amount to a contributing source, we are assigning responsibility to someone, an agency, group, or individuals, to reduce their contribution in order to meet water quality standards.

The federal Clean Water Act requires every state to evaluate its waterbodies and maintain a list of waters (303(d) Impaired Waters List) that are considered impaired either because the water exceeds water quality standards or does not achieve its designated use. For each waterbody on the Central Coast's 303(d) Impaired Waters List, the Central Coast Regional Water Quality Control Board (Central Coast Water Board) must develop and implement a plan to reduce pollutants so that the waterbody is no longer impaired and can be de-listed.

### **Problem statement**

The San Lorenzo River, Branciforte Creek, Zayante Creek, and Arana Gulch were listed as impaired on the 2008-2010 Clean Water Act section 303(d) list because two of eight samples from the San Lorenzo River and two of two samples from Branciforte Creek, Zayante Creek, and Arana Gulch exceeded the toxicity concentration for chlorpyrifos. These samples were taken in 2006. Ten recent samples (2010/2011) show no detection of chlorpyrifos in any of the four waterbodies.

### **Numeric Targets, TMDLs, Sources, and Allocations**

The numeric targets for these TMDLs are the same as the numeric water quality criteria that were derived by the California Department of Fish and Game (now referred to as California Department of Fish and Wildlife)<sup>1</sup>. Numeric targets for the TMDLs include acute and chronic water column numeric targets for chlorpyrifos.

The TMDLs herein are concentration-based TMDLs equal to the numeric targets.

Discharges of chlorpyrifos leading to the impairments addressed in this TMDL came from urban areas; however staff was unable to definitively confirm any specific locations or source. There were no applications of chlorpyrifos from agricultural operations upstream of the sampling sites where chlorpyrifos was detected at toxic concentrations. Therefore, irrigated agriculture is not considered a source of the impairment.

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<sup>1</sup> These targets were also approved by the Central Coast Water Board on May 5, 2011 for the Lower Salinas River Watershed Chlorpyrifos and Diazinon TMDL, which was approved by USEPA on October 7, 2011.

Allocations are assigned to potential sources of chlorpyrifos and are equal to the numeric targets and TMDLs, as represented in the table below. Table 1 below identifies the numeric targets, allocations, and TMDLs assigned to impaired waterbodies. Allocations are assigned in this TMDL; however, staff concludes that existing efforts have already corrected the impairment. Results from future monitoring will be used to confirm this conclusion.

**Table 1. Numeric Targets, TMDLs, and Wasteload and Load Allocations for San Lorenzo River and Arana Gulch Watersheds**

<b>NUMERIC TARGETS, TMDLs, AND ALLOCATIONS</b>			
<b>Wasteload Allocation</b>			
<b><u>Waterbodies Assigned TMDLs<sup>1</sup></u></b>	<b><u>Responsible Party Assigned Allocation<sup>2</sup></u></b>	<b><u>Receiving Water Numeric Targets, TMDLs, and Allocation (Chlorpyrifos, ppb)</u></b>	
		<b><u>CMC<sup>A</sup></u></b>	<b><u>CCC<sup>B</sup></u></b>
San Lorenzo River, Branciforte Creek, Zayante Creek, Arana Gulch	Urban storm water  <i>County of Santa Cruz                      City of Santa Cruz                      City of Scotts Valley                      University of California at Santa Cruz</i>  (General Permit No. CAS000004)	0.025	0.015
<b>Load Allocation</b>			
<b><u>Waterbodies Assigned TMDLs<sup>1</sup></u></b>	<b><u>Responsible Party Assigned Allocation<sup>2</sup></u></b>	<b><u>Receiving Water Numeric Targets, TMDLs, and Allocation (Chlorpyrifos, ppb)</u></b>	
		<b><u>CMC<sup>A</sup></u></b>	<b><u>CCC<sup>B</sup></u></b>
San Lorenzo River, Branciforte Creek, Zayante Creek, Arana Gulch	Irrigated agriculture	0.025	0.015
	<i>(No allocations to natural background since this is not a naturally occurring substance)</i>	0	0
<sup>A</sup> CMC – Criterion Maximum Concentration or acute (1- hour average). Not to be exceeded more than once in a three year period. <sup>B</sup> CCC – Criterion Continuous Concentration or chronic (4-day (96-hour) average). Not to be exceeded more than once in a three year period.  <sup>1</sup> All reaches of the San Lorenzo River, Branciforte Creek, Zayante Creek, Arana Gulch, and their tributaries. <sup>2</sup> While these parties are given allocations, they are not considered a current source of impairment.			

**TMDL Implementation, Monitoring, and TMDL Timeline**

Staff concludes that the requirements described in the USEPA’s Chlorpyrifos Reregistration Eligibility Decision (RED), and the Integrated Pest Management



Policies implemented by the City of Santa Cruz, the City of Scotts Valley, the University of California at Santa Cruz, and the County of Santa Cruz, have resulted in achieving these TMDLs; no other regulatory mechanism is required to implement and achieve the TMDLs.

*In accordance with the California Impaired Waters Policy, staff proposes that the Central Coast Water Board certify the RED and policies as the mechanism for implementing this TMDL.*

The timeline to verify this TMDL is achieved is by October 2016.

## 1 INTRODUCTION

### 1.1 Clean Water Act Section 303(d)

Section 303(d) of the federal Clean Water Act requires every state to evaluate its waterbodies and maintain a list of waters that are considered “impaired” either because the water exceeds water quality standards or does not achieve its designated use. For each water on the Central Coast’s “303(d) Impaired Waters List,” the California Central Coast Water Board must develop and implement a plan to reduce pollutants so that the waterbody is no longer impaired and can be de-listed. Section 303(d) of the Clean Water Act states:

*Each State shall establish for the waters identified in paragraph (1)(A) of this subsection, and in accordance with the priority ranking, the total maximum daily load, for those pollutants which the Administrator identifies under section 1314(a)(2) of this title as suitable for such calculation. Such load shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality.*

The State complies with this requirement by periodically assessing the conditions of the rivers, lakes, and bays and identifying them as “impaired” if they do not meet water quality standards. These waters, and the pollutant or condition causing the impairment, are placed on the 303(d) List of Impaired Waters. In addition to creating this list of waterbodies not meeting water quality standards, the Clean Water Act mandates each state to develop Total Maximum Daily Loads (TMDLs) for each waterbody listed. The Central Coast Regional Water Quality Control Board (Water Board) is the agency responsible for protecting water quality consistent with the Basin Plan, including developing TMDLs for waterbodies identified as not meeting water quality objectives.

## **1.2 Pollutants Addressed**

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This project addresses impairments due to chlorpyrifos, which is an organophosphate (OP) pesticide.

## **1.3 USEPA RED and FIFRA/FQPA**

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Since 2001, the USEPA has mandated chlorpyrifos use cancellations (phase-outs) and restrictions for urban and agricultural uses (USEPA Chlorpyrifos Reregistration Eligibility Decision (RED)). The USEPA has undertaken the reregistration process for chlorpyrifos to ensure that the pesticides meet the safety standards under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Food Quality Protection Act (FQPA) of 1996.

Under the chlorpyrifos RED (USEPA 2006), virtually all products labeled for homeowner use have been cancelled effective December 31, 2001, except containerized ant and roach baits in child-resistant packaging which have not been cancelled because they present minimal exposure. Distribution and sale of products for all other residential uses were prohibited since December 31, 2001. The application rate for termite treatments was reduced as of December 1, 2000. Full-barrier (wholehouse) termite treatment products are no longer distributed or sold as of December 31, 2001. Spot and local post-construction use was cancelled on December 31, 2002, and pre-construction termiticide uses were cancelled on December 31, 2005, unless acceptable exposure data are submitted and demonstrate that post application risks to residents are not of concern. Practically speaking, this means that the general public's accessibility to chlorpyrifos ended in late 2001 and Water Board staff conclude that any urban applications would have ceased at the time of this document preparation.

## **1.4 City, County and UCSC's Pest Management Policies**

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The City and County of Santa Cruz both have Integrated Pest Management Policies<sup>23</sup>. In the City's policy, their goal was to eliminate all toxic pesticide products by January 2000. In other words, the City would not apply any chlorpyrifos (and other toxic pesticides) to any of their properties after January 2000. Additionally, the City developed and implemented a public education program aimed to inform the public about the dangers of toxic chemicals. In the County's policy, their goal was to eliminate the use of pesticides on County owned property. Chlorpyrifos application would be eliminated by January 1, 2003. The County also has a public involvement clause in their policy. In summary, these policies state that any application of chlorpyrifos should have ended by January 1, 2003 on City and County properties.

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<sup>2</sup> City of Santa Cruz, Integrated Pest Management Policy, Resolution No. NS-24,067. <http://www.cityofsantacruz.com/index.aspx?page=164>

<sup>3</sup> County of Santa Cruz, Integrated Pest Management Policy, 2011-2012, [http://www.co.santa-cruz.ca.us/cao/2011-12\\_IPM.pdf](http://www.co.santa-cruz.ca.us/cao/2011-12_IPM.pdf)

The City of Scotts Valley has a policy that aims to reduce its use of pesticides through the development and implementation of a comprehensive Integrated Pest Management Policy. Effective May 21, 2008, no EPA Toxicity Category II pesticides (chlorpyrifos is a Category II pesticide) will be applied on City property unless they are granted an exemption. There has never been an exemption granted and no chlorpyrifos has been applied since the approval of this policy (pers. comm. McGrath 2013).

The University of California at Santa Cruz follows an evaluation policy (UCSC 1980) in which any pesticide application must be approved in advance by the Director of Campus Facilities. The University has not applied chlorpyrifos on their campus since 1995.

## **2 PROBLEM IDENTIFICATION**

### **2.1 Watershed Description**

The San Lorenzo watershed encompasses approximately 140 square miles (89,600 acres) within Santa Cruz County. Santa Cruz County is located approximately 50 miles south of San Francisco. Most of the watershed is rugged mountainous terrain and is densely forested. Maximum elevation is approximately 3,200 feet. The San Lorenzo River flows generally south-southeast in a narrow highly developed valley. The towns of Boulder Creek, Ben Lomond, and Felton are located along the upper watershed. The river generally flows southerly to the City of Santa Cruz before emptying into the Pacific Ocean. The San Lorenzo River spans 25 miles from Waterman Gap to the Pacific Ocean. Tributaries include Bean, Bear, Boulder, Branciforte, Carbonera, Clear, Fall, Kings, Lompico, Newell, and Zayante Creeks.

The Arana Gulch watershed encompasses approximately 7 square miles (4,480 acres) and is also within Santa Cruz County. The Arana Gulch watershed is directly to the east of the San Lorenzo River watershed. Please see Figure 2-1 for a map of the watersheds.

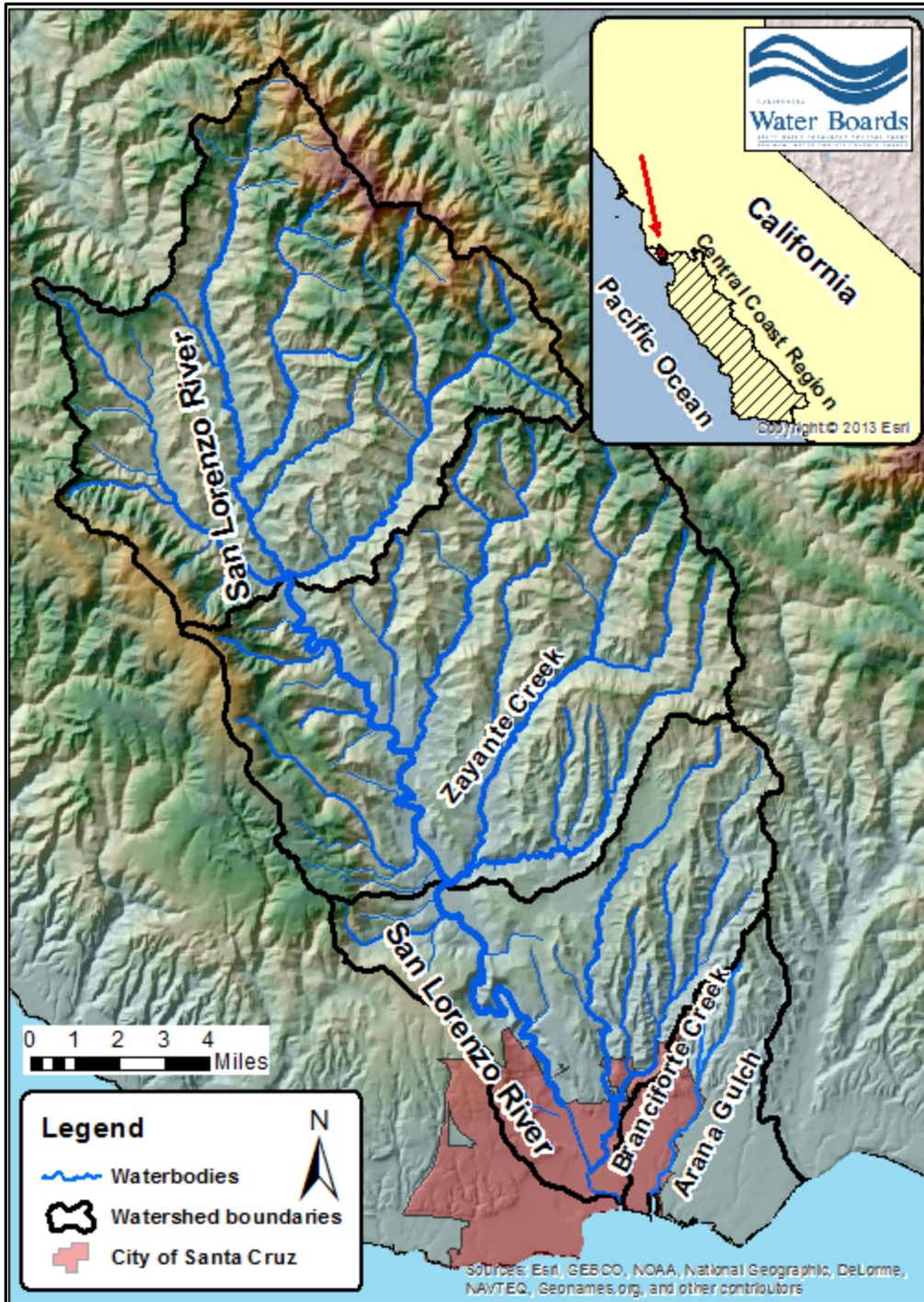


Figure 2-1: The San Lorenzo River Watershed and Arana Gulch Watershed.

The area's Mediterranean climate is moderated by its close proximity to the Pacific Ocean. Summers are warm and dry, cooled at times by morning fog at lower elevations. The winters are cool and wet. Average annual rainfall is about 47 inches, ranging from about 30 inches in Santa Cruz to 60 inches above Boulder Creek.

Land cover within the San Lorenzo River watershed and Arana Gulch watershed is primarily comprised of undeveloped or forested land (82%). Urban areas comprise the second largest land cover at 16.5% and are concentrated most densely in the lower portion of the watershed. Grazing lands and farmlands comprise less than 1% of the entire watersheds. Please see Table 2-1 and Figure 2-2 for more information.

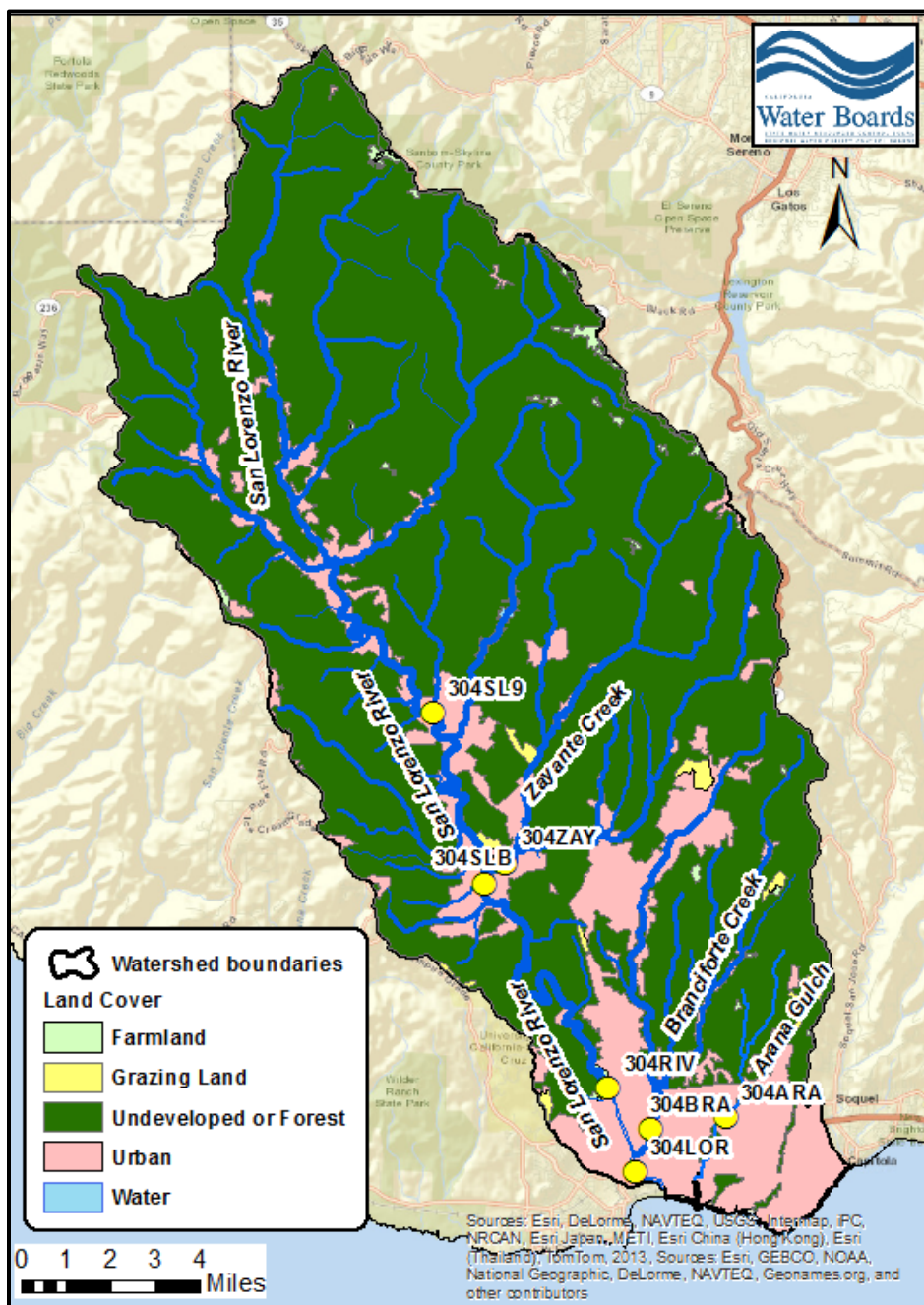


Figure 2-2: Land cover in the San Lorenzo River Watershed and the Arana Gulch Watershed according to Farmland Mapping and Monitoring Program (2008).

**Table 2-1. Land cover in the San Lorenzo River and Arana Gulch Watersheds (FMMP 2008)**

Land cover	Area (acres)	Percent of entire watershed
Urban	15,505.4	16.5%
Farmland	492.5	0.5%
Grazing Land	580.9	0.6%
Water	173.2	0.2%
Undeveloped or Forest	77327.6	82.2%
Total	94,079.6	100%

## 2.2 Beneficial Uses

The San Lorenzo River, Branciforte Creek, Zayante Creek, and Arana Gulch, along with several tributaries, have designated beneficial uses in the Water Quality Control Plan for the Central Coast Basin (Basin Plan). Table 2-2 summarizes the designated beneficial uses for San Lorenzo River, San Lorenzo River Estuary, Zayante Creek, Branciforte Creek, and Arana Gulch. For a more comprehensive list of tributaries to the San Lorenzo River and Arana Gulch, and their respective beneficial uses, please see

[http://www.waterboards.ca.gov/centralcoast/publications\\_forms/publications/basin\\_plan/docs/basin\\_plan\\_2011.pdf](http://www.waterboards.ca.gov/centralcoast/publications_forms/publications/basin_plan/docs/basin_plan_2011.pdf) beginning on page II-3.

Porter-Cologne requires that the “past, present, and probable future beneficial uses of water” be considered in establishing water quality objectives. Existing designated beneficial uses are appropriate in the San Lorenzo River watershed and Arana Gulch watershed. Aquatic habitat beneficial uses (COLD, EST, WILD, BIOL, RARE, MIGR, SPWN) are sensitive to chlorpyrifos and therefore using water quality criteria to protect for these uses is appropriate.

Since the aquatic habitat beneficial use is the most sensitive beneficial use, using criteria to protect the aquatic habitat will support all beneficial uses.

**Table 2-2. Basin Plan designated beneficial uses**

Beneficial Use	Waterbody				
	San Lorenzo River	San Lorenzo River Estuary	Branciforte Creek	Zayante Creek	Arana Gulch
Municipal and Domestic Supply (MUN)	X		X	X	X
Agricultural Supply (AGR)	X		X	X	
Industrial Service Supply (IND)	X			X	
Ground Water Recharge (GWR)	X		X	X	X
Freshwater Replenishment (FRSH)	X				X
Water Contact Recreation (REC-1)	X	X	X	X	X
Non-Contact Water Recreation (REC-2)	X	X	X	X	X
Commercial and Sport Fishing (COMM)	X	X	X	X	X
*Cold Freshwater Habitat (COLD)	X	X	X	X	X
*Estuarine Habitat (EST)		X			
*Wildlife Habitat (WILD)	X	X	X	X	X
*Preservation of Biological Habitats of Special Significance (BIOL)	X	X			
*Rare, Threatened, or Endangered Species (RARE)	X	X			X
*Migration of Aquatic Organisms (MIGR)	X	X	X	X	X
*Spawning, Reproduction, and/or Early Development (SPWN)	X	X	X	X	X

\* = Aquatic Habitat beneficial use

Beneficial uses are regarded as existing whether the waterbody is perennial or ephemeral, and whether the flow is intermittent or continuous.

Municipal and Domestic Supply (MUN) - Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply. According to State Board Resolution No. 88-63, "Sources of Drinking

Water Policy" all surface waters are considered suitable, or potentially suitable, for municipal or domestic water supply except where:

- a. TDS exceeds 3000 mg/l (5000 uS/cm electrical conductivity);
- b. Contamination exists, that cannot reasonably be treated for domestic use;
- c. The source is not sufficient to supply an average sustained yield of 200 gallons per day;
- d. The water is in collection or treatment systems of municipal or industrial wastewaters, process waters, mining wastewaters, or storm water runoff; and
- e. The water is in systems for conveying or holding agricultural drainage waters.

Agricultural Supply (AGR) - Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

Industrial Service Supply (IND) – Uses of water for industrial activities that depend primarily on water quality (i.e., waters used for manufacturing, food processing, etc.).

Ground Water Recharge (GWR) - Uses of water for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers. Ground water recharge includes recharge of surface water underflow.

Water Contact Recreation (REC-1) - Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

Non-Contact Water Recreation (REC-2) - Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

\*Wildlife Habitat (WILD) - Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.



\*Cold Fresh Water Habitat (COLD) - Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.

\*Estuarine Habitat (EST) – Uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds). An estuary is generally described as a semi-enclosed body of water having a free connection with the open sea, at least part of the year and within which the seawater is diluted at least seasonally with fresh water drained from the land. Included are water bodies which would naturally fit the definition if not controlled by tidegates or other such devices.

\*Preservation of Biological Habitats of Special Significance (BIOL) – Uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance (ASBS), where the preservation or enhancement of natural resources requires special protection.

\*Migration of Aquatic Organisms (MIGR) - Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.

\*Spawning, Reproduction, and/or Early Development (SPWN) - Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

\*Rare, Threatened, or Endangered Species (RARE) - Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.

Freshwater Replenishment (FRESH) - Uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity) which includes a water body that supplies water to a different type of water body, such as, streams that supply reservoirs and lakes, or estuaries; or reservoirs and lakes that supply streams. This includes only immediate upstream water bodies and not their tributaries.

\*Commercial and Sport Fishing (COMM) - Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

\* = Aquatic habitat beneficial use.

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## **2.3 Water Quality Objectives and Criteria**

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The Basin Plan contains narrative water quality objectives that apply to all inland surface waters, enclosed bays and estuaries (CCRWQCB, 1994, pg. III-4). Relevant water quality objectives for this project include:

### **2.3.1 Toxicity**

*All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, toxicity bioassays of appropriate duration, or other appropriate methods as specified by the Regional Board.*

*Survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality conditions, shall not be less than that for the same water body in areas unaffected by the waste discharge or, when necessary, for other control water that is consistent with the requirements for "experimental water" as described in Standard Methods for the Examination of Water and Wastewater, latest edition. As a minimum, compliance with this objective shall be evaluated with a 96-hour bioassay.*

*In addition, effluent limits based upon acute bioassays of effluents will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances is encouraged.*

### **2.3.2 Pesticides**

*No individual pesticide or combination of pesticides shall reach concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life.*

### **2.3.3 Prohibitions**

*Waste discharges shall not contain materials in concentrations which are hazardous to human, plant, animal, or aquatic life (Basin Plan IV.A, pg. V-8).*

*Wastes discharged to surface waters shall be essentially free of toxic substances, grease, oil, and phenolic compounds.*

*Waste discharges to the following inland waters are prohibited:*

*4. All coastal surface streams and natural drainageways that flow directly to the ocean within the Santa Cruz Coastal, Monterey Coastal, San Luis Obispo Coastal from the Monterey County line to the northern boundary of San Luis Obispo Creek drainage, and the Santa Barbara Coastal Subbasins except where*

discharge is associated with an approved wastewater reclamation program. (Basin Plan IV.B, pg. V-8).

### 2.3.4 Basin Plan narrative objectives summary

The Basin Plan does not identify numeric objectives for chlorpyrifos. The Central Valley Water Board's *Policy for Application of Water Quality Objectives*<sup>4</sup> states that the Water Board will consider "relevant numerical criteria and guidelines developed and/or published by other agencies and organizations. When considering such criteria, the Water Board will evaluate whether the specific available numeric criteria are relevant, appropriate, and should be applied in determining compliance with the Basin Plan narrative objective." As such, staff proposes using Department of Fish and Wildlife's numeric criteria (see Section 2.3.5) to determine compliance with the Basin Plan's narrative objective.

### 2.3.5 Water Quality Criteria

The California Department of Fish and Game (now known as California Department of Fish and Wildlife) published freshwater water quality criteria for chlorpyrifos (CDFG 2000) using USEPA methodology (USEPA 1985). Central Valley Water Board (2005) staff recalculated these criteria<sup>5</sup> and Table 2-3 shows these water quality criteria.

**Table 2-3. California Department of Fish and Game (now California Department of Fish and Wildlife) freshwater quality criteria for chlorpyrifos.**

Compound	CMC <sup>A</sup> (ppb or µg/L)	CCC <sup>B</sup> (ppb or µg/L)
Chlorpyrifos <sup>C</sup>	0.025	0.015

A. CMC – Criterion Maximum Concentration or acute (1- hour average). Not to be exceeded more than once in a three year period.

B. CCC – Criterion Continuous Concentration or chronic (4-day (96-hour) average). Not to be exceeded more than once in a three year period.

## 2.4 Pollutant Addressed

The pollutant addressed in this TMDL is chlorpyrifos. This pesticide was detected in surface waters of the San Lorenzo River watershed and Arana Gulch watershed in 2006 at concentrations that impaired designated beneficial uses. Chlorpyrifos was not detected in streams of this watershed during monitoring events in 2010/2011.

Chlorpyrifos is a broad spectrum OP insecticide that was first registered for use on food and feed crops in 1965. It was a widely used residential pesticide until 2001 when USEPA cancelled residential use of chlorpyrifos (USEPA, 2004).

<sup>4</sup> Chapter IV of The Central Valley's Basin Plan.

<sup>5</sup> Central Valley Water Board staff calculated chlorpyrifos criteria that are slightly higher than the CDFG calculated acute criterion (0.025 v. 0.02 µg/L) and chronic criterion (0.015 v. 0.014 µg/L). The differences in results are likely due to differences in rounding. Please see the 2005 reference for more details.

Current registered uses in the state of California include food and feed crops and professional application for golf course turf, greenhouses, non-structural wood treatments, and as an adult mosquiticide. All structural treatments for termites were terminated in 2005.

## **2.5 Data Analysis**

This section provides a summary of the data that led to the 2008-2010 303(d) listings in the San Lorenzo River watershed and Arana Gulch watershed along with a summary of more recent data.

Staff used the following data in this water quality analysis:

- Central Coast Ambient Monitoring Program (CCAMP), *water quality data*
- California Department of Pesticide Regulation's (CDPR) Pesticide Use Reporting (PUR), *pesticide use data*
- Central Coast Water Board's eNOI data, *self-reported information from growers on past and planned pesticide use.*

### **2.5.1 Water quality impairments**

#### **2.5.1.1 2008-2010 303(d) listings (data up to 2006)**

Staff summarized the 2008-2010 303(d) listings for chlorpyrifos in the San Lorenzo River watershed and Arana Gulch watershed in Table 2-4. In summary, the San Lorenzo River, Branciforte Creek, Zayante Creek, and Arana Gulch were identified as impaired by chlorpyrifos based on 2006 data. The Central Coast Ambient Monitoring Program (CCAMP) took all the samples in this dataset. Note that in the San Lorenzo River, there were no exceedances at the two most northern sampling locations, 304SLB and 304SL9.

**Table 2-4. Waterbodies, sample sites, sampling dates, and number of exceedances for chlorpyrifos (exceedance = samples that exceed 0.025 µg/L) based on data used in the 2008-2010 303(d) list.**

Waterbody and length of impairment	Sample site	Sampling dates	Analyte	Number of exceedances and explanation
San Lorenzo River (7 miles; impairment from the Lagoon to Zayante Creek)	304SLB* 304SL9* 304RIV 304LOR	1/3/2006 5/30/2006	Chlorpyrifos	2/8 samples exceed 0.025 µg/L. <i>Original listing stated 3/10 samples exceed criteria, however 2 of those samples were interstitial water<sup>1</sup> samples and will not be included.</i>
Zayante Creek (9 miles)	304ZAY	1/3/2006, 5/30/2006	Chlorpyrifos	2/2 samples exceeded criteria
Branciforte Creek (6 miles)	304BRA	1/3/2006, 5/30/2006	Chlorpyrifos	2/2 samples exceeded criteria
Arana Gulch (5 miles)	304ARA	1/3/2006, 5/30/2006	Chlorpyrifos	2/2 samples exceeded criteria

\* No exceedances were found at these sites.

1 = There is no chlorpyrifos evaluation guideline specific to interstitial water (pore water). Because there are not evaluation guidelines that are specific to interstitial water, these samples are used as supporting evidence only and are not the sole basis for any decision as it pertains to the 303(d) list of impaired waters.

### 2.5.1.2 Current status and review of data collected in 2010 and 2011

CCAMP took additional samples in San Lorenzo River, Zayante Creek, Branciforte Creek, and Arana Gulch in 2010 (Coastal Confluences sampling - San Lorenzo River only) and 2011 (Pajaro and North Coast Rotational sampling 2011). CCAMP collected a total of ten samples during this time period and all of the samples showed non-detectable levels of chlorpyrifos. Please see Table 2-5 for details.

**Table 2-5. Waterbodies, sample sites, sampling dates and number of exceedances for chlorpyrifos (exceedance = samples that exceed 0.015 µg/L) based on data from 2010-2011.**

Waterbody	Sample site	Sampling dates	Analyte	Number of exceedances, post Dec. 31, 2006	Total no. of exceedances (from 2006-2011)
San Lorenzo River	304LOR 304RIV	2/23/2010 (LOR only) 7/20/2010 (LOR only) 2/24/2011 (RIV only) 9/22/2011 (RIV only)	Chlorpyrifos	0/4 samples exceeded criteria	2/12
Zayante Creek	304ZAY	2/24/2011 9/22/2011	Chlorpyrifos	0/2 samples exceeded criteria	2/4
Branciforte Creek	304BRA	2/24/2011 9/22/2011	Chlorpyrifos	0/2 samples exceeded criteria	2/4

Waterbody	Sample site	Sampling dates	Analyte	Number of exceedances, post Dec. 31, 2006	Total no. of exceedances (from 2006-2011)
Arana Gulch	304ARA	2/24/2011 9/22/2011	Chlorpyrifos	0/2 samples exceeded criteria	2/4

Please see Figure 2-3 for a map of sampling station locations. To view the raw data, please see Appendix A.

### **2.5.1.3 Different criteria used for 2006 samples and 2010 – present samples**

During the 2008-2010 303(d) listing cycle, staff evaluated waterbodies in our region for chlorpyrifos impairment using the 0.025 µg/L value (acute or CMC (criterion maximum concentration)). Please see Table 2-3. Staff did this because the samples we were evaluating were grab samples and we did not have any four-day average samples to use against the chronic concentration target. However, future 303(d) listings will be using the 0.015 µg/L chlorpyrifos number (chronic or CCC (criterion continuous concentration)). The rationale is that this lower number is consistent with basin plan language (Basin Plan page III-4):

Toxicity: All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or aquatic life...

Pesticides: No individual pesticide or combination of pesticides shall reach concentrations that adversely affect beneficial uses.

To protect the aquatic life from “detrimental physiological responses” we use the chronic criteria as it is protective of not just survival of the organism but the growth and reproduction of aquatic life as well. In other words, the chronic criterion is more protective of aquatic life and will be used to evaluate future samples during the 303(d) listing process.

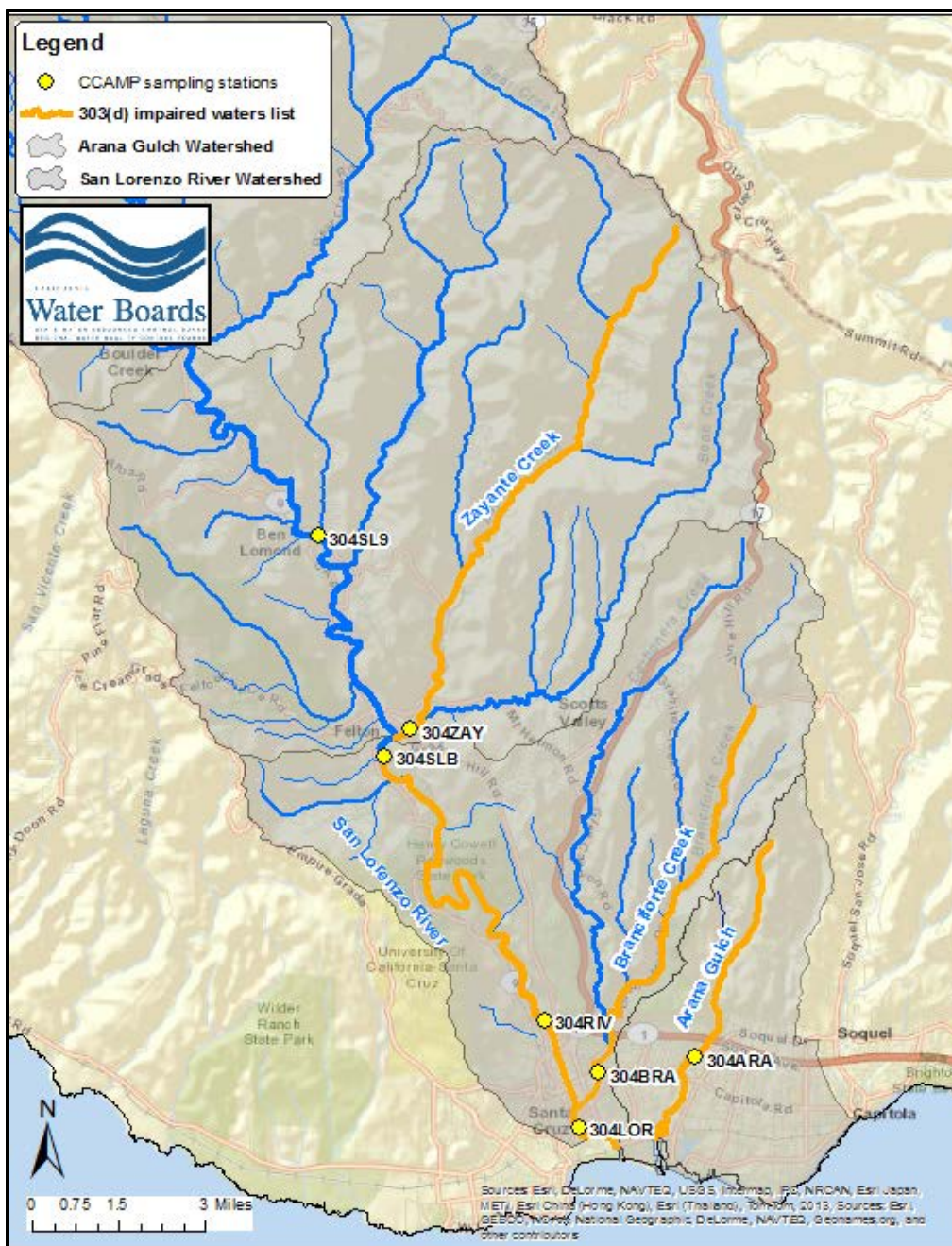


Figure 2-3. Map showing sampling stations in the San Lorenzo River Watershed and Arana Gulch Watershed. Note: San Lorenzo River is not considered impaired above sampling station 304SLB.

### 2.5.2 Problem Statement

The San Lorenzo River (only below sampling station 304SLB<sup>6</sup>), Branciforte Creek, Zayante Creek, and Arana Gulch are on the 2008-2010 303(d) list as impaired due to chlorpyrifos (see Table 2-6). The designated aquatic habitat beneficial uses were not being supported in these waterbodies because of these impairments. However, water quality sampling from 2010/2011 suggests that these waterbodies are currently meeting numeric targets for chlorpyrifos. This project identifies the probable past causes of impairment and describes existing solutions to achieve water quality objectives and protection of beneficial uses.

According to the Water Quality Control Policy for Developing California’s Clean Water Act Section 303(d) List (Listing Policy), Table 3.1, Regional Boards should list a waterbody on the 303(d) list for toxicants if two or more samples exceed water quality criteria (when two to twenty-four samples are available). All four of the waterbodies mentioned had two exceedances each; qualifying them as impaired. However, 2010/2011 sampling results showed non-detectable levels of chlorpyrifos in all four waterbodies (each waterbody was sampled twice and San Lorenzo River was sampled four times – twice at two sampling stations) which indicates that these waterbodies are currently meeting numeric targets for chlorpyrifos. Therefore, they are currently listed as impaired on the current 303(d) list, but 2010/2011 data show that they are meeting the numeric targets for chlorpyrifos.

The latter is an important distinction because, as staff concludes in source analysis, Section 4.6, no current sources of chlorpyrifos are present.

**Table 2-6. Impaired waterbodies that are assigned TMDLs. Note that 2010/2011 data suggest that these waterbodies were meeting water quality criteria.**

WATERBODY	2008-2010 303(d) listed? (Y/N)	WBID	2008-2010 303(d) list pollutant/stressor	Assigned a TMDL and load allocations?
San Lorenzo River	Y	CAR3041202219980827084709	Chlorpyrifos	Y
Zayante Creek	Y	CAR3041202220020124155410	Chlorpyrifos	Y
Branciforte Creek	Y	CAR3041205119990223104548	Chlorpyrifos	Y
Arana Gulch	Y	CAR3041205119990222133711	Chlorpyrifos	Y
Number of waterbody/impairment combinations				4

<sup>6</sup> Note that on the 2008-2010 303(d) list San Lorenzo River is listed as impaired for chlorpyrifos for a 27 mile reach. Based on staff analysis, only the lower reach of San Lorenzo River, below sampling station 304SLB, is considered impaired. This distance is closer to 7 miles as opposed to 27.



### 3 NUMERIC TARGETS

Numeric targets are water quality targets developed to ascertain when and where water quality objectives are achieved, and hence, when beneficial uses are protected. The pesticide objectives in the Basin Plan are narrative objectives (see Section 2.3).

#### 3.1 Water Column Numeric Targets

In 2000, CDFG published freshwater water quality criteria for chlorpyrifos (CDFG, 2000) using USEPA methodology (USEPA, 1985). Staff selected the CDFG water quality criteria as numeric targets for these TMDLs. As mentioned in Section 2, we will be using numeric water criteria CDFG developed to measure attainment of the narrative Basin Plan objectives. These targets are used as TMDL targets in several approved TMDLs, including the Lower Salinas Watershed Chlorpyrifos and Diazinon TMDL, the San Antonio Creek Chlorpyrifos TMDL, and the Pajaro River Watershed Chlorpyrifos and Diazinon TMDL.

**Table 3-1. Chlorpyrifos water column numeric targets.**

Chemical	CMC <sup>A</sup> µg/L (ppb)	CCC <sup>B</sup> µg/L (ppb)	Reference
Chlorpyrifos	0.025	0.015	CDFG, 2000, Central Valley Water Board, 2005

A. CMC – Criterion Maximum Concentration (Acute: 1- hour average). Not to be exceeded more than once in a three year period.

B. CCC – Criterion Continuous Concentration (Chronic: 4-day (96-hour) average). Not to be exceeded more than once in a three year period.

### 4 SOURCE ANALYSIS

#### 4.1 Introduction

Chlorpyrifos is a man-made pesticide. The following is a general discussion of the past sources of chlorpyrifos and a discussion of why information staff gathered suggests there are no current sources of chlorpyrifos to these watersheds.

#### 4.2 Urban Storm Water and Chlorpyrifos

Urban uses of chlorpyrifos include historic homeowner residential use and professional residential application.

#### **4.2.1 Residential use**

In 2000, EPA announced the agreed phase-out with the registrants of residential uses of chlorpyrifos. The timing of the residential product phase-out is summarized below:

1. Residential phase-outs announced of chlorpyrifos (2000)
2. Formulation of chlorpyrifos stopped (December 1, 2000)
3. Retail sales of chlorpyrifos stopped (December 31, 2001)

Since chlorpyrifos for residential (non-agricultural) use has not been available for public purchase since Dec. 31, 2001, staff determined that residential use in urban settings are not current sources of chlorpyrifos.

As another line of evidence, staff offers the following study from DPR. DPR conducts water quality monitoring in the State of California. They have been conducting surface water monitoring in urban areas for many years and sample for many different pesticides and herbicides. As part of their ongoing sampling throughout the state, DPR took samples in urban areas that had no agricultural input in Sacramento, San Francisco, Orange County, and San Diego areas. From 2008 to 2012 DPR detected<sup>7</sup> chlorpyrifos in urban runoff 1.9% of the time (8 detections out of 414 samples) (Ensminger 2012 and pers. comm. Ensminger 2013), which is a relatively low detection rate. Detection of the chemical does not mean that the chemical was necessarily detected above the water quality criteria.

It is possible that a resident purchased and stored chlorpyrifos at their residence and applied it near their homes in 2006, five years after retail sales stopped. These applications could have caused an exceedance of the chlorpyrifos water quality criteria. Because there are no reporting requirements for residential use, and because the chemical was taken off the shelves for public purchase since Dec. 2001, staff is unable to unequivocally determine if urban uses alone contributed to the 2006 exceedances. Again, given current data and efforts to reduce and eliminate chlorpyrifos from the urban setting and more recent data indicating non-detectable concentration of chlorpyrifos, staff concludes that current storm water discharges are not causing exceedances.

#### **4.2.2 Professional residential use**

Professionals have applied chlorpyrifos for landscape maintenance, structural pest control, and rights of way in Santa Cruz County. However, in Santa Cruz County, professional application in urban areas is typically zero to one pound annual average, with the exception of 2005 for structural pest control. The professional who applies the pesticide is required to report the amount of

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<sup>7</sup> “Detected” is not synonymous with the concentration being at or above the water quality criteria for chlorpyrifos. Detected means the target compound can be distinguished from potential interferences present in an environmental sample (Memorandum, DPR, Feb. 13, 1996).

pesticide applied and the month the pesticide was applied to the county agricultural commissioner. Operators are required to apply the pesticide in a manner consistent with specific labeling requirements, which have grown increasingly stringent over the last decade.

Staff reviewed the pounds of chlorpyrifos<sup>8</sup> that professionals applied. As can be seen in Figure 4-1, application of chlorpyrifos was either zero or less than a pound, with a few exceptions in 2005 (128 pounds), 2008 (6.5 pounds) and 2009 (2.7 pounds). An independent supporting line of evidence is available from the Santa Cruz County Agricultural Commissioner records; these records state that there has been no use of chlorpyrifos for either landscape maintenance or structural application in 2012<sup>9</sup>.

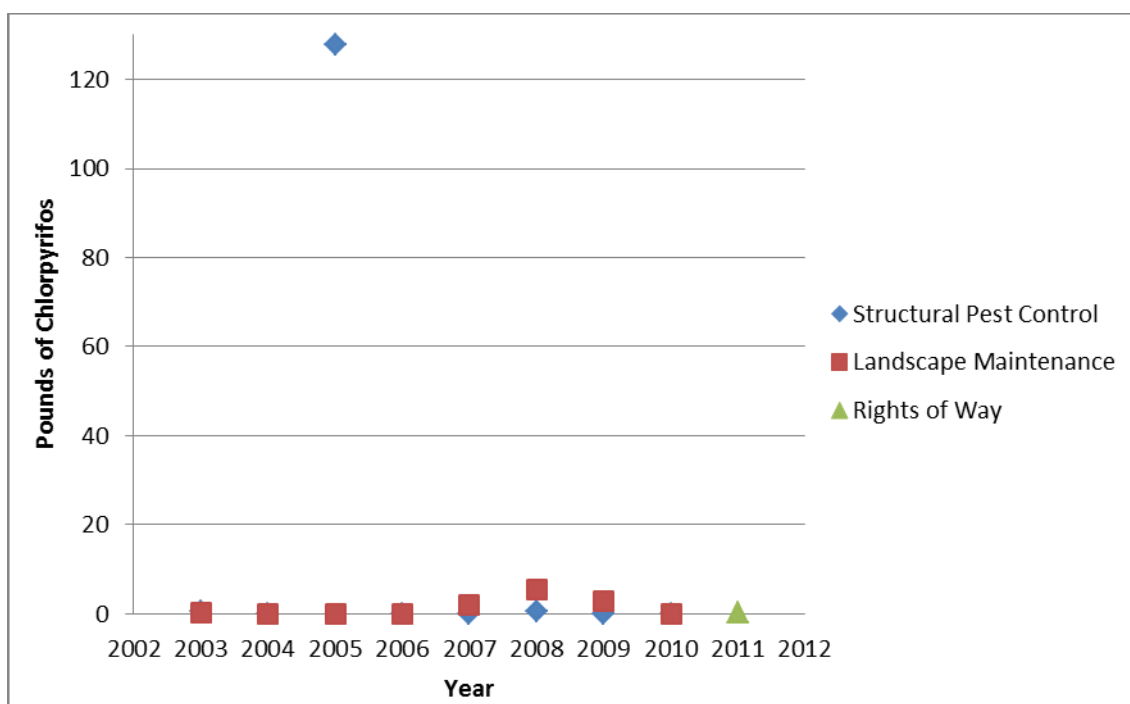


Figure 4-1. Pounds (active ingredient) of chlorpyrifos applied in Santa Cruz County between 2000 and 2011. It is possible that these applications did not occur in the San Lorenzo River Watershed or Arana Gulch Watersheds but were applied in other areas in Santa Cruz County

### 4.2.3 Application by County or City entities

The City of Santa Cruz, the City of Scotts Valley, and the County of Santa Cruz state in their Integrated Pest Management Policies that they will not apply any chlorpyrifos to any City or County property whatsoever beginning in January 2000 (City of Santa Cruz), January 2003 (County) and May 2008 (City of Scotts

<sup>8</sup> Staff obtained the numbers for urban application from DPR PUR. This information is reported by County, with no other location information. Therefore, the graph represents Santa Cruz County in its entirety and is not specific to San Lorenzo River and Arana Gulch Watersheds. Actual numbers in these watersheds are presumed to be lower than this graph shows.

<sup>9</sup> DPR data for 2012 was unavailable at the time this report was written.

Valley). Therefore, staff concludes that urban storm water from property owned by the Cities and the County is not a source of chlorpyrifos in this watershed. Please see Figure 4-2 for a visual of the boundaries for urban sources.

#### ***4.2.4 Application by University of California at Santa Cruz***

The campus has an official campus pesticide policy established in 1980 that dictates any use of pesticide on the campus must be approved by the Director of Campus Facilities. In short, any use of pesticides on the campus must go through a rigorous approval process. The University has not permitted any chlorpyrifos application in over 15 years (since 1995) and does not have plans to do so in the future. Staff concludes that urban storm water from the University is not a source of chlorpyrifos in this watershed.

#### ***4.2.5 Urban sources conclusion***

Based on the information in this section, staff concludes that *current* urban applications are not a source of chlorpyrifos. However, it is possible that the exceedances in 2006 were a result of urban storm water.

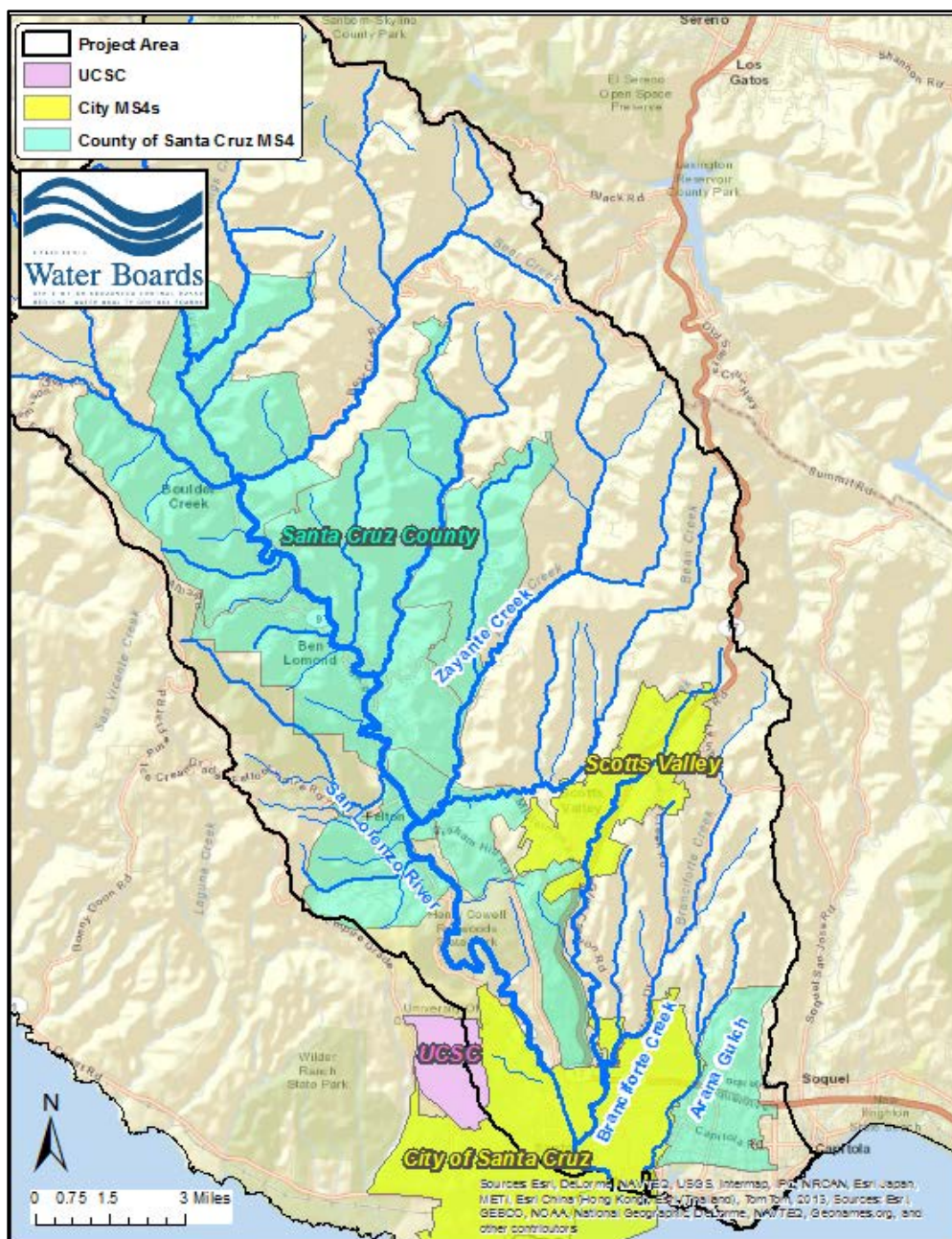


Figure 4-2. San Lorenzo River Watershed and Arana Gulch Watershed MS4 permit boundaries.

### 4.3 Agricultural Application of Chlorpyrifos

Staff evaluated the pounds of active ingredient (AI) of chlorpyrifos applied in the San Lorenzo River watershed and Arana Gulch watershed from 2000-2011 from agricultural operations (DPR PUR data). As can be seen in Figure 4-3, in the twelve years of record, there was one application of chlorpyrifos in one location in the watersheds; however, the application was located downstream of the sampling site (304ARA). Figure 4-3 provides compelling evidence that agricultural operations were not a source of chlorpyrifos to any of the water

quality stations sampled because all the agricultural applications of chlorpyrifos fall outside the watershed area of the impaired waterbodies, with the exception of one application area which is located downstream of the sampling site.

As of June 2013, self-reported data (eNOI) received from growers enrolled in the agricultural waiver program indicated that there are eleven growers in the San Lorenzo River watershed (none in the Arana Gulch watershed). None of these growers have applied chlorpyrifos in the last twelve months, nor do they plan to in the next twelve months. These growers represent nurseries and vineyards. Their locations are shown in Figure 4-3 as green squares. Of the eleven growers, five of them are directly upstream of a site that has shown no exceedances of chlorpyrifos (304SL9).

With regards to agricultural uses in the area, staff spoke with Santa Cruz County Agricultural Commissioner staff and learned that many growers have moved away from chlorpyrifos use, in part because of the Jacob's farm lawsuit<sup>10</sup>. Staff finds that this is further evidence that growers will not choose to apply chlorpyrifos to their agricultural operations in the future.

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<sup>10</sup> Jacob's farm is an organic farm. In 2006 and 2007 they were unable to sell some of their produce because some of it was contaminated with organophosphate pesticides. In 2008 they sued and won a lawsuit against a neighboring farm stating that the pesticides applied on that nearby farm evaporated after application and then blew onto their farm.

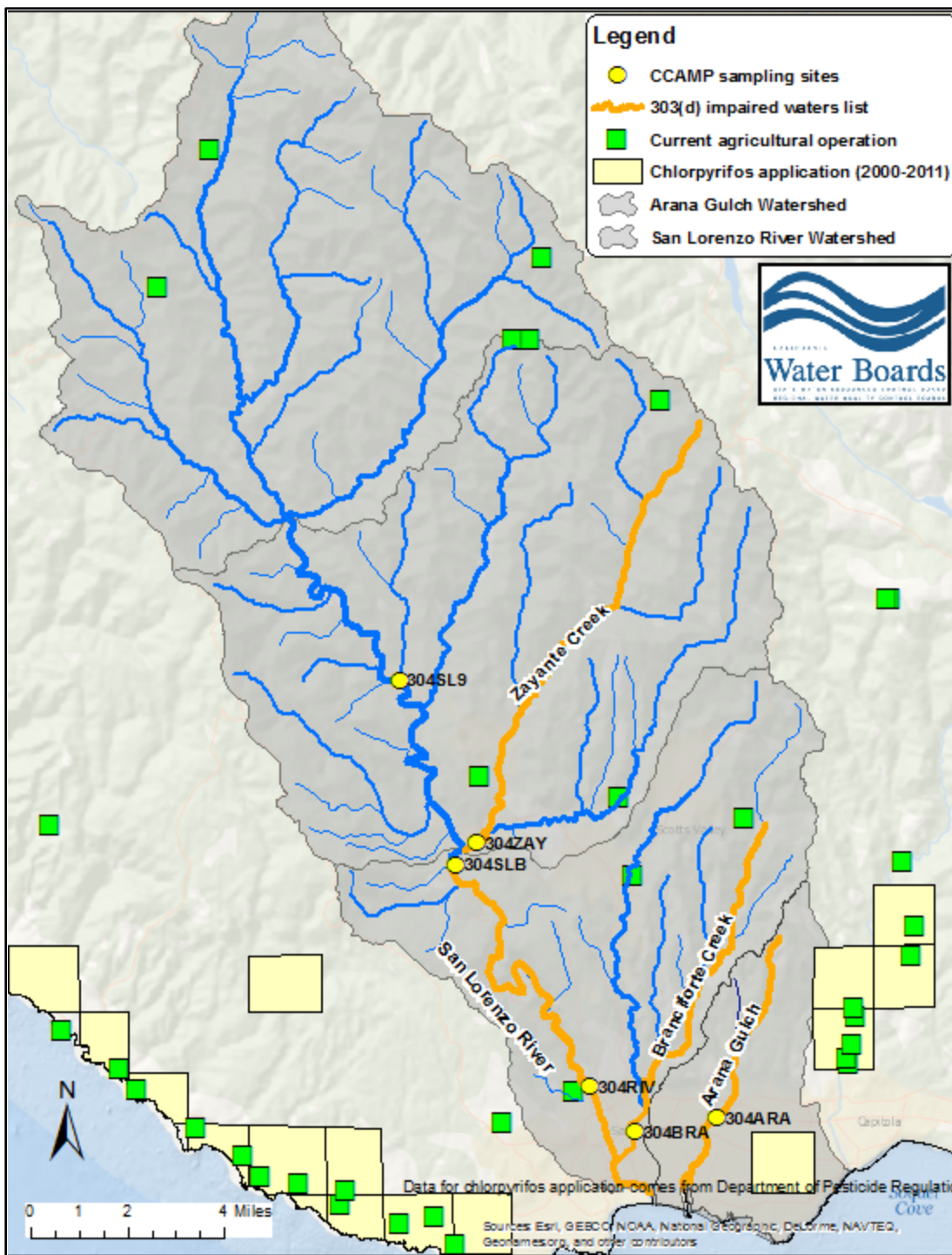


Figure 4-3. Map showing sampling stations in the San Lorenzo River and Arana Gulch watersheds. Orange line represents impaired waterbodies, yellow boxes show where chlorpyrifos has been applied between 2000-2011 (sole yellow box in the watershed was applied in 2007, below the sampling station), and green boxes show current agricultural operations where they are not, and have not, applied chlorpyrifos.

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### **4.3.1 Agricultural sources conclusion**

Based on the information in preceding section, staff concludes that agricultural operations were not a historic source nor are they a current source of chlorpyrifos causing impairment in these watersheds.

## **4.4 Application by State of Federal Entities**

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Staff used GIS software to determine that there are no Federal Forest Service Lands in these watersheds. There are two State Parks within the San Lorenzo River watershed. These are Henry Cowell Redwoods State Park and Castle Rock State Park. Staff from the California Department of State Parks indicated that they have not applied chlorpyrifos in either of these parks (pers. comm. Spohrer 2013).

## **4.5 Atmospheric Deposition**

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The Central Valley Water Board, in their TMDL for Diazinon and Chlorpyrifos in Sacramento County (2004), stated,

Fractions of pesticides applied in urban and agricultural settings become entrained in the atmosphere as aerosols or volatiles. Majewski and Capel (1995) found that organophosphorus compounds are often detected in air, rain and fog nationwide. The atmospheric pesticides can drift and be deposited via precipitation or fog onto urban outdoor surfaces and directly into waterways. Between spring and fall, these drift deposited pesticides may be washed off over-watered lawns, gardens and impervious surfaces into storm drains and, subsequently, into Sacramento County urban creeks.

The Central Valley's Report goes on to cite many different studies that state that chlorpyrifos (and other pesticides) are often found in the air and fog and may be deposited at a great distance from where they originated. One study cited<sup>11</sup> in their report states that organophosphate residues were detected at one study site and likely moved there by air transport from nearby orchards which were one kilometer and up to 100 kilometers away. This study showed that area-wide contamination of the air with OP pesticides may be significant.

While there are no orchards that have applied chlorpyrifos in the San Lorenzo River watershed or Arana Gulch watershed, there were orchards in the surrounding areas to the east of the watershed that have applied chlorpyrifos. Staff chose to look at orchards that applied chlorpyrifos because of the dormant spray application applied to orchards in the winter months.

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<sup>11</sup> Seiber, J.N., B.W. Wilson, M.M. McChesney. 1993. Air and Fog Deposition Residues of Four Organophosphorus Insecticides used on Dormant Orchards in the San Joaquin Valley, California. *Environmental Science and Technology*. 27:2236-2243.



While studies in the Sacramento area indicate detections of chlorpyrifos due to atmospheric deposition, staff determined that the chance of atmospheric deposition would be much less and likely insignificant in the Santa Cruz area. The reasons are as follows. 1) The Sacramento Valley area has a high density of orchards over a wide area. In contrast, Santa Cruz County area has very few orchards and they are small in the area they cover (area around Corralitos, approximately 42 mi<sup>2</sup> in 2005/2006). Again, there are no orchards in the San Lorenzo River and Arana Gulch watersheds, so any atmospheric deposition would have to travel approximately nine miles to arrive at the closest waterbody. 2) Staff evaluated to general wind direction in the Santa Cruz area and the general direction of the winds tends from west to east. This means that the wind would blow any potential particulates away from the San Lorenzo River watershed and Arana Gulch watershed as opposed to towards it. 3) Application rates of chlorpyrifos to apples have been similar from 2005 to 2011, yet exceedances in the project area occurred only in 2006.

While atmospheric deposition may have a small potential to contribute minute amounts of chlorpyrifos to the watersheds, staff concludes that the risk is very low and likely did not and will not contribute to detectable levels in the waterbodies.

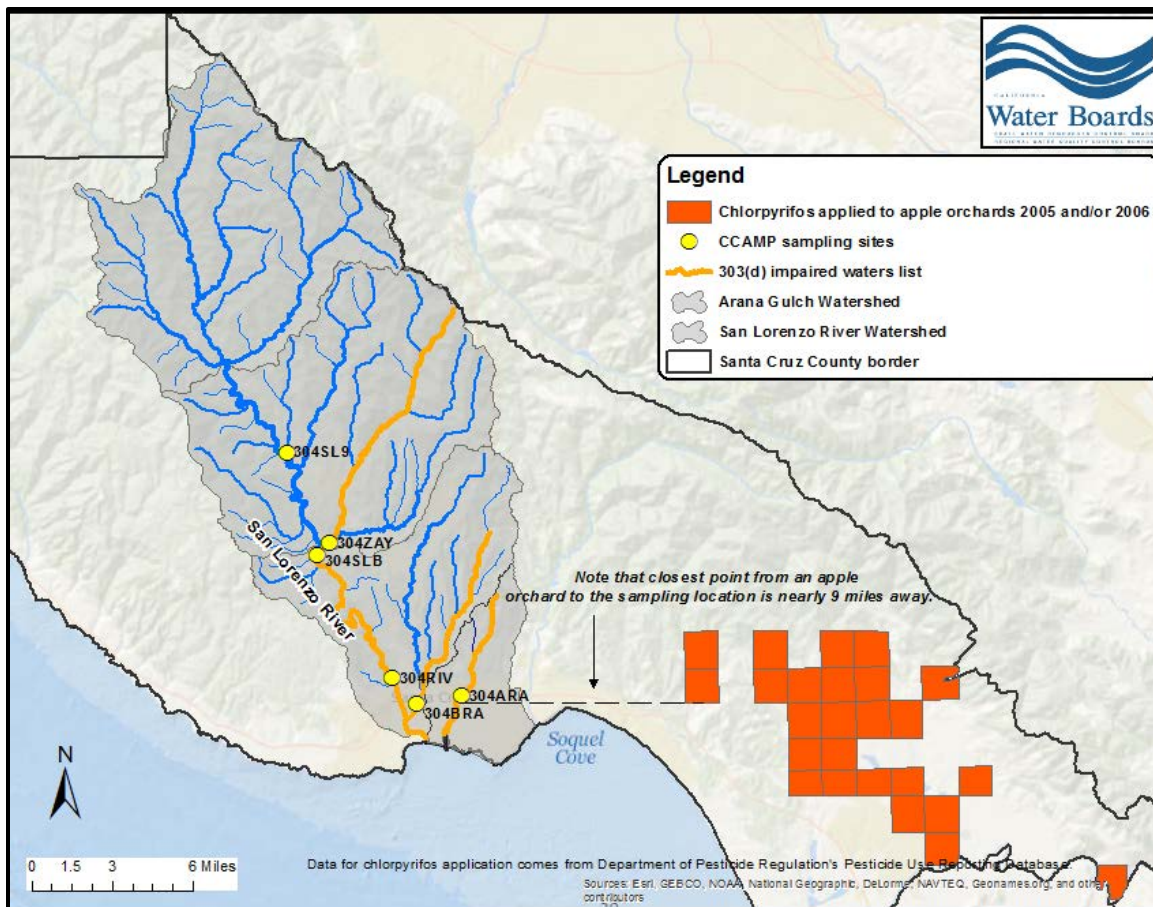


Figure 4-4. Map showing distance of closest apple orchard (in 2005/2006) to the closest sampling location in the Watersheds.

## 4.6 Source Analysis Conclusions

Based on the information presented in the preceding sections, staff concludes that there are no current sources of chlorpyrifos causing exceedance to the San Lorenzo River watershed and Arana Gulch watershed. The source analysis suggests that a potential cause of the numeric target exceedances of chlorpyrifos in 2006 was from urban storm water.

# 5 LOADING CAPACITY, TMDLS, AND ALLOCATIONS

## 5.1 Introduction

TMDLs are “[t]he sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background. TMDLs can

be expressed in terms of either mass per time, toxicity, or other appropriate measure” in accordance with Code of Federal Regulations, Title 40, §130.2[i].

The loading capacity for the San Lorenzo River and Arana Gulch watersheds is the amount of chlorpyrifos that can be assimilated without exceeding the water quality objectives. The allowable water column concentrations of chlorpyrifos that will achieve the objectives for toxicity and pesticides are equal to the numeric targets.

Staff proposes concentration-based TMDLs in accordance with federal regulations.

## 5.2 Loading Capacity and TMDLs

TMDLs for chlorpyrifos in the project watersheds are equal to the numeric targets.

The following TMDLs are established in the San Lorenzo River watershed and Arana Gulch watershed, including the San Lorenzo River, Zayante Creek, Branciforte Creek, and Arana Gulch and their tributaries.

The loading capacity, or Total Maximum Daily Load, for chlorpyrifos is a water column concentration-based Total Maximum Daily Load (Table 5-1) and is applicable to each day of all seasons.

**Table 5-1. Concentration-based TMDLs for chlorpyrifos.**

Chemical	CMC <sup>A</sup> µg/L (ppb)	CCC <sup>B</sup> µg/L (ppb)
Chlorpyrifos	0.025	0.015

A. CMC – Criterion Maximum Concentration (Acute: 1- hour average). Not to be exceeded more than once in a three year period.

B. CCC – Criterion Continuous Concentration (Chronic: 4-day (96-hour) average). Not to be exceeded more than once in a three year period.

## 5.3 Linkage Analysis

The goal of the linkage analysis is to establish a link between pollutant loads and desired water quality. This, in turn, ensures that the loading capacity specified in the TMDLs will result in attaining the desired water quality. For these TMDLs, this link is established because the load allocations are equal to the numeric targets, which are the same as the TMDLs. Therefore, reductions in chlorpyrifos loading will result in achieving the water quality standards.

## 5.4 Allocations

Allocations to urban storm water and irrigated agriculture are equal to the TMDLs, however, the allocations are assumed achieved unless future information indicates that the allocations are not being achieved.

Table 5-2 shows the allocations assigned to responsible parties. The allocations are receiving water allocations.

Table 5-2. Numeric targets, TMDLs, and allocations.

<b>NUMERIC TARGETS, TMDLs, AND ALLOCATIONS</b>			
<b>Wasteload Allocation</b>			
<b><u>Waterbodies Assigned TMDLs<sup>1</sup></u></b>	<b><u>Responsible Party Assigned Allocation<sup>2</sup></u></b>	<b><u>Receiving Water Numeric Targets, TMDLs, and Allocation (Chlorpyrifos, ppb)</u></b>	
		<b><u>CMC<sup>A</sup></u></b>	<b><u>CCC<sup>B</sup></u></b>
San Lorenzo River, Branciforte Creek, Zayante Creek, Arana Gulch	Urban storm water  County of Santa Cruz City of Santa Cruz City of Scotts Valley University of California at Santa Cruz (General Permit No. CAS000004)	0.025	0.015
<b>Load Allocation</b>			
<b><u>Waterbodies Assigned TMDLs<sup>1</sup></u></b>	<b><u>Responsible Party Assigned Allocation<sup>2</sup></u></b>	<b><u>Receiving Water Numeric Targets, TMDLs, and Allocation (Chlorpyrifos, ppb)</u></b>	
		<b><u>CMC<sup>A</sup></u></b>	<b><u>CCC<sup>B</sup></u></b>
San Lorenzo River, Branciforte Creek, Zayante Creek, Arana Gulch	Irrigated agriculture	0.025	0.015
	(No allocations to natural background since this is not a naturally occurring substance)	0	0

<sup>A</sup> CMC – Criterion Maximum Concentration or acute (1- hour average). Not to be exceeded more than once in a three year period.  
<sup>B</sup> CCC – Criterion Continuous Concentration or chronic (4-day (96-hour) average). Not to be exceeded more than once in a three year period.  
<sup>1</sup> All reaches of the San Lorenzo River, Branciforte Creek, Zayante Creek, Arana Gulch, and their tributaries.  
<sup>2</sup> While these sources are given allocations, they are not considered a current source of impairment.

## 5.5 Margin of Safety

This TMDL uses an implicit margin of safety. The margin of safety for this TMDL is implicit in the water column numeric targets selected for chlorpyrifos. Since this is a concentration-based TMDL, the TMDL is the same as the loading capacity for chlorpyrifos.

The assigned TMDL assumes no significant reductions in chlorpyrifos loading due to removal from the water column by degradation and/or adsorption to sediment particles and subsequent sediment deposition. Since these processes are likely to take place, this assumption contributes to the implicit margin of safety in the proposed allocation methodology. This is a conservative assumption resulting in an implicit margin of safety.

Staff used water column numeric criteria for chlorpyrifos, developed by the California Department of Fish and Game, now known as California Department of Fish and Wildlife (CDFG, 2000) following USEPA protocols (USEPA 1985), to establish the loading capacity. Therefore, the loading capacity has the same conservative assumptions used in those procedures.

## **5.6 Critical Conditions and Seasonal Variation**

A critical condition is the combination of environmental factors resulting in the water quality standard being achieved by a narrow margin, i.e., that a slight change in one of the environmental factors could result in exceedance of the water quality standard. Such a phenomenon could be significant if the TMDL were expressed in terms of load, and the allowed load was determined on achieving the water quality standard by a narrow margin. However, this TMDL is expressed as a concentration, which is equal to the desired water quality condition. Consequently, there are no critical conditions.

Exceedances of water quality objectives occurred in the months of January and June which are inclusive of both wet and dry weather. Therefore, there is no seasonal variation affecting the TMDLs and allocations. Further monitoring had non-detectable concentrations of chlorpyrifos.

# **6 IMPLEMENTATION AND MONITORING**

## **6.1 Introduction**

The State's Impaired Waters Guidance states that if the Regional Water Quality Control Board finds that a proposed solution of another state, local, or federal agency will correct the impairment, the Water Board may *certify* that the regulatory action will correct the impairment. Staff proposes that USEPA requirements pertaining to chlorpyrifos, such as cancellation restrictions, and the Integrated Pest Management Policies of the City of Santa Cruz, City of Scotts Valley, County of Santa Cruz, and UCSC's pesticide application policy have corrected the problem. No new regulation or implementation is proposed.

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## 6.2 Implementation Requirements

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Implementing parties must comply with the USEPA cancellation restrictions and labeling changes, the City of Santa Cruz's Integrated Pest Management Policy, and the County of Santa Cruz's Integrated Pest Management Policy, UCSC's pesticide policy, and the City of Scotts Valley Pesticide Policy.

### 6.2.1 USEPA cancellation restrictions

As mentioned in Section 1.3, the USEPA's RED states that virtually all products labeled for homeowner use have been cancelled effective December 31, 2001 (except for containerized bait). The public has not had access to these products since Dec. 31, 2001. If there were individuals who stored this product and continued to use it for years after its cancellation, the majority of that product should be used by 2013. If there are any individuals who have some of this product left, their use should be minimal and will eventually cease as there has been no access in over a decade.

CDPR has worked with chemical companies and the USEPA on changing many of the labeling requirements associated with how agricultural professionals need to apply these chemicals (Reregistration Eligibility Decisions, chlorpyrifos). Examples of labeling changes include:

- Setting maximum application rates per application
- Require engineering controls for all uses
- Setback requirements
- Use all measures necessary to control drift

DPR set forth regulations regarding controlling dormant spray applications in August 2006. Specific prohibitions<sup>12</sup> on applications within 100 feet of sensitive aquatic sites, when runoff is expected within 48 hours, when winds are <3 mph and >10 mph, have also likely reduced detections of these chemicals near agricultural fields.

### 6.2.2 City of Santa Cruz's Integrated Pest Management Policy

The City's Policy states in part,

The City, in carrying out its operations, shall assume pesticides are potentially hazardous to human and environmental health. City departments shall give first priority to available non-pesticide alternatives when considering the use of pesticides on City property. For all pest problems on City property, City departments shall follow the procedures outlined in the Integrated Pest

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<sup>12</sup> [http://www.cdpr.ca.gov/docs/emon/dormspray/05\\_004final.pdf](http://www.cdpr.ca.gov/docs/emon/dormspray/05_004final.pdf) text of final regulations made to the California Code of Regulations, Pesticides and Pest Control Operations...dormant insecticide contamination prevention.

Management (IPM) program. Additionally, the City shall develop and implement a public education program to inform the public about the dangers of toxic chemicals.

The goal of this policy of the City of Santa Cruz is to eliminate the application of all Toxicity Category I and Category II pesticide products<sup>13</sup> by **January 2000** (emphasis added).

### **6.2.3 City of Scotts Valley's Pesticide Policy**

The City of Scotts Valley's policy states in part,

#### 1. Statement of Goals

It is the goal of the City of Scotts Valley City Council to eliminate or reduce the use of pesticides on City property. In establishing this policy, it is acknowledged that this is a long-term goal which cannot be achieved instantaneously. It is also acknowledged that, even after dedicated review and exploration of all available options, it may not be possible to completely eliminate all pesticide use on City property. However, in those situations where pesticides cannot be completely eliminated, it is the City Council's intention that the quantity and the risk level of pesticides which are used be reduced. The City Council further establishes the following:

- a. The City shall reduce its use of pesticides through the development and implementation of a comprehensive Integrated Pest Management Policy.
- b. Effective immediately, and except for pesticides granted an exemption pursuant to Section 2 below, the following pesticides shall not be applied to City property:
  - i. EPA Toxicity Category I pesticides,
  - ii. Pesticides which contain chemicals identified by the State of California as known to cause cancer or reproductive toxicity pursuant to the California Safe Drinking Water and Toxic Enforcement Act of 1986, or
  - iii. Pesticides classified as proven human carcinogens by the United States Environmental Protection Agency.
- c. EPA Toxicity Category II pesticides will only be used with prior approval from the Public Works Director.

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<sup>13</sup> Chlorpyrifos is moderately toxic following acute oral, dermal and inhalation exposures and is classified as a toxicity category II pesticide (USEPA RED 2006).

Chlorpyrifos is classified as an EPA Toxicity Category II pesticide and has not been applied on City property since before May 2008.

#### **6.2.4 County of Santa Cruz's Integrated Pest Management Policy**

The County of Santa Cruz's policy states in part,

##### 1. Statement of Goals

It is the goal of the Santa Cruz County Board of Supervisors to eliminate the use of pesticides on County property. In establishing this policy, it is acknowledged that this is a long-term goal, which cannot be achieved instantaneously. It is also acknowledged that, even after dedicated review and exploration of all available options, it may not be possible to completely eliminate all pesticide use on County property. However, in those situations where pesticides cannot be completely eliminated, it is the Board's intention that the quantity and the risk level of pesticides which are used be reduced to the maximum degree possible. The Board of Supervisors further establishes the following:

- a. The County shall reduce its use of pesticides through the development and implementation of a comprehensive Integrated Pest Management Policy.
- b. Effective July 1, 2001, and except for pesticides granted an exemption pursuant to Section 2 below, the following pesticides shall not be applied to County property:
  - i. EPA Toxicity Category I pesticides,
  - ii. Pesticides which contain chemicals identified by the State of California as known to cause cancer or reproductive toxicity pursuant to the California Safe Drinking Water and Toxic Enforcement Act of 1986, or
  - iii. Pesticides classified as proven human carcinogens by the United States Environmental Protection Agency.
- b. Effective January 1, 2003, and except for pesticides granted an exemption pursuant to Section 2 below, County departments shall not apply EPA Toxicity Category II pesticides on County property.

Chlorpyrifos is classified as an EPA Toxicity Category II pesticide and has not been applied on County property since January 1, 2003.



### **6.2.5 UCSC's policy on pesticide application on the campus**

The University of California at Santa Cruz has a policy in place that states in part,

Due to increasing concern about the use of pesticides and their related potential or active health hazards, any use of a pesticide on the campus of the University of California, Santa Cruz must be approved in advance by the Director of Campus Facilities...Buildings and Grounds will obtain Environmental Health and Safety evaluation of previously unapproved compounds or techniques. These requirements apply to all pesticide use on campus including contracting with private firms for pesticide control.

As mentioned in Section 4, the University has not applied any chlorpyrifos on the campus since 1995.

## **6.3 Monitoring and Reporting Requirements**

**Table 6-1. Recommended receiving water monitoring sites for TMDL progress assessment.**

Impaired Waterbody	Recommended Monitoring Sites
San Lorenzo River	304SLB, 304RIV
Zayante Creek	304ZAY
Branciforte Creek	304BRA
Arana Gulch	304ARA

The San Lorenzo River watershed and Arana Gulch watershed is currently scheduled for rotational monitoring by CCAMP in 2016; CCAMP monitoring efforts will include chlorpyrifos. It should be noted that unforeseen changes to CCAMP efforts, as well as other programs at the Central Coast Water Board, may occur due to available resources or other challenges. Furthermore, stakeholders are welcomed to provide their own data for impairment analysis; we recommend that stakeholders communicate with CCAMP prior to implementing monitoring efforts in order to assure proper quality assurance.

## **6.4 Timeline and Milestones**

Staff concludes that allocations are currently being met. Future sampling will confirm this. Should future sampling confirm that allocations are being met, staff will recommend delisting these waterbodies from the 303(d) list in a timely manner. Staff anticipates using a weight of evidence approach (Listing Policy, Section 4.11) to support a delisting, as opposed to using the number of samples necessary approach described at Table. 4.1 in the policy.

The target date to achieve the allocations, numeric targets, and TMDLs in the impaired waterbodies addressed in this TMDL is October 2016.

## 6.5 Cost Estimates

Existing regulatory requirements are sufficient to attain water quality standards for chlorpyrifos in the project area. The Regional Board is not approving any new activity, but merely finding that ongoing activities and regulatory requirements are sufficient. Therefore, Water Board staff is not required to develop cost estimates associated with implementing this TMDL<sup>14</sup>.

## 6.6 Existing Implementation Efforts

As noted in Section 6.2, USEPA, the City of Santa Cruz, the City of Scotts Valley, UCSC, and the County of Santa Cruz have been implementing measures aimed at reducing and/or eliminating this pesticide. Staff acknowledges these existing implementation efforts and concludes that we can certify these policies. No further regulation is necessary.

## 7 PUBLIC PARTICIPATION

Staff posted a copy of this Report online for public review on November 18, 2013. Interested parties were notified of this Report via email distribution.

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