



Water Quality Progress Report

Sacramento County Urban Creeks – Diazinon and Chlorpyrifos

(Approved 2004)

WATER QUALITY STATUS

- TMDL targets achieved
- Conditions improving
- Improvement needed
- Data inconclusive

Contacts

EPA:

Erin Foresman at (916) 930-3722 or foresman.erin@epa.gov

Central Valley Water Board:

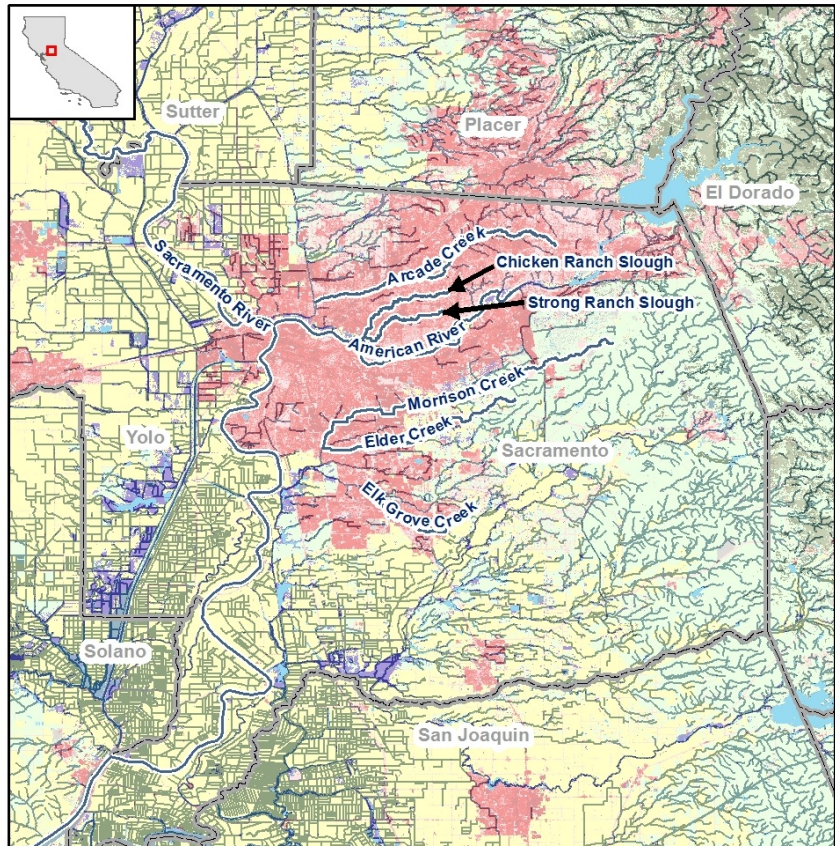
Danny McClure at (916) 464-4751 or dmclure@waterboards.ca.gov

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Total Maximum Daily Load (TMDL) Summary

Waterbody – Six urban creeks in Sacramento County (see map below) were found to be impaired for diazinon and chlorpyrifos in the late 1990s; therefore a TMDL was developed. These creeks include:

- Arcade Creek, Elder Creek, Elk Grove Creek, and Morrison Creek – tributaries to the Sacramento River
- Chicken Ranch Slough and Strong Ranch Slough – tributaries to the American River (which is a tributary to the Sacramento River)



Urban Creeks in Sacramento County
(red and pink shading represent urban areas)

Water Quality Goals

According to water quality objectives, all waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life.

The TMDL includes numeric targets (represented by concentrations in micrograms per liter [$\mu\text{g/L}$]) that are not to be exceeded more than once in a three year period to interpret this narrative objective:

Chlorpyrifos	Acute	0.020 $\mu\text{g/L}$ (1 hour average)
	Chronic	0.014 $\mu\text{g/L}$ (4 day average)
Diazinon	Acute	0.080 $\mu\text{g/L}$ (1 hour average)
	Chronic	0.050 $\mu\text{g/L}$ (4 day average)

Targeted Attainment Date – not specified in the TMDL

Water Quality Impairment –Diazinon and chlorpyrifos are two insecticides that were commonly used in non-agricultural settings before the United States Environmental Protection Agency (USEPA) cancelled all non-agricultural diazinon and nearly all non-agricultural chlorpyrifos product registrations in the 2000s. These insecticides can be acutely toxic to aquatic life, wildlife, and humans. Aquatic invertebrates appear to be the aquatic organisms most sensitive to chlorpyrifos and diazinon exposure. These insecticides are also more toxic when they are together in solution.

Data collected by several agencies in the early 1990s documented concentrations of diazinon and chlorpyrifos in Sacramento County urban creeks at levels that can cause toxicity to some aquatic invertebrate species. High concentrations had been measured in rainfall, urban runoff, urban water bodies, and sumps that discharge to urban water bodies. The Sacramento County urban creeks were first added to the California List of Impaired Water bodies in 1998 due to elevated concentrations of diazinon and/or chlorpyrifos shown in monitoring data that may impair freshwater aquatic life.

Pollutant Sources – Urban storm water was a primary source of diazinon and chlorpyrifos in Sacramento County urban creeks prior to cancellation of product registration for most non-agricultural uses. Urban uses of these insecticides include applications by professional pest control personnel, municipal workers, and homeowners to control pests (aphids, spider mites, fleas, ants, roaches, and boring insects) on residential and commercial landscapes, around building foundations and roadways, and at commercial and industrial locations. The product registrations for almost all non-agricultural uses of diazinon and chlorpyrifos were cancelled in 2004 and 2000, respectively. Urban irrigation, precipitation runoff, and atmospheric deposition from spray drift are the primary mechanisms that transport diazinon and chlorpyrifos from urban surfaces to urban storm drains and creeks. Atmospheric transport can also bring diazinon and chlorpyrifos from agricultural application sites into urban water bodies, especially during the winter months (the dormant spray season). Diazinon and chlorpyrifos are not highly persistent (like other historic pesticides such as dichlorodiphenyltrichloroethane [DDT]), so the sources of recent detections are assumed to be relatively recent uses. Continuing sources are use of remaining stocks by homeowners, transport from agricultural uses within or near to the Sacramento area, and the remaining registered non-agricultural chlorpyrifos uses, such as golf courses, industrial areas and rights of way.

Loading Capacity and Allocations – The loading capacity is the maximum amount of a contaminant or stressor that can be assimilated in a water body without exceeding the TMDL numeric targets (which in this case are interpretations of the narrative water quality objectives). The diazinon and chlorpyrifos loading capacity and source allocations in this TMDL are concentration-based limits. These limits are measured in receiving waters. Additive toxicity was incorporated into the loading capacity because diazinon and chlorpyrifos can be present at levels of concern at the same time and are more toxic to aquatic life when they are found in combination than they are individually. The diazinon and chlorpyrifos loading capacity is represented by an equation, where the sum of diazinon and chlorpyrifos concentrations divided by their corresponding numeric target (i.e., the cumulative impact) must be less than one (<1). This relationship is expressed as:

$$\text{Loading Capacity} = (C_{\text{diazinon}}/O_{\text{diazinon}}) + (C_{\text{chlorpyrifos}}/O_{\text{chlorpyrifos}}) < 1$$

Where:

C_{diazinon} = Diazinon concentration in the receiving water.

$C_{\text{chlorpyrifos}}$ = Chlorpyrifos concentration in the receiving water.

O_{diazinon} = Acute or chronic diazinon criterion.

$O_{\text{chlorpyrifos}}$ = Acute or chronic chlorpyrifos criterion

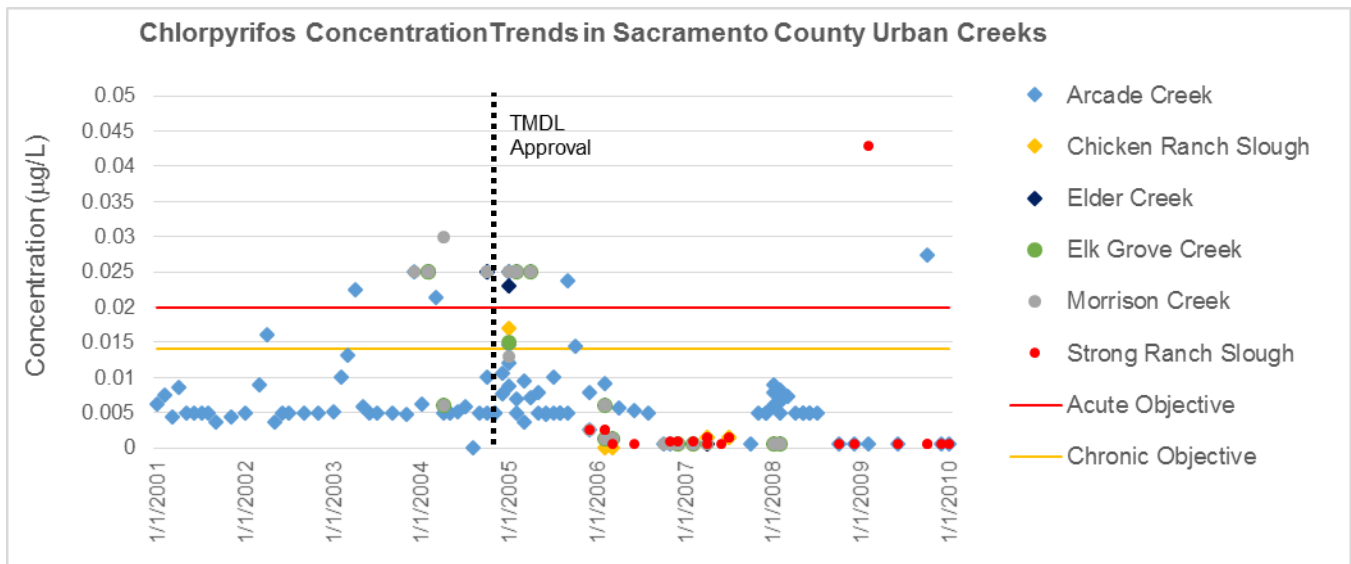
Wasteload allocations (point sources) for urban sources with National Pollutant Discharge Elimination System (NPDES) permits and load allocations (nonpoint sources) for agricultural sources and rainwater are both set equal to the equation for the loading capacity. If each source does not exceed one in this cumulative impact equation, then the loading capacity will be met.

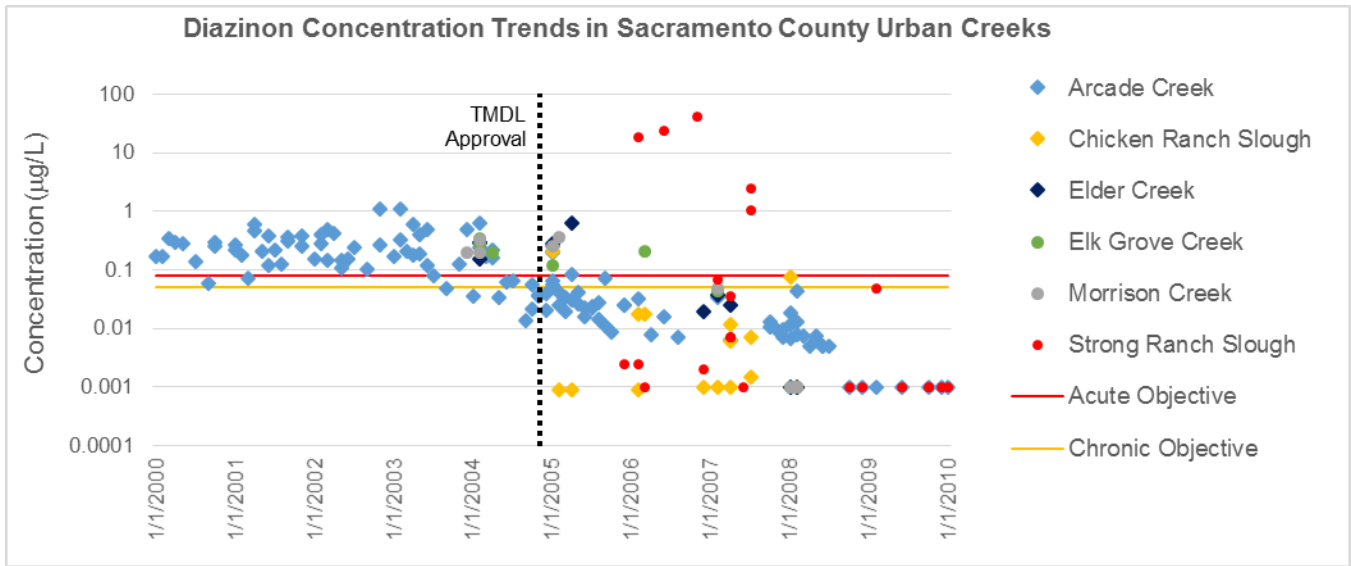
Is Water Quality Improving?

Water quality is improving in the six impaired urban creeks through successful efforts to reduce pesticide contamination including the cancellation of non-agricultural uses of diazinon and chlorpyrifos in the early 2000s, which had an immediate effect on the concentrations in Sacramento County urban streams. Furthermore, the Sacramento County Stormwater Partnership continues to implement the Pesticide Plan approved by the Central Valley Water Board in 2006, which includes a number of activities which help to reduce discharges of **all** pesticides to urban creeks. In addition to these successful implementation activities, further effort to reduce sources of pesticide pollution may be needed to ensure consistent attainment of water quality objectives. If concentrations continue with the recent observed trends, then diazinon is anticipated to meet the TMDL loading capacity. The most recent exceedances of diazinon were observed in 2007 (data were only available through January 2010). These exceedances were associated with concentrations above both the acute and chronic numeric targets. Except for one exceedance of the chronic target at Chicken Ranch Slough, all other exceedances observed since 2007 were at Strong Ranch Slough.

Chlorpyrifos concentrations have declined significantly since the phase out in 2000. Except for two exceedances in 2009, all other measurements since 2006 were below the numeric targets. These exceedances were observed at Arcade Creek and Strong Ranch Creek.

While conditions have improved considerably since implementation of the TMDL, additional efforts may need to be implemented to consistently minimize chlorpyrifos and diazinon discharges to urban creeks if subsequent monitoring shows continued chlorpyrifos exceedances. These could include increased education and buy-back programs, working with any agricultural users of these pesticides within the vicinity of urban streams with remaining exceedances, and working with USEPA and Department of Pesticide Regulation (DPR) to investigate if the remaining non-agricultural chlorpyrifos uses have potential to impact water quality, and how those impacts can be addressed through additional use regulations or cancellations.





Additionally, replacement pesticides for diazinon and chlorpyrifos, such as pyrethroid pesticides, have been shown to impact water quality in Sacramento County urban creeks. The Central Valley Water Board is continuing to work with the stormwater dischargers, DPR, and USEPA Office of Pesticide Programs to address these impacts through improved coordination, stormwater dischargers’ stormwater improvement programs and through regulatory efforts, such as DPR’s [Urban Water Quality Protection Regulations](#) and the Central Valley Water Board development of a [TMDL for pyrethroid pesticides](#).

TMDL Progress – Implementation activities and milestones

Urban runoff is the primary source of diazinon and chlorpyrifos to urban creeks in the Sacramento area; therefore, the TMDL is implemented through the Sacramento Municipal Separate Storm Sewer System (MS4) permit, which already contains the necessary information to implement the TMDL.

Implementation Activity	Target Date	Status	Progress Details
USEPA urban phase-out of diazinon and phase-down of chlorpyrifos	2004 for diazinon and 2000 for chlorpyrifos	Complete	<ul style="list-style-type: none"> Some personal residential stocks may remain in use, but they are expected to be minor
NPDES MS4 Permit Order No. R5-2008-0142 NPDES No. CAS082597	Regular updates every five years	Complete	<ul style="list-style-type: none"> Updated in 2008 (link) Update expected soon

Implementation Activity	Target Date	Status	Progress Details
Stormwater Quality Improvement Plan (link) including: <ul style="list-style-type: none"> • Pesticide Monitoring • Pesticide Toxicity Control Plan • Target Pollutant Program for Pesticides • Regional Public Outreach Activities 	Draft 6/1/2007 Revised 3/11/2009	In Progress/ Complete	<ul style="list-style-type: none"> • Adopted on January 29, 2010 (link) • Pesticide Plan approved in 2006 • Permittees currently implementing plan, including supporting education programs such as the Water Wise Pest Control Program and Our Water Our World, promoting Integrated Pest Management (IPM), and participation in State and Federal regulatory activities that pertain to pesticides of significance to urban stormwater discharges
MS4 Permit Monitoring Requirements: wet season and dry season monitoring of receiving waters, urban tributaries, urban discharges, and rain	None specified	In Progress/ Complete	<ul style="list-style-type: none"> • Coordinated Monitoring Program (link) monitors receiving waters • Sacramento Stormwater Quality Partnership monitors tributaries and other special studies

What Next?

Water quality is improving but has not yet achieved water quality goals. Cancellation of residential uses of Diazinon and chlorpyrifos has mitigated risks to aquatic life from these two pesticides in urban areas. However, use of alternative pesticides, such as pyrethroids and fipronil, have increased which also cause aquatic toxicity. Likely, new pesticides will emerge in the future and continued monitoring for aquatic toxicity will be the most efficient way to assess pesticide impacts over time. During pesticide registration and registration review, aquatic life risk mitigation strategies are developed into pesticide use instructions that must appear on product labels and must be followed by pesticide applicators. Increased coordination between State and Federal water quality and pesticide use regulators will help to achieve the long term goal of improved aquatic health.

Information Source Documents

- **Total Maximum Daily Load (TMDL) Report** for the Pesticides Diazinon & Chlorpyrifos in: Arcade Creek, Elder Creek, Elk Grove Creek, Morrison Creek, Chicken Ranch Slough, and Strong Ranch Slough; Sacramento County, California ([link](#))
- **CV RWQCB TMDL Resolution** – Establishment of Total Maximum Daily Loads of Diazinon and Chlorpyrifos in Sacramento Area Urban Creeks ([link](#))
- **NPDES MS4 Permit** – California Regional Water Quality Control Board Central Valley Region, Order No. R5-2008-0142, NPDES No. CAS082597, Waste Discharge Requirements Cities of Citrus Heights, Elk Grove, Folsom, Galt, Rancho Cordova, Sacramento, and County of Sacramento Storm Water Discharges from Municipal Separate Storm Sewer System ([link](#))
- **Monitoring and Reporting Program** ([link](#))
- **Stormwater Quality Improvement Plan** ([link](#))

- **Water Wise Pest Control Program ([link](#))**
- **Concentrations of Pesticides in Sacramento Metropolitan Area Rainwater and Creeks during the 2001, 2002 and 2003 Orchard Dormant Spray Seasons ([link](#))**
- **Concentrations of Pesticides in Sacramento Metropolitan Area Rainwater during the 2004 Orchard Dormant Spray Season ([link](#))**
- **Quality Assurance Project Plan (QAPP): Concentrations of Pesticides in Sacramento Metropolitan Area Rainwater during the 2005 Orchard Dormant Spray Season ([link](#))**